

PHYTOCHEMICAL SCREENING

P. C. MAITI

*Botanical Survey of India, Calcutta**

ABSTRACT

This is a report of preliminary screening of 202 plants belonging to 162 genera distributed over 64 natural orders wherein 47, 25 and 51 rich sources of alkaloids, saponins and sterols respectively have been observed.

INTRODUCTION

In 1960 when the chemistry laboratory of the Botanical Survey of India was started with very meagre facilities we had no clear idea what could be its functions *vis a vis* existence of so many well established laboratories in our country carrying out extensive research on plant products. We had of course competent botanists as our colleagues engaged in field collection all over the country, the national herbarium at our door and Dr. J. C. Sen-gupta as the Chief Botanist. During this time appeared the publications of the Commonwealth Scientific and Industrial Research Organisation, Australia which dealt with phyto-chemical survey of Australian plants. Immediately we thought over such surveys which were yet to be undertaken in our country and for which the Botanical Survey of India seemed to be the most appropriate venue. A project was drawn up in 1961 which received encouraging approval of the Chief Botanist.

COLLECTION OF PLANTS MATERIALS

Most of the local plants and those from Ranchi were collected by the author himself in collaboration with Shri R. K. Basak, Systematic Botanist, Botanical Survey of India. The Solanaceous plants are part of collections by Shri A. N. Henry for the P. L. 480 Project and the museum specimens are gifts from the Economic Botany Section, Botanical Survey of India.

The parts used for the screening are leaves if not otherwise stated. One pound of each plant was collected, air-dried and brought to the chemistry laboratory, then situated at 43, Sarat Bose Road, Calcutta. Proper herbarium sheets were maintained for future identification.

LABORATORY WORK

The air-dried plant material was powdered and 10 g of this powder was taken in a stoppered bottle. Sufficient quantity of petroleum ether (b.p. 60-80) was added so that the entire plant material remained submerged in it. The bottle was left overnight and the solvent decanted out. The solvent was evaporated on water-bath. It was marked A.

The plant material left in the bottle was allowed to stand in contact with prolious mixture for 24 hours whereafter it was poured out. It was marked B.

The plant material left in the bottle was finally extracted with 50% ethyl alcohol as above and the extract evaporated on water-bath. It was marked C.

Treatment of A : The nature and quantity of the oil was noted. Portions were tested with Liebermann-Burchard reagent and Salkowski's reagent for presence of sterols and triterpenes.

Treatment of B : The prolious mixture was shaken with 2% hydrochloric acid and few drops of the clear acid layer was tested for alkaloids with Mayer's reagent. Where the test was positive the entire acid extract was basified with ammonia, the liberated base was extracted with ether and evaporated. The residue was tested for alkaloids.

Treatment of C : The dry or semi-dry residue was shaken with water to examine if any honey comb like froth lasting for half an hour was produced. If such froth was suspected, it was boiled for five minutes with one-fifth of its own volume of conc. hydrochloric acid, the hydrolysed mass was cooled, extracted with chloroform and the chloroform extract tested with Liebermann-Burchard reagent. If the test was positive as evidenced by a violet, brown or reddish colour the plant was reported to contain saponins.

*Present address : Central Forensic Science Laboratory, Calcutta.

DISCUSSION

In this screening programme the alkaloids have been extracted with prolious mixture and then tested with Mayer's reagent. We are aware of its shortcomings. The water soluble bases evade this process of extraction but there is practically no scope for any false positive reaction for the alkaloids.

We have relied on the froth test for saponins only when the genin has been found to respond to Liebermann-Burchard test. Here also few completely

saturated triterpenoids and steroids may evade the testing procedure but the scope for any false positive reaction for saponins has been avoided.

The ratings have been done from the wide experience of the author which will indicate that ++ or +++ against any particular constituent correspond to an approximate yield as follows:

Sterols $\geq 0.01\%$

Alkaloids $\geq 0.2\%$

Saponins (as genins) $\geq 0.5\%$

Name of plant with place and date of collections	Oil	Sterol	Terpene	Alkaloid	Saponin	Tannin	Glyco-alkaloid	Mucilage
ACANTHACEAE								
<i>Acanthus ilicifolius</i> Linn. (Calcutta Suburb. Dec., 1961)	++	++	+	negligible	+			
<i>Barleria prionites</i> Linn. (Calcutta Suburb. Dec., 1961)	+	+	+	—	—			
<i>Cardanthera triflora</i> Ham. ex Benth. (Calcutta Suburb. March, 1961)	waxy ++	+	+	—	+			
<i>Ecballium viride</i> Alston (Calcutta Suburb. March, 1961)	waxy ++	+	++	—	—			
<i>Hemigraphis hirta</i> T. And. (Calcutta Suburb. March, 1961)	waxy +	—	+++	—	+			
<i>Hygrophila polysperma</i> T. And. (Calcutta Suburb. Feb., 1963)	negligible	+	+	traces	—			
<i>Hygrophila spinosa</i> T. And. (Calcutta Suburb. Dec., 1961)	negligible	+	—	—	—			
<i>Justicia gendarussa</i> Linn. (Calcutta Suburb. Dec., 1961)	negligible	++	—	—	—			
<i>Peristrophe bicalyculata</i> Nees (Calcutta Suburb. Dec., 1961)	+	+	—	+	—			
<i>Phayloopsis parviflora</i> Willd. (Calcutta Suburb. Dec., 1961)	+	+++	—	+++	—			
<i>Strobilanthes alatus</i> Nees (Dehra Dun. Sept., 1962)	+	—	+	—	—			
<i>Strobilanthes dalhousianus</i> Clarke (Dehra Dun. Sept., 1962)	+	++	+	—	—			
AIZOACEAE								
<i>Mollugo hirta</i> Thunb. (Calcutta Suburb. March, 1961)	+	—	++	—	++			
ALANGIACEAE								
<i>Alangium salvifolium</i> Wang (Calcutta Suburb. March, 1961)	waxy ++	+++	+	+++	—			
ANACARDIACEAE								
<i>Lannea coromandellica</i> Merr. (Calcutta Suburb. Feb., 1963)	++	—	+	—	—			
<i>Mangifera indica</i> Linn. (Calcutta Suburb. Feb., 1963)	negligible	—	+	—	—			
<i>Semecarpus anacardium</i> Linn. f. (Calcutta Suburb. March, 1961)	+++	—	+	—	++			

Name of plant with place and date of collections	Oil	Sterol	Terpene	Alkaloid	Saponin	Tannin	Glyco-alkaloid	Mucilage
APOCYNACEAE								
<i>Holarrhena antidysenterica</i> Wall. (Calcutta Suburb. Feb., 1963)	+	—	+	++	—		++	
<i>Ichnocarpus frutescens</i> R. Br. (Calcutta Suburb. Feb., 1963)	+	—	++	—	—			
<i>Rauwolfia serpentina</i> Benth. (Calcutta Suburb. Dec., 1961)	+	—	+	+++	—			
ASCLEPIADACEAE								
<i>Cryptolepis buchanani</i> Roem. & Sch. (Ranchi. May, 1963)	+	—	+++	traces	—			
<i>Dregea volubilis</i> Benth. (Calcutta Suburb. Dec., 1961)	+++	+++	—	—	+++			
<i>Perguleria pallida</i> Wt. & Arn. (Calcutta Suburb. Dec., 1961)	waxy +++	+++	—	+	—			
<i>Tylophora indica</i> Merr. (Calcutta Suburb. March, 1961)	waxy +++	+	+	+++	—			
BEGONIACEAE								
<i>Begonia malabarica</i> Linn. (Assam)	+	+++	—	—	—			
BIGNONIACEAE								
<i>Oroxylum indicum</i> Vent. (M.P.) (Seeds)	+++	—	+	traces	+++			
BIXACEAE								
<i>Bixa orellana</i> Linn. (Museum specimen) (Seeds)	++	++	—	—	—			
BORAGINACEAE								
<i>Heliotropium indicum</i> Linn. (Calcutta Suburb. March, 1961)	++	—	+++	—	—			
CAESALPINACEAE								
<i>Bauhinia retusa</i> Ham. (Museum specimen)	+	—	+	—	+			
<i>Bauhinia vahlii</i> Wt. & Arn. (Museum specimen)	++	—	+	—	—			
<i>Cassia fistula</i> Linn. (Calcutta Suburb. March, 1961)	+	—	+	—	+			
CAPPARIDACEAE								
<i>Capparis zeylanica</i> Linn. (Calcutta Suburb. March, 1961)	waxy ++	++	—	traces	—			
CHENOPODIACEAE								
<i>Chenopodium ambrosioides</i> Linn. (Calcutta Suburb. March, 1961)	++	—	+++	—	—			
COMBRETACEAE								
<i>Terminalia arjuna</i> Wt. & Arn. (Museum specimen) (Bark)	+	—	++	—	—			
<i>Terminalia chebula</i> Retz. (Museum specimen) (Bark)	+	—	+	—	—			
<i>Terminalia tomentosa</i> Wt. & Arn. (Museum specimen) (Bark)	+	—	++	—	—			
COMMELINACEAE								
<i>Commelina salicifolia</i> Roxb. (Calcutta Suburb. Dec., 1961)	++	++	+	—	—			

Name of plant with place and date of collections	Oil	Sterol	Terpene	Alkaloid	Saponin	Tannin	Glyco-alkaloid	Mucilage
COMPOSITAE								
<i>Blumea mollis</i> Merr. (Calcutta Suburb. March, 1961)	+++	—	++	++	—			
<i>Cnicus arvensis</i> Hoffm. (Calcutta Suburb. March, 1961)	viscous +++	—	++	—	—			
<i>Eclipta alba</i> Hassk. (Calcutta Suburb. March, 1961)	++	+	++	—	—			
<i>Elephantopus scaber</i> Linn. (M. P.)	+	—	—	—	—			
<i>Eupatorium odoratum</i> Linn. (Calcutta Suburb. March, 1961)	waxy ++	+	++	—	—			
<i>Gnaphalium indicum</i> Linn. (Calcutta Suburb. Dec., 1961)	+	+++	—	—	+			
<i>Grangea maderaspatana</i> Poir. (Calcutta Suburb. March, 1961)	waxy +	—	+++	traces	+++			
<i>Mikania scandens</i> Willd. (Calcutta Suburb. March, 1961)	waxy +++	+	+	—	—			
<i>Sphaeranthus indicus</i> Linn. (Calcutta Suburb. Dec., 1961)	waxy +++	+++	—	+	—			
<i>Spilanthes acmella</i> Linn. (Calcutta Suburb. Dec., 1961)	++	+++	—	+++	—			
<i>Tridax procumbens</i> Linn. (Calcutta Suburb. March, 1961)	waxy ++	—	++	—	—			
<i>Wedelia calendulacea</i> Less. (Calcutta Suburb. March, 1961)	waxy ++	+	—	—	—			
<i>Xanthium strumarium</i> Linn. (Calcutta Suburb. March, 1961)	waxy ++	++	—	—	—			
CONVOLVULACEAE								
<i>Evolvulus nummularius</i> Linn. (Calcutta Suburb. March, 1961)	++	+	++	—	+++			
<i>Ipomoea campanulata</i> Linn. (Calcutta Suburb. Dec., 1961)	+++	+++	—	+	—			
<i>Ipomoea pulchella</i> Roth (Calcutta Suburb. Feb., 1963)	++	+++	—	+	++			
<i>Ipomoea turpethum</i> Br. (Ranchi, May, 1963)	+	+	+	traces	—			
CRUCIFERAE								
<i>Nasturtium officinale</i> Br. (Calcutta Suburb. March, 1961)	+	+	+++	—	—			
DIOSCOREACEAE								
<i>Dioscorea glabra</i> Roxb. (Museum specimen) (Yams)	+	—	+	—	++			
<i>Dioscorea hispida</i> Dennst. (Museum specimen) (Yams)	+	—	+	—	++			
<i>Dioscorea pentaphylla</i> Linn. (Museum specimen) (Yams)	+	—	+	—	+			
EUPHORBIACEAE								
<i>Cleistanthus collinus</i> Benth. (Calcutta Suburb. March, 1961) (Fruits)	+	—	+	—	—	++		

Name of plant with place and date of collections	Oil	Sterol	Terpene	Alkaloid	Saponin	Tannin	Glyco-alkaloid	Mucilage
<i>Crotophora plicata</i> A. Juss. (Calcutta Suburb.)	+++	+++	—	—	—			
<i>Euphorbia hirta</i> Linn. (Calcutta Suburb. March, 1961)	waxy +++	—	+	—	—			
<i>Excoecaria agallocha</i> Linn. (Calcutta Suburb. Dec., 1961)	waxy +++	+	+++	—	—			
<i>Mallotus philippensis</i> Muell.-Arg. (Dehra Dun. Sept., 1962)	+	—	+	—	+			
<i>Phyllanthus reticulatus</i> Poir. (Calcutta Suburb. March, 1961)	waxy +++	+	++	—	+++			+++
GESNERIACEAE								
<i>Klugia notoniana</i> (Wall.) A. DC. (Deccan Hills)	+	—	+	traces				
GLEICHENIACEAE								
<i>Dicranopteris linearis</i> Underwood (Deccan Hills)	++	—	+	—	++			
GRAMINEAE								
<i>Bambusa arundinacea</i> Willd. (Calcutta Suburb.)	+	—	++	—	—			
<i>Heteropogon contortus</i> Beauv. (Calcutta Suburb.)	+	—	++	—	++			
HYDROPHYLLACEAE								
<i>Hydrolea zeylanica</i> Vahl (Calcutta Suburb. Dec., 1961)	negligible	—	++	++	—			
LABIATAE								
<i>Leonurus sibiricus</i> Linn. (Calcutta Suburb. March, 1961)	++	+++	++	+	—			
<i>Leucas aspera</i> Spreng. (Calcutta Suburb. March, 1961)	+++	+++	—	traces	++			
<i>Orthosiphon rubicundus</i> Benth. (Ranchi. May, 1963)	+	—	++	—	—			
LEEACEAE								
<i>Leea indica</i> (Burm.) Merrill (Dehra Dun. Sept., 1962)	+	++	++	—	—			
LECYTHIDACEAE								
<i>Careya arborea</i> Roxb. (Museum specimen)	+	—	+	—	—			
LILIACEAE								
<i>Asparagus racemosus</i> Willd. (Museum specimen) (Roots)	+	+	+	—	—			
<i>Smilax proliфера</i> Roxb. (Museum specimen) (Roots)	+	—	+	—	+			
LOBELIACEAE								
<i>Lobelia nicotianaeifolia</i> Roth ex Roem. & Sch. (Museum specimen)	+	—	+++	+++	—			
LOGANIACEAE								
<i>Strychnos nux-vomica</i> Linn. (Museum specimen) (Seeds)	+	+	+	++	—			
<i>Strychnos potatorum</i> Linn. f. (Museum specimen) (Seeds)	++	—	++	—	+++			+++

Name of plant with place and date of collections	Oil	Sterol	Terpene	Alkaloid	Saponin	Tannin	Glyco-alkaloid	Mucilage
LYTHRACEAE								
<i>Ammania pentandra</i> Roxb. (Calcutta Suburb. Dec., 1961)	negligible	+	—	+++	—			
<i>Ammania peploides</i> Spreng. (Calcutta Suburb. Dec., 1961)	+	—	++	—	—			
<i>Woodfordia fruticosa</i> Kurz (Calcutta Suburb.)	+++	+	+++	—	—			
MALVACEAE								
<i>Abutilon indicum</i> G. Don (Calcutta Suburb.)	+	++	—	—	—			
<i>Hibiscus vitifolius</i> Linn. (Calcutta Suburb. March, 1961)	viscous ++	++	+++	—	—			
<i>Sida humilis</i> Willd. (Calcutta Suburb. Dec., 1961)	++	+++	—	—	—			
<i>Sida rhombifolia</i> Linn. (Calcutta Suburb. March, 1961)	+	+	+	—	—			+++
<i>Thespesia lampas</i> Dahy. & Gibs. (Kanara)	++	—	+	—	+			
<i>Urena lobata</i> Linn. (Calcutta Suburb. Dec., 1961)	+++	+++	—	—	—			
MARATTIACEAE								
<i>Angiopteris evecta</i> Hoffm. (Deccan Hills)	+	+++	—	—	—			
MARTYNIACEAE								
<i>Martynia annua</i> Linn. (Museum specimen)	+++	++	—	—	—			
MATIACEAE								
<i>Amoora rohituka</i> Wt. & Arn. (Calcutta Suburb. Dec., 1961)	+++	+++	—	+	—			
MELIACEAE								
<i>Cipadessa fruticosa</i> Bl. (Calcutta Suburb. March, 1961)	+++	—	+++	—	—			
MENISPERMACEAE								
<i>Cocculus villosus</i> DC. (Calcutta Suburb. Dec., 1961)	waxy ++	+	+++	+	—			
<i>Stephania hernandifolia</i> Walp. (Calcutta Suburb. Dec., 1961)	waxy +++	+++	—	+++	—			
MIMOSACEAE								
<i>Acacia concinna</i> DC. (Museum specimen) (Fruits)	+	++	—	nil	+			
<i>Leucaena glauca</i> Benth. (Calcutta Suburb. Dec., 1961)	+	++	—	—	—			
<i>Xylia xylocarpa</i> Taub. (Museum specimen) (Bark)	+	—	+	—	—			
MORACEAE								
<i>Ficus heterophylla</i> Linn. (Calcutta Suburb. March, 1961)	++	—	+++	—	—			
MORINGACEAE								
<i>Moringa oleifera</i> Lamk. (Calcutta Suburb. Feb., 1963)	+	+	++	—	—			

Name of plant with place and date of collections	Oil	Sterol	Terpene	Alkaloid	Saponin	Tannin	Glyco-alkaloid	Mucilage
MYRSINACEAE								
<i>Ardisia humilis</i> Vahl (Calcutta Suburb. March, 1961)	deep brown sticky + + + +	+	+	-	-			
MYRTACEAE								
<i>Psidium guyava</i> Linn. (Calcutta Suburb. Feb., 1963)	+	-	++	-	-			
NYCTAGINACEAE								
<i>Boerhavia repens</i> Linn. (Calcutta Suburb. March, 1961)	yellow sticky +	++	-	-	-			
OLEACEAE								
<i>Jasminum malabaricum</i> Wight (Museum specimen)	++ (solid)	-	++	-	+			
<i>Schrebera swietenoides</i> Roxb. (Ranchi. May, 1963)	++ (solid)	-	++	-	-			
ORCHIDACEAE								
<i>Dendrobium heterocarpum</i> Wall. (Shillong. Sept., 1962)	Leaves:	+	+	-	-	-		
	Roots:	+	-	-	-	-		
	Other parts:	+	-	-	-	+		
		+	-	-	-	+		
<i>Pholidota articulata</i> Lindl. (Shillong. Sept., 1962)	Pseudo-bulb:	+	-	++	-	+		
	Roots:	+	-	++	-	++		
	Other parts:	+	-	-	-	-		
		+	-	-	-	-		
PAPILIONACEAE								
<i>Abrus precatorius</i> Linn. (Museum specimen) (Seeds)	+	-	+	-	-			
<i>Aeschynomene americana</i> Linn. (Calcutta Suburb. Dec., 1961)	+++	-	+++	-	+++			
<i>Alysicarpus vaginalis</i> DC. (Calcutta Suburb. Dec., 1961)	+++	+++	-	+	-			
<i>Atylosia scarabaeoides</i> Benth. (Calcutta Suburb. Dec., 1961)	+++	+++	-	-	-			
<i>Dalbergia latifolia</i> Roxb. (Museum specimen) (Seeds)	+	-	+	-	-			
<i>Dalbergia paniculata</i> Roxb. (Museum specimen) (Seeds)	++	+	+	-	+			
<i>Desmodium diffusum</i> DC. (Calcutta Suburb. Dec., 1961)	+++	+++	-	-	-			
<i>Erythrina varegata</i> Linn. (Calcutta Suburb. Feb., 1963)	+	-	+	-	+			
<i>Indigofera pulchella</i> Roxb. (Calcutta Suburb. Dec., 1961)	+	-	+	-	+			
<i>Indigofera tinctoria</i> Linn. (Calcutta Suburb. Dec., 1961)	++	+++	-	-	-			
<i>Millettia auriculata</i> Baker (Ranchi. May, 1963)	+	-	+	traces	-			
<i>Pongamia pinnata</i> Pierre (Museum specimen) (Seeds)	+	-	+	-	+			
<i>Pterocarpus marsupium</i> Roxb. (Museum specimen) (Seeds)	+	-	-	-	-			

Name of plant with place and date of collections	Oil	Sterol	Terpene	Alkaloid	Saponin	Tannin	Glyco-alkaloid	Mucilage
<i>Sesbania aegyptiaca</i> Pers. (Calcutta Suburb. Dec., 1961)	+	—	++	—	++++			
	(solid)							
<i>Sesbania grandiflora</i> Pers. (Calcutta Suburb. Dec., 1961)	+	—	+	—	+			
<i>Tephrosia purpurea</i> Pers. (Museum specimen)	+	—	+	—	—			
PIPERACEAE								
<i>Heckeria subpeltata</i> (Willd.) Kunth (Museum specimen)	negli- gible	++	++	—	—			
POLYGONACEAE								
<i>Polygonum chinense</i> Linn. (Kanara)	negli- gible	++	—	—	traces			
<i>Polygonum flaccidum</i> Meissn. (Calcutta Suburb. March, 1961)	deep green viscous +++	++	+	—	++			
<i>Polygonum glabrum</i> Willd. (M.P.)	+	+	+	—	—			
<i>Polygonum orientale</i> Linn. (Calcutta Suburb. March, 1961)	green yellow waxy +++	(deep yellow colour with H ₂ SO ₄ + AC ₂ O + CHCl ₃ & with H ₂ SO ₄ alone)		—	—			
POLYPODIACEAE								
<i>Arthromeris wallichiana</i> Ching (Shillong)	++	—	+	++	+++			
<i>Athyrium atkinsoni</i> Bedd. (Shillong)	++	—	++	—	—			
<i>Athyrium drepanopterum</i> A. Br. (Shillong)	+	—	+	—	+			
<i>Blechnum orientale</i> Linn. (Museum specimen)	negli- gible	+++	—	—	—			
<i>Crypsinus crenato-pinnatus</i> Copel. (Shillong)	++	—	+	++	++			
<i>Leucostegia immersa</i> Presl (Shillong)	+	—	+	—	+			
<i>Pteris quadriaurita</i> Retz. (Museum specimen)	negli- gible	—	+	+	—			
<i>Pyrrosia heteractis</i> Ching (Shillong)	++	—	+	—	+			
<i>Woodwardia radicans</i> Sm. (Shillong)	++	+	—	—	—			
PORTULACACEAE								
<i>Portulaca oleracea</i> Linn. (Calcutta Suburb. March, 1961)	yellowish green waxy solid ++	+	+	—	++			
RHAMNACEAE								
<i>Ventilago calyculata</i> Tul. (Museum specimen) (Bark)	++++ (solid orange yellow)	—	++	—	—			
RUBIACEAE								
<i>Dentella repens</i> Forst. (Calcutta Suburb. March, 1961)	yellow +	—	+	—	—			

Name of plant with place and date of collections	Oil	Sterol	Terpene	Alkaloid	Saponin	Tannin	Glyco-alkaloid	Mucilage
<i>Gardenia turgida</i> Roxb. (Kanara)	+	—	++	—	+++			
<i>Ixora undulata</i> Roxb. (Calcutta Suburb. March, 1961)	deep green viscous +++	+++	+	—	—			
<i>Leptodermis lanceolata</i> Wall. (Dehra Dun. Sept., 1962)	+++	+	++	—	+			
<i>Mitragyna parvifolia</i> Korth. (Museum specimen)	+	—	+	—	—			
<i>Morinda tinctoria</i> Roxb. (Museum specimen)	+(solid orange)	—	+	—	+			
<i>Oldenlandia paniculata</i> Linn. (Calcutta Suburb. Dec., 1961)	+++	+++	—	—	—			
<i>Pavetta indica</i> Linn. (Calcutta Suburb. March, 1961)	deep green ++	++	—	+++	—			
<i>Rubia cordifolia</i> Linn. (Museum specimen)	negligible	++	++	—	+			
<i>Sparmacoce hispida</i> Linn. (Calcutta Suburb. March, 1961)	yellow green+	—	+++	—	—			
<i>Wendlandia exserta</i> DC. (Ranchi. May, 1963)	+++	—	++	—	—			
RUTACEAE								
<i>Murraya paniculata</i> Jack. (Museum specimen)	negligible	++	—	+++	traces			
<i>Ruta graveolens</i> Linn. (Museum specimen)	++++	—	+	+++	—			
SAPINDACEAE								
<i>Cardiospermum halicacabum</i> Linn. (Calcutta Suburb. March, 1961)	yellow green waxy +++	+	++	—	+++			
<i>Sapindus emarginatus</i> Vahl (Museum specimen)	++	+	+	+++	—			
<i>Schleichera oleosa</i> Oken. (Museum specimen)	negligible	+	—	—	+			
SCHIZAEACEAE								
<i>Lygodium japonicum</i> Sw. (Shillong)	+	—	+	—	+			
SCROPHULARIACEAE								
<i>Limnophila gratissima</i> Bl. (Calcutta Suburb. Dec., 1961)	yellow negligible	—	++	+	—			
<i>Scoparia dulcis</i> Linn. (Calcutta Suburb. March, 1961)	deep greenish yellow ++	—	+++	—	—			
SELAGINELLACEAE								
<i>Selaginella plumosa</i> Baker (Museum specimen)	negligible	—	—	—	—			
SOLANACEAE*								
<i>Capsicum frutescens</i> Linn. (Nilgiris)	Fruits: Leaves:			3.364% 0.652%				

* Plants of genus *Solanum* contain glyco-alkaloids. The percentages shown are for total alkaloids, free and aglycone.

Name of plant with place and date of collections		Oil	Sterol	Terpene	Alkaloid	Saponin	Tannin	Glyco-alkaloid	Mucialge
<i>Cestrum aurantiacum</i> Lindl. (Nilgiris)	Fruits: Leaves:				0.388% 0.840%				
<i>Cyphomandra betacea</i> Sendt. (Nilgiris)	Leaves:				0.452%				
<i>Datura arborea</i> Linn. (Nilgiris)	Leaves:				1.512%				
<i>Datura innoxia</i> Mill. (Coimbatore)	Leaves:				0.552%				
<i>Datura metel</i> Linn. (Coimbatore)		++	++	—	+++	+++			
<i>Datura quercifolia</i> HBK. (Coimbatore)	Fruits:				0.644%				
<i>Datura stramonium</i> Linn. (Nilgiris)	Fruits: Leaves: Roots:				0.1102% 3.624% 0.524%				
<i>Lycopersicon esculentum</i> Mill. (Coimbatore)	Leaves:				0.560%				
<i>Nicandra physalodes</i> Gaertn. (Calcutta Suburb.)		+	++	—	+	—			
<i>Nicotiana plumbaginifolia</i> Viv. (Calcutta Suburb. March, 1961)		pale yellow +	+	+	++	—			
<i>Physalis peruviana</i> Linn. (Nilgiris)	Fruits:				1.692%				
<i>Solanum aculeatissimum</i> Jacq. (Assam)	Leaves: Fruits:				0.26% 0.14%				
<i>Solanum capsicoides</i> Mart. (Nilgiris)	Fruits: Leaves:				1.6% 2.48%				
<i>Solanum ferrox</i> Linn. (Mysoie)	Fruits: Leaves:				0.304% 0.432%				
<i>Solanum incanum</i> Linn. (Coimbatore)	Fruits: Leaves:				1.052% 0.968%				
<i>Solanum indicum</i> Linn. (Calcutta Suburb. Assam)	Leaves:				0.324%				
<i>Solanum jasminoides</i> Paxt. (Nilgiris)	Leaves:				1.108%				
<i>Solanum khasianum</i> Clarke, var. <i>chatterjeanum</i> Sengupta (Nilgiris)	Fruits:				5.2%				
<i>Solanum kurzii</i> Brace ex Prain (Garo Hills)	Fruits: Leaves:				0.5% 0.22%				
<i>Solanum nigrum</i> Linn. (K. and J. Hills.)	Fruits:				0.292%				
<i>Solanum pubescens</i> Willd. (Coimbatore)	Fruits:				0.554%				
<i>Solanum seafortianum</i> Andr. (Nilgiris)	Fruits:				2.064%				
<i>Solanum sisymbirifolium</i> Lam. (Shillong)	Leaves: Roots:				0.156% 0.192%				

Name of plant with place and date of collections	Oil	Sterol	Terpene	Alkaloid	Saponin	Tannin	Glyco-alkaloid	Mucilage
<i>Solanum spirale</i> Roxb. (Kamrup)	Leaves:			1.292%				
<i>Solanum torvum</i> Sw. (K. and J. Hills.)	Fruits:			0.372%				
<i>Solanum trilobatum</i> Linn. (Coimbatore)	Fruits: Leaves:			0.956% 0.36%				
<i>Solanum verbascifolium</i> Linn. (Calcutta Suburb.)	Fruits: Leaves:			0.392% 0.368%				
<i>Withania somnifera</i> Dun. (Coimbatore)	Fruits: Leaves:			0.436% 3.184%				
THYMELAEACEAE								
<i>Wikstroemia canescens</i> Meiss. (Dehra Dun. Sept., 1962)	+++	++	+	—	—			
TILIACEAE								
<i>Grewia tiliaefolia</i> Vahl (Ranchi. May, 1963)	+ (Solid)	—	++	—	—			
TURNERACEAE								
<i>Turnera ulmifolia</i> Linn. (Calcutta Suburb. March, 1961)	+++ (Deep green)	+++	++	—	—			
URTICACEAE								
<i>Pouzolzia indica</i> Gaud. (Calcutta Suburb. March, 1961)	negligible	—	+	—	—			
<i>Streblus asper</i> Lour. (Museum specimen) (Bark)	+	—	+	traces	—			
VERBENACEAE								
<i>Callicarpa tomentosa</i> (Linn.) Murrey (Kanara. 1963)	negligible	—	+++	traces	—			
<i>Clerodendrum inerme</i> Gaertn. (Calcutta Suburb. Dec., 1961)	green ++	+	—	negligible	++			
<i>Duranta plumieri</i> Jacq. (Calcutta Suburb. Feb., 1963)	++	—	+++	traces	+++			
<i>Lantana camara</i> Linn. (Calcutta Suburb. March, 1961)	yellow waxy +++	++	+	—	—			
<i>Lippia geminata</i> HBK. (Calcutta Suburb. March, 1961)	yellow granules +	++	++	—	++			
<i>Lippia nodiflora</i> Rich. (Calcutta Suburb. March, 1961)	greenish yellow waxy +	++	—	—	—			
VITACEAE								
<i>Leea sambucina</i> Willd. (Calcutta Suburb. Dec., 1961)	++	+++	—	—	+++			
<i>Vitis adnata</i> Wall. (Calcutta Suburb. March, 1961)	yellow sticky +++	+	++	—	—			
<i>Vitis pedata</i> Vahl (Calcutta Suburb. March, 1961)	deep green waxy +++	+++	—	—	—			
<i>Vitis trifolia</i> Linn. (Calcutta Suburb. March, 1961)	yellow waxy ++	+	—	—	—			

ACKNOWLEDGEMENTS

The author is grateful to Dr. J. C. Sengupta and Rev. Fr. H. Santapau for all the facilities given for this study.

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