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A Contribution to the Phytochemical Survey of Peninsular Malaysia

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ABSTRAK

Spesimen daripada 216 spesies tumbuh-tumbuhan yang mengandungi 150 genus dan 50 famili telah dikumpulkan dari empat kawasan barat dan tengah Semenanjung Malaysia. Daun-daun daripada setiap spesies telah diuji kandungan alkaloid, steroid dan triterpena, dan saponin. Sebanyak 28 (13%) spesies didapati positif bagi alkaloid, 86 (40%) bagi saponin dan 55 (25%) bagi steroid/triterpena.

ABSTRACT

Specimens of 216 plants representing 150 genera and 50 families were collected from four areas in the western and central parts of Peninsular Malaysia. The leaves of each species were screened for alkaloids, steroids and triterpenes, and for saponins. 28 species (13%) gave a positive test for alkaloids, 86 (40%) for saponins and 55 (25%) for triterpenes/steroids.

INTRODUCTION

Systematic phytochemical survey work is an adjunct to a knowledge of traditional folk medicine and plays an important role in identifying new and possibly biologically active compounds. The first such work for Peninsular Malaysia and Singapore was reported by Douglas and Kiang in 1957 and consisted of the screening of some 200 plants for alkaloids. The work was subsequently extended and a further 708 species tested (Kiang *et al.*, 1961). Further alkaloid screening results were also reported by Amarasingham *et al.* (1964) and Nakanishi *et al.* (1965). The latter group of workers included in their screening procedures tests for phenolic substances, amino acids and peptides and also carried out some preliminary antimicrobial, toxicity and antitumor testing.

A new systematic phytochemical survey commenced in 1965, with plants being screened for saponins and triterpenes/steroids as well as alkaloids, and to date, has been published in four parts (Carrick *et al.*, 1968; Chan and Teo, 1969; Chan and Teo, 1972; Chan, Mak and Teo, 1977). More recently, surveys on the tannin contents of some Malaysian plants (Abdul Razak

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et al., 1981) and a phytochemical screening of some Malaysian hardwoods (Abdul Razak, 1982) have appeared.

As a further contribution to the phytochemical survey of Malaysia, we now report the results from screening 212 species of plants for alkaloids, saponins and triterpenes/steroids collected from four locations in the central and western parts of Peninsular Malaysia.

MATERIALS AND METHODS

Sample Collection

Plant species in the present survey were collected from four areas. Each specimen was given a collection number and pressed and dried within a few days. One set of voucher specimens has been deposited in the herbarium of Biology Dept at Universiti Pertanian Malaysia, and a second partial set at the herbarium in Universiti Kebangsaan Malaysia. Specimens numbered 1 – 90 were from the Bangi area in the vicinity of Universiti Kebangsaan Malaysia, Selangor; 91 – 144 from the Forest Research Institute research station at Pasoh, Negri Sembilan; 145 – 159 near the 45th milestone from Kuala Kubu *en route* to Fraser's Hill, Selangor; 160 – 196 from Fraser's Hill, Pahang; and 197 – 212 from the University of Malaya's field station at Ulu Gombak, Selangor.

Chemical Testing

(i) Alkaloids — alkaloid screening was conducted according to procedures described by Culvenor and Fitzgerald, 1963. Thus, 2 – 3 leaves of each plant were cut into small pieces then ground together with sand and ammoniacal chloroform (15 ml)>. The chloroform was filtered, shaken with aqueous sulphuric acid (2M, 10 drops), then the aqueous layer tested with Meyer's reagent. A dense, heavy precipitate was designated as 4+, a strong precipitate as 3+, a moderate precipitate as 2+ and a weak precipitate as 1+.

(ii) Triterpenes/steroids and saponins — these compounds were screened for on the basis of the Liebermann-Burchard and froth tests respectively, as generally described by Simes *et al.*, 1959. Thus, 2 – 3 leaves of each plant were cut into small pieces and thoroughly ground in a mortar and pestle with ethanol. The mixture was boiled for 15 minutes, filtered whilst hot and evaporated to dryness. The extract was triturated with ether and the ether insolubles shaken with water. The formation of a foam, stable for at least 30 minutes, was considered as indicative of saponins. A foam lasting for four hours was designated as 4+. The ether soluble fraction was subjected to the Liebermann-Burchard test using acetic anhydride and sulphuric acid. The formation of a bright purple, red or pink colouration was considered to indicate the presence of triterpenes/steroids.

CONCLUSION

Of the 216 species tested, (Table 1), 28 were found to give positive tests for alkaloids, 86 for saponins and 55 for triterpenes/steroids, representing 13%, 40% and 25% of the total, respectively. Particularly strong positive tests (4+) for alkaloids were given by three species whilst nine species gave strong positive tests for saponins and nine species for triterpenes/steroids (Table 2).

When compared with the already published phytochemical survey work conducted in Malaysia, an overlap of approximately 12% is found between the species from the present collection with those previously tested. Of the plants giving strong positive tests (Table 2) for the various classes of compounds tested for, a literature survey shows that only limited chemotaxonomic studies have been carried out (Table 2). The other species in this table are, therefore, good potential candidates for chemical investigation.

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TABLE 1
Screening results

Family Species*	Herbarium No.	Alkaloids	Saponins	Triterpene-Steroid
Acanthaceae				
Asystasia coromandeliana	MR 29	–	–	–
Filetia hirta	MR 180	–	3+	4+
Justicia species	MR 109	–	+	+
Staurogyne lanceolata	MR 112	2+	–	–
Staurogyne setigera	MR 42	+	–	–
Actinidaceae				
Saurauria nudiflora	MR 160	–	4+	4+
Saurauria nudiflora	MR 173	–	4+	4+
Saurauria nudiflora	MR 186	–	–	–
Saurauria nudiflora	MR 187	–	2+	4+
Annonceae				
Desmos dasymachala	MR 120	2+	–	–
Fissistigma fulgens	MR 3	–	3+	–
Polyalthia parviflora	MR 199	–	+	–
Unknown species	MR 211	–	–	–
Apocynaceae				
Allamanda cathartica	MR 161	–	–	4+
Tabernaemontana peduncularis	MR 85 & 87B	–	+	–
Willughbeia coriacea	MR 64	–	2+	–
Araceae				
Aglaonema angustifolium	MR 103	–	–	–
Aglaonema oblongifolium	MR 115	–	–	–
Homalomena griffithii	MR 53	–	–	–
Scindapsus species (juvenile)	MR 65	+	+	–
Burseraceae				
Canarium aff. littorea (sterile)	MR 82	–	–	–
Canarium aff. littorea	MR 62	–	4+	–
Canarium pilosum	MR 61	–	4+	–
Campanulaceae				
Laurentia longiflora	MR 145a	–	–	3+
Capparidaceae				
Cleome rutidosperma	MR 9	–	–	–
Compositae				
Eupatorium odoratum	MR 48	–	–	–
Eupatorium odoratum	MR 140	–	–	–

TABLE 1 (cont.)
Screening results

Family Species*	Herbarium No.	Alkaloids	Saponins	Triterpene-Steroid
Elephantopus scaber	MR 13	–	–	–
Elephantopus scaber	MR 141	–	–	–
Elephantopus scaber	MR 146	–	–	–
Vernonia cinerea	MR 51	+	–	2+
Wedelia biflora	MR 10	+	2+	–
Convolvulaceae				
Merremia umbellata	MR 45	–	–	–
Merremia tridentata	MR 152	–	–	2+
Dilleniaceae				
Tetracera indica	MR 148	–	4+	3+
Dioscoreaceae				
Dioscorea pyrifolia	MR 155	–	–	–
Dipterocarpaceae				
Shorea acuminata	MR 94	–	–	–
Shorea parvifolia	MR 95	–	–	–
Shorea parvifolia	MR 129	–	–	–
Ebenaceae				
Diospyros argentea	MR 80	–	2+	4+
Elaeocarpaceae				
Eleocarpus petiolatus	MR 21	–	–	–
Eleocarpus stipularis	MR 66	–	–	–
Erythroxylaceae				
Ixonanthes reticulata	MR 57	–	–	–
Euphorbiaceae				
Antidesma cuspidatum	MR 208B	–	3+	4+
Aporosa aurea	MR 86	–	–	–
Aporosa benthamiana	MR 93	–	–	–
Breynia coronata	MR 204	–	–	–
Euphorbia hirta	MR 6	–	–	–
Galearia fulva	MR 56	–	–	–
Glochidion hypoleucum	MR 102	–	+	–
Glochidion species	MR 153	–	3+	+
Glochidion wallichianum	MR 128	–	–	–
Macaranga curtisii	MR 166	+	3+	+
Macaranga javanica	MR 156	–	+	–
Mallotus macrostachyus	MR 72	–	–	–
Manihot glaziovii	MR 17	–		
Phyllanthus pulcher	MR 23	–	+	–
Phyllanthus urinaria	MR 26	–	3+	–
Gesneriaceae				
Didymocarpus platypus	MR 178	–	+	–
Gnetaceae				
Gnetum microcarpum	MR 104	–	+	–
Gnetum microcarpum	MR 110	–	+	–

TABLE 1 (cont.)
Screening results

Family Species*	Herbarium No.	Alkaloids	Saponins	Triterpene-Steroid
Hypoxidaceae				
Curculigo latifolia	MR 60	–	–	–
Labiatae				
Hyptis capitata	MR 19	–	–	4+
Lauraceae				
Cinnamomum mollissimum	MR 58	+	–	–
Cinnamomum mollissimum	MR 96	+	–	–
Litsea hirsutissima	MR 134	–	–	–
Phoebe species	MR 59	–	–	–
Leeaceae				
Leea indica	MR 193	–	+	–
Leguminosae				
Bauhinia andax	MR 157	+	+	–
Bauhinia integrifolia spp. *integrifolia*	MR 12	–	+	–
Bauhinia species	MR 192	–	–	–
Cassia alata	MR 144	–	+	+
Centrosema pubescens	MR 208a	–	–	–
Centrosema pubescens	MR 4	3+	–	–
Crotalaria mucronata	MR 191	4+	–	–
Desmodium heterophyllum	MR 52	–	–	–
Desmodium heterocarpum	MR 78	–	2+	–
Milletia sericea	MR 188	–	2+	–
Mimosa pudica	MR 88	–	–	–
Pueraria phaseoloides	MR 79	–	–	–
Unknown species	MR 87a	–	–	–
Loranthaceae				
Scurrula ferruginea	MR 168	–	–	–
Malvaceae				
Urena lobata	MR 27	–	–	–
Urena lobata	MR 49	–	–	–
Marantaceae				
Donax grandis	MR 7	–	+	–
Melastomataceae				
Allomorphia malaccensis	MR 35	2+	–	–
Allomorphia malaccensis	MR 198	–	–	3+
Allomorphia malaccensis	MR 212	–	–	2+
Clidemia hirta	MR 162	–	3+	–
Diplectria divaricata	MR 184	–	3+	–
Diplectria divaricata	MR 74	–	–	–
Diplectria divaricata	MR 14	–	–	–
Dissochaeta annulata var. *annulata*	MR 185	–	+	4+
Dissochaeta velutina var. *velutina*	MR 189	–	+	–
Medinilla crassifolia	MR 177	–	–	–
Melastoma malabathricum	MR 54	–	+	+

TABLE 1 (cont.)
Screening results

Family Species*	Herbarium No.	Alkaloids	Saponins	Triterpene-Steroid
Melastoma malabathricum	MR 76	–	+	+
Pternandra echinata	MR 195	–	2+	+
Sonerila aff. begoniifolia	MR 106	–	+	–
Sonerila begoniifolia	MR 201	–	+	2+
Sonerila erecta	MR 170	–	+	–
Sonerila heterostemon	MR 15	–	+	–
Sonerila rudis	MR 183	–	–	–
Sonerila species	MR 39	–	–	–
Meliaceae				
Aglaia cordata	MR 91	–	+	–
Moraceae				
Ficus grossularoides	MR 145b	–	–	2+
Ficus grossularoides	MR 154	–	–	–
Ficus species	MR 142	–	–	–
Myrsinaceae				
Ardisia malayensis	MR 118	–	+	2+
Ardisia korthalsiana	MR 90	–	4+	–
Grenacheria amentacea	MR 70	–	4+	–
Grenacheria amentacea	MR 151	–	–	–
Labisia crispa	MR 50	–	–	–
Labisia pothoina	MR 169	–	–	–
Labisia pumila	MR 123	–	+	–
Maesa ramentacea	MR 1	–	4+	4+
Myrtaceae				
Eugenia palembanica	MR 171	–	4+	–
Rhodamnia trinervis	MR 5	–	4+	4+
Passifloraceae				
Passiflora foetida	MR 77	–	–	–
Piperaceae				
Piper aduncum	MR 205	–	+	–
Rhizophoraceae				
Gynotroches axillaris	MR 11	–	–	3+
Rosaceae				
Prunus grisea	MR 182	–	2+	–
Prunus grisea var. *tomentosa*	MR 114	–	2+	4+
Rubus moluccanus	MR 172	–	4+	3+
Rubiaceae				
Borreria laevicaulis	MR 20	–	2+	–
Borreria latifolia	MR 31	–	–	–
Canthium didymum	MR 99	+	–	4+
Cephaelis cf. griffithii	MR 108	–	–	–
Chasalia curviflora	MR 209	–	–	–
Gaertnera oblanceolata	MR 121	–	2+	+
Gaertnera oblanceolata	MR 92	–	–	–
Greenia corymbosa	MR 203	–	+	+

TABLE 1 (cont.)
Screening results

Family Species*	Herbarium No.	Alkaloids	Saponins	Triterpene-Steroid
Hedyotis coronaria	MR 18	−	−	4+
Hedyotis philippensis	MR 32	−	−	−
Hedyotis philippensis	MR 101	−	+	+
Ixora grandifolia	MR 122	−	2+	+
Ixora species	MR 16	−	−	−
Lasianthus attenuatus	MR 89	−	−	−
Lasianthus bractescens	MR 41	−	+	−
Lasianthus chryseus	MR 105	−	3+	−
Lasianthus maingayi	MR 97	−	−	−
Pavetta indica	MR 100	−	−	−
Pavetta species	MR 116	−	−	−
Pavetta species	MR 117	−	−	−
Pavetta species	MR 119	−	−	−
Porterandia anisophylla	MR 44	+	−	3
Porterandia anisophylla	MR 138	−	4+	+
Psychotria malayana	MR 181	−	2+	−
Psychotria rostrata	MR 36	3+	−	−
Psychotria rostrata	MR 83	2+	−	−
Psychotria rostrata	MR 98	2+	−	−
Psychotria rostrata	MR 43	4+	−	−
Psychotria viridiflora	MR 38	−	−	4+
Rennellia elongata	MR 202	−	−	−
Rothmannia macrophylla	MR 37	−	−	−
Rothmannia macrophylla	MR 55	−	±	−
Rothmannia macrophylla	MR 84	−	−	+
Rothmannia macrophylla	MR 107	−	−	−
Timonius wallichianus	MR 2	−	−	3+
Uncaria borneensis	MR 207a	3+	−	2+
Uncaria cordata	MR 33	4+	+	−
Uncaria cordata	MR 71	+	2+	4+
Uncaria longiflora	MR 210	4+	+	4+
Unknown species	MR 40	−	+	−
Urophyllum cf. hirsutum	MR 133	−	−	−
Urophyllum species	MR 124	−	−	−
Urophyllum species	MR 174	−	−	−
Wendlandia burkillii	MR 163	−	3+	−
Wendlandia burkillii	MR 175	−	3+	−
Sapindaceae				
Allophyllus cobbe	MR 111	2+	−	2+
Simaroubaceae				
Eurycoma longifolia	MR 63	−	2+	−
Solanaceae				
Physalis minima	MR 196	−	+	−
Symplocaceae				
Symplocos rubiginosa	MR 176	−	−	−

TABLE 1 (cont.)
Screening results

Family Species*	Herbarium No.	Alkaloids	Saponins	Triterpene-Steroid
Taccaceae				
Tacca cristata	MR 34	–	–	–
Theaceae				
Schima wallichii	MR 167	–	4+	2+
Tiliaceae				
Grewia tomentosa	MR 25	–	–	–
Grewia tomentosa	MR 28	–	–	–
Muntingia calabura	MR 22	–	–	–
Ulmaceae				
Trema cannabina	MR 69	–	4+	+
Trema orientalis	MR 149	–	–	3+
Urticaceae				
Poikilospermum suaveleus	MR 190	–	+	+
Verbenaceae				
Callicarpa arborea	MR 73	–	–	2+
Clerodendron deflexum	MR 113			
Clerodendron deflexum	MR 125	–	–	–
Clerodendron laurifolium	MR 179	3+	+	–
Clerodendron paniculatum	MR 194	–	–	–
Clerodendron serratum	MR 197	–	–	–
Clerodendron species	MR 81	4+	+	–
Clerodendron villosum	MR 150	–	–	–
Lantana aculeata	MR 8	–	–	–
Stachytarpheta indica	MR 139	–	–	–
Stachytarpheta jamaicensis	MR 46	–	–	–
Stachytarpheta jamaicensis	MR 158	–	–	3+
Vitex gamosepala	MR 135	–	–	–
Vitex pubescens	MR 30	–	–	–
Vitaceae				
Cayratia triflora	MR 47	–	–	–
Pterisanthes cissoides	MR 130	–	+	–
Zingiberaceae				
Costus speciosus	MR 24	–	4+	+
Globba pendula	MR 200	–	–	–
Unidentified Specimens				
	MR 67	–	+	2+
	MR 68	–	–	–
	MR 75	–	–	–
	MR 126	–	–	–
	MR 127	–	–	–
	MR 131	–	–	–
	MR 132	–	+	–
	MR 136	–	–	–
	MR 137	–	3+	–
	MR 143	2+	–	–

TABLE 1 (cont.)
Screening results

Family Species*	Herbarium No.	Alkaloids	Saponins	Triterpene-Steroid
	MR 147	4+	–	–
	MR 159	–	–	4+
	MR 164	–	3+	–
	MR 165	–	2+	–
	MR 206	–	+	0
	MR 207b	–	–	–

*For the authorities of species, see Tree Flora of Malaya Vol. I – III (1972 – 1978) or The Flora of the Malay Peninsula (1922 – 1925).

TABLE 2
Plants giving very strong (4+) test results and references to previous chemotaxonomic studies

ALKALOIDS	
Leguminoseae	
Crotalaria mucronata	Sawhney *et al.* (1967) Bhacca and Sharma (1968) Atal *et al.* (1968) Batra *et al.* (1975)
Rubiaceae	
Psychotria rostrata	
Uncaria cordata	
Uncaria longiflora	Phillipson and Hemmingway (1973)
SAPONINS	
Actinidaceae	
Saurauria nudiflora	
Dilleniacae	
Tetracera indica	
Myrsinaceae	
Maesa ramentacea	
Myrtaceae	
Rhodamnia trinervis	
Rosaceae	
Rubus moluccanus	Das *et al.* (1979) Bhattacharya and Dutta (1969)
Rubiaceae	
Porterandia anisophylla	
Theaceae	
Schima wallichii	Candel and Rastogi (1980)
Urticaceae	
Trema cannabina	

TABLE 2 (cont.)
Plants giving very strong (4+) test results and references to previous chemotaxonomic studies

Zingiberaceae	
Costus speciosus	Tschesche and Pandey (1968) Rathere and Khanna (1978) Pandley and Dasgupta (1970)
TRITERPENES/STEROIDS	
Acanthaceae	
Filetia hirta	
Actinidaceae	
Saurauria nudiflora	
Apocynaceae	
Allamanda cathartica	
Ebenaceae	
Diospyros argentea	
Labiatae	
Hyptis capitata	Farnsworth (1969)
Myrsinaceae	
Maesa ramentacea	
Myrtaceae	
Rhodamnia trinervis	
Rubiaceae	
Hedyotis coronaria	
Psychotria viridflora	

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