http://www.e-journals.net

CODEN ECJHAO
E-Journal of Chemistry
Vol. 2, No. 2, pp 142 -151, March 2005

Physicochemical and Phytochemical Examination of Medicinal Plants Used in Indigenous System of Medicine

M. K. SANTOSH,* D. SHAILA, T. CHANDRAKUMAR,
I. RAJYALAKSHMI and I. SANJEEVA RAO

Varun Herbals, 5-8-293/A, Mahesh Nagar,
Chirag Ali lane, Hyderabad - 500 001

Received 2 February 2005; Accepted 9 March 2005

Abstract: The present paper deals with the physicochemical and phytochemical examination of seventy-six medicinal plants belonging to thirty-six dicot and six monocot families. These are used in indigenous system of medicine as well as local inhabitants either as single drugs or in combination, for the cure of various ailments. In physicochemical study, the parameters such as moisture content, pH (1% aqueous), total ash, acid insoluble ash, water-soluble extractive and alcohol soluble extractive were carried out. The preliminary phytochemical study was done for the detection of secondary metabolites such as alkaloid, flavonoid, glycoside, phenol, saponin, resin, steroid and tannin. The preliminary phytochemical study revealed the presence of alkaloid and saponin in 68.4%; flavonoid in 44.7%; glycoside, phenol and steroid in 72.37%; resin in 60.5% and tannin in 71% of selected medicinal plants.

Key words: Physicochemical, Phytochemical, Medicinal plants

Introduction

Indian Ayurvedic Pharmacopoeia recorded more than 300 medicinal plants that are in common use in indigenous system of medicine. It has been observed that there is a wide dissimilarity and variation in clinical results obtained by the use of crude drugs obtained from different geographical regions¹. The knowledge of chemical compounds present in a plant helps the scientists to understand the mode of action of drug².

The preliminary phytochemical screening of medicinal plants was reported by several workers¹⁻⁶. The variation in phytochemical results was found among these workers.

In the present investigation out of the selected 76 plants, 63 plants are covered in the Ayurvedic Pharmacopoeia but physicochemical test limits are provided only for total ash, acid insoluble ash, water soluble extractive and alcohol soluble extractive. The acid insoluble ash values of *Oryza sativa* and *Zingiber officinale*, alcohol soluble extractive value for *Trapa bispinosa* and water soluble extractive value for *Withania somnifera* are not provided. The alcohol soluble extractive values of *Ferula foetida*, *Holarrhena antidysenterica*, *Withania somnifera* and *Zingiber officinale* are provided in Ayurvedic Pharmacopoeia using 90%, 60%, 25% and 90% aqueous alcohol respectively⁷⁻¹⁰.

Medak district is one of the 10 districts of Telangana region of Andhra Pradesh has forests, which are of the southern tropical dry deciduous type account for 9.9% of the total geographical area. It lies between 17° 27' and 18° 18' Northern latitude and 77° 28' and 79° 10' of Eastern longitude. The rainfall during the southwest monsoon months amounts to about 84% of the annual rainfall. The average annual rainfall in the district is 896.7mm. Narsapur reserve forest of Medak district has a forest area of 202.70 sq. km and is a good source of medicinal plants. Black cotton soils are moderately alkaline with high soluble salt content and comprising of clay loams, clays and silty clays are found in Narsapur¹¹. Narsimha Rao (1986) reported 616 taxa of angiosperms including 116 cultivated species, belonging to 395 genera and 111 families¹². The local herbal drug pharmacies utilize the available raw drugs from this forest area. In the present investigation, 38 medicinal plants were collected from the same area and the remaining drugs were procured from the local market.

In view of the above facts and growing interest on plant sources for evolution of therapeutic agents, the present investigation of physico-chemical and phytochemical study of seventy-six medicinal plants belonging to thirty-six dicot and six monocot families has been taken up to determine the quality of raw drugs.

Materials and Methods

The authentic plant materials were collected from Narsapur forest, Medak district, Andhra Pradesh and identified using Flora of Medak District (Andhra Pradesh)¹¹. Voucher specimen of the collected plants were prepared and maintained. The ingredients that were not available in and around were procured from the local market of Hyderabad, Andhra Pradesh. The respective plant parts were shade dried and finely powdered using laboratory blender and fine powder was used for further studies.

The physico-chemical parameters such as moisture content, pH (1% aqueous), total ash, acid insoluble ash, alcohol soluble extractive, water soluble extractive and preliminary phytochemical screening for the presence of alkaloid, flavonoid, glycoside, phenol, saponin, resin, steroid, tannin were carried out by following the standard procedures¹³⁻¹⁶.

Physicochemical tests

Moisture content: Weigh accurately 5g of powdered material in a dry and flat petri dish. Dry the sample in an oven at 110°C. Dry until two consecutive weighing do not differ by more than 5mg. Calculate the loss of weight in terms of percentage.

pH (1% aqueous): Dissolve 1g of powdered sample in 100ml of distilled water, shake frequently, then allow it to stand for 18 hours. Filter and check the pH using pH meter.

Total ash: Weigh accurately about 2-5g of dried plant material in a previously ignited and tared crucible. Ignite it by gradually heating it to 500 – 600°C until it is white. Cool in a desiccator and weigh. Calculate the content of total ash in terms of percentage.

Acid insoluble ash: To the crucible containing total ash, add 25ml of HCl (~ 70g/l), cover with watch glass and boil gently for 5min. Rinse the watch glass with 5ml of hot water and add this liquid to the crucible. Collect the insoluble matter on an ashless filter paper and wash with hot water until the filtrate is neutral. Ignite the filter paper containing insoluble matter in crucible to constant weight. Cool in a desiccator and weigh. Calculate the content of acid insoluble ash in terms of percentage.

Water-soluble extractive: Weigh accurately about 4g of air-dried material in a glass stoppered conical flask. Macerate with 100ml of distilled water for 6hours, shaking frequently, then allow to stand for 18hours. Filter rapidly taking care not to lose any solvent, transfer 25ml of the filtrate to a tared flat bottomed petri dish and evaporate to dryness on a water bath. Dry at 105°C for 6 hours, cool in a desiccator for 30 min and weigh. Calculate the content of water- soluble matter in terms of percentage.

Alcohol soluble extractive: Weigh accurately about 4g of air-dried material in a glass stoppered conical flask. Macerate with 100ml of absolute alcohol for 6hours, shaking frequently, then allow to stand for 18hours. Filter rapidly taking care not to lose any solvent, transfer 25ml of the filtrate to a tared flat bottomed petri dish and evaporate to dryness on a water bath. Dry at 105°C for 6 hours, cool in a desiccator for 30 min and weigh. Calculate the content of alcohol-soluble matter in terms of percentage.

Phytochemical tests:

Alkaloid (Wagner's test): Acidify 1ml of alcoholic extract of the drug with 1.5% of HCl and add a few drops of Wagner's reagent. A brown precipitate indicates positive test for alkaloids.

Flavonoid: In a test tube containing 0.5ml of the alcoholic extract of the drug, add 5-10 drops of dilute HCl followed by a small piece of magnesium. Boil the solution for a few minutes. In the presence of flavonoids a pink, reddish pink or brown color is produced.

Glycoside: Dissolve a small amount of alcoholic extract of the drug in 1ml of water and add 1N NaOH solution. A yellow color indicates the presence of glycosides.

Phenols (FeCl₃ test): Dissolve a small quantity of alcoholic extract of the drug in 2ml of distilled water and a few drops of 10% ferric chloride solution. A blue or green color is produced indicates the presence of phenols.

Saponin: Dissolve a small quantity of alcoholic extract of the drug in 5ml of distilled water, shake the mixture vigorously and leave for 3min. Honeycomb like froth indicates the presence of saponins.

Resin: Dissolve a small quantity of ethanolic extract of the drug in 5ml of acetic anhydride by means of gentle heat, cool and add a drop of sulphuric acid. A bright purplish red color indicates the presence of resins.

Steroid (Liebermann - Burchard's test): To the ethanolic extract of the drug in CHCl₃, add acetic anhydride followed by 1ml of concentrated sulphuric acid. A reddish brown ring is formed at the juncture of two layers indicates the presence of steroids.

Tannin: To the ethanolic extract of the drug, add a few drops of 5% aqueous ferric chloride solution. A bluish black color indicates the presence of tannins.

Results and Discussion

The results of the physicochemical and phytochemical study are tabulated in **Table 1** and **2**. A slight variation in physicochemical results was found in 46 plants of present study with that of Ayurvedic Pharmacopoeial standard values. Among these 46 plants, the variation in total ash, acid insoluble ash, water-soluble extractive and alcohol soluble extractive was observed in 23, 15, 30 and 18 selected plants respectively. The preliminary phytochemical study revealed the presence of alkaloid and saponin in 68.4%; flavonoid in 44.7%; glycoside, phenol and steroid in 72.37%; resin in 60.5% and tannin in 71% of selected medicinal plants. The variation in phytochemical results of present study was found with that of reported¹⁻⁶.

The slight variation in physicochemical and phytochemical results may be due to several factors such as different geographical conditions, edaphic factors, environmental conditions, period of cultivation and harvesting, method of collection, source of irrigation and fertilizers, age of the plant, powdering method, and extraction method.

It has been reported that the variation in physico-chemical values may be due to powdering of fibrous material of an ingredient in mixer grinder, while this fibrous material is discarded during powdering in mortar and pestle. Similarly, the total ash and acid insoluble ash were slightly higher in the mixer grinder made material as the powdered fibres contribute additional ash¹⁷.

Though, a slight variation in physicochemical parameters was observed in some of the selected plants; phytochemically they showed better test results. Apart from the physicochemical parameters provided in Ayurvedic Pharmacopoeia, the data for moisture content, pH value and phytochemical study evolved can be considered as viable parameters, which will go a long way for prescribing a dependable standards to the raw drugs.

Hence, this study has been carried out along with the parameters given in Pharmacopoeia to determine the quality of the raw drugs, as these are used in the preparation of Ayurvedic and Unani formulations in this region.

Table – 1: Results of physico-chemical study

S. No.	Botanical name	Family	Part used	1	2	3	4	5	6	7	8
1.	<i>Abutilon indicum</i> (Linn.) Sw.	Malvaceae	Rt.	Narsapur	58	7.85	7.03	8.5*	0.82	9.65	3.35
2.	<i>Acorus calamus</i> Linn.	Araceae	Rz.	Market	--	11.49	4.62	6.52	0.35	19	9.5
3.	<i>Aegle marmelos</i> Corr. 4.65*	Rutaceae	Fr.	Narsapur	06	8.12	5.66	3.87	3.15*	12.55*	
4.	<i>Aegle marmelos</i> Corr. 3.75*	Rutaceae	St. Bk.	Narsapur	06	6.09	6.94	12.81*	0.43	6.0*	
5.	<i>Aerva lanata</i> (L.) Juss. ex. Schult	Amaranthaceae	Rt.	Narsapur	45	7.59	5.9	10.93	1.4	6.55	2.85
6.	<i>Ailanthus excelsa</i> Roxb.	Simarubaceae	St. Bk.	Narsapur	02	7.55	6.45	12.03*	0.57*	7.8	6.9
7.	<i>Aloe vera</i> Tourn.ex. Linn. 29.8*	Liliaceae	Lf.Exd.	Market	--	7.8	6.56	3.17	1.9	45.95*	
8.	<i>Alpinia galanga</i> Willd.	Zingiberaceae	Rz.	Market	--	7.08	5.08	7.46	1.3	6.0	4.1
9.	<i>Areca catechu</i> Linn. ex. Benth.	Palmae	Sd.	Market	--	9.27	5.83	2.35	1.81*	12.35	9.9
10.	<i>Asparagus racemosus</i> Willd.	Liliaceae	Rt	Narsapur	27	5.01	8.11	3.23	0.39	26.05*	6.0
11.	<i>Asteracantha longifolia</i> Nees	Acanthaceae	Rt.	Narsapur	03	9.86	6.2	14.16*	2.75*	9.0	3.34*
12.	<i>Azadirachta indica</i> A. Juss	Meliaceae	St. Bk.	Narsapur	42	12.78	6.15	5.67	0.26	8.7	10.1
13.	<i>Bacopa monnieri</i> (Linn.) Pennel	Scrophulariaceae	Pl.	Narsapur	67	9.82	6.68	16.18	2.45	7.8*	6.9
14.	<i>Bambusa arundinacea</i> Willd.	Gramineae	S.C.	Market	--	1.09	8.93	91.45	87.3	1.55	0.45
15.	<i>Berberis aristata</i> DC. 2.55*	Berberidaceae	St.	Market	--	5.71	4.92	14.96*	6.45*	4.45*	
16.	<i>Boerhaavia diffusa</i> Linn.	Nyctaginaceae	Wh. Pl.	Narsapur	17	6.92	5.37	13.93	0.57	19.85	7.8
17.	<i>Carum carvi</i> Linn.	Umbelliferae	Fr.	Market	--	5.89	4.96	7.85	0.55	18.35	7.65
18.	<i>Cassia fistula</i> Linn.	Leguminosae	Fr.P	Narsapur	34	10.82	5.58	9.4*	0.46	7.15*	15.35
19.	<i>Centella asiatica</i> (L.) Urban	Apiaceae	Wh. Pl.	Narsapur	26	9.64	6.83	16.3	3.92	12.65*	11.5
20.	<i>Cinnamomum camphora</i> Nees & Eberm	Lauraceae	Vol. Matter	Market	--	--	9.29	--	--	0.2	14
21.	<i>Cinnamomum tamala</i> Nees & Eberm	Lauraceae	Lf.	Market	--	4.67	6.04	4.46	0.19	6.85*	8.1
22.	<i>Cinnamomum zeylanicum</i> Blume	Lauraceae	St. Bk.	Market	--	7.5	7.9	2.72	0.25	5.4	6.7
23.	<i>Commiphora myrrha</i> (Nees) Engl.	Burseraceae	Exd.	Market	--	10.9	4.85	5.62	0.21	39.1	7.05
24.	<i>Coriandrum sativum</i> Linn.	Umbelliferae	Fr.	Market	--	5.93	8.41	5.46	0.55	20.9	10.95
25.	<i>Cuminum cyminum</i> Linn.	Umbelliferae	Fr.	Market	--	8.59	7.7	8.14*	0.43	14.5*	7.8

26.	<i>Curcuma longa</i> Linn.	Zingiberaceae	Rz.	Market	--	5.75	6.1	6.7	0.6	16.29	8.05
27.	<i>Cymbopogan citratus</i> (DC.)Stapf	Gramineae	Rt.	Narsapur	44	12.32	5.17	2.06	1.29	35.1	4.7

Contd.....

28.	<i>Cyperus rotundus</i> Linn.	Cyperaceae	Rz.	Narsapur	01	9.98	8.24	5.62	3.13	13.1	5.75
29.	<i>Desmostachya bipinnata</i> Stapf.	Gramineae	Rt.	Narsapur	20	2.25	5.6	7.6	1.15	4.05*	2.65*
30.	<i>Elettaria cardmomum</i> Maton	Zingiberaceae	Sd.	Market	--	9.0	7.48	3.82	1.0	11.55	6.2

31.	<i>Embelia ribes</i> Burm. f.	Myrsinaceae	Fr.	Market	--	5.68	5.4	3.81	0.31	10.45	11.3
32.	<i>Embllica officinalis</i> Gaertn.	Euphorbiaceae	Fr.	Narsapur	10	6.77	3.85	3.29	0.31	10.45*	6.2*
33.	<i>Evolvulus alsinoides</i> Linn.	Convolvulaceae	Wh. Pl.	Narsapur	57	5.93	6.95	14.6	7.19	7.75	4.4
34.	<i>Ferula foetida</i> Regel	Umbellifereae	Exd.	Market	--	8.16	6.25	4.21	2.23	9.95*	9.35*
35.	<i>Glycyrrhiza glabra</i> Linn.	Fabaceae	Rt.	Market	--	6.31	5.29	8.14	4.93*	10.5*	7.05*
36.	<i>Hedychium spicatum</i> Ham. ex Smith	Zingiberaceae	Rz.	Market	--	8.12	8.09	4.19	0.72	9.85	4.5
37.	<i>Hemidesmus indicus</i> R. Br.	Asclepiadaceae	Rt.	Narsapur	65	8.85	6.94	11.28*	4.19*	6.7*	3.65*
38.	<i>Holarrhena antidysenterica</i> Wall.	Apocynaceae	St.bk.	Narsapur	48	7.53	5.9	6.05	0.8	10.61	5.55*
39.	<i>Mesua ferrea</i> Linn.	Clusiaceae	Fl.	Market	--	15.34	5.83	4.42	0.13	9.15*	8.85*
40.	<i>Mucuna prurita</i> Hook.	Leguminosae	Sd.	Narsapur	11	6.9	5.74	8.78*	2.84*	16.8*	4.05
41.	<i>Myristica fragrans</i> Houtt.	Myristicaceae	Aril	Market	--	5.08	6.65	2.36	0.16	6.3	13.7
42.	<i>Myristica fragrans</i> Houtt.	Myristicaceae	Sd.	Market	--	12.67	7.8	1.93	0.1	5.4*	8.8*
43.	<i>Nardostachys jatamansi</i> DC.	Valerianaceae	Rt.+Rz.	Market	--	7.04	6.01	9.52*	4.41	2.95*	2.55
44.	<i>Nelumbo nucifera</i> Gaertn.	Nymphaeaceae	Sd.	Market	--	7.29	7.72	3.93	0.06	12.9	4.8
45.	<i>Nymphea stellata</i> Willd.	Nymphaeaceae	Fl.	Narsapur	22	11.84	5.26	12.68*	3.12*	19.8*	3.65
46.	<i>Oryza sativa</i> Linn.	Gramineae	Rt.	Narsapur	15	3.97	5.2	7.96	3.59	5.9	4.1*
47.	<i>Phaseolus trilobus</i> Ait.	Leguminosae	Pl.	Narsapur	16	6.72	5.59	14.27*	6.27*	6.75*	5.6
48.	<i>Phyllanthus amarus</i> Schum & Thonn.	Euphorbiaceae	Pl.	Narsapur	23	7.48	5.71	13.9	6.46	8.0*	9.05
49.	<i>Picrorhiza kurroa</i> Royle ex. Benth.	Scrophulariaceae	Rz.	Market	--	5.99	6.48	4.62	1.57*	20.55	13.65
50.	<i>Piper cubeba</i> Linn.f.	Piperaceae	Fr.	Market	--	16.0	6.48	8.57*	0.68	17.2	14.6
51.	<i>Piper longum</i> Linn.	Piperaceae	Fr.	Market	--	11.25	6.98	7.28*	0.36	22	9.25
52.	<i>Piper nigrum</i> Linn.	Piperaceae	Fr.	Market	--	10.19	7.48	5.41*	0.32	6.9	6.1
53.	<i>Plumbago zeylanica</i> Linn.	Plumbaginaceae	Rt.	Narsapur	08	12.5	5	4.57*	0.36	11.75*	13.5

Contd...

54.	<i>Prunus cerasoides</i> D. Don	Rosaceae	St.	Market	--	5.6	6.24	10.08*	0.39	3.65	2.3*
55.	<i>Pterocarpus santalinus</i> Linn. f.	Fabaceae	Ht.Wd.	Market	--	5.17	6.24	1.57	0.23	1.4	10.55
56.	<i>Pueraria tuberosa</i> DC.	Leguminosae	Rt.	Market	--	6.43	8.08	2.26	0.17	25.8	4.6
57.	<i>Punica granatum</i> Linn.	Punicaceae	Sd.	Narsapur	32	7.04	4.5	3.55	0.13	32.4*	20.5
58.	<i>Rubia cordifolia</i> Linn.	Rubiaceae	St.	Market	--	6.39	5.75	12.3*	0.7*	18.45	3.35
59.	<i>Saccharum spontaneum</i> linn.	Gramineae	Rt.	Narsapur	52	3.94	5.19	8.37*	1.97	4.2	2.5*
60.	<i>Santalum album</i> Linn.	Santalaceae	Ht.Wd.	Narsapur	50	6.92	5.95	1.09*	0.09	1.45	8.55
61.	<i>Scindapsus officinalis</i> Schott	Araceae	Fr.	Market	--	9.08	8.06	5.21	0.44	29.45	4.8
62.	<i>Sesbania bispinosa</i> (Jacq.) Fawett & Rendle	Leguminosae	Rt.	Narsapur	66	3.75	5.5	8.37	1.06	7.4	6.5
63.	<i>Sida cordifolia</i> Linn.	Malvaceae	Rt.	Narsapur	05	6.75	7.12	2.32	0.15	3.8	2.2
64.	<i>Solanum xanthocarpum</i> Schrad & Wendl.	Solanaceae	Rt.	Narsapur	51	4.54	5.23	4.76	0.8	16.9	4.4
65.	<i>Syzygium aromaticum</i> (Linn.) Merr.&L.M.Perry	Myrtaceae	Fl.	Market	--	9.73	6.15	5.36	0.39	11.65	13.4
66.	<i>Terminalia arjuna</i> W. & A. 11.95*	Combretaceae	St. Bk.	Narsapur	33	8.08	5.15	15.27	4.85*	10.5*	
67.	<i>Terminalia bellerica</i> Roxb.	Combretaceae	Fr.	Narsapur	31	6.79	4.6	3.25	0.29	33.4*	9.35
68.	<i>Terminalia chebula</i> Retz.	Combretaceae	Fr. P.	Narsapur	35	7.98	3.96	2.66	0.24	18.5*	18.4*
69.	<i>Tinospora cordifolia</i> (Willd.) Miers.	Menispermaceae	St.	Narsapur	09	8.2	3.54	11.46	3.88*	9.8*	3.15
70.	<i>Trachyspermum ammi</i> Spargue.	Umbelliferae	Fr.	Market	--	8.78	5.65	9.69*	0.27*	15.7	6.6
71.	<i>Trapa bispinosa</i> Roxb.	Onagraceae	Fr.	Market	--	12.59	7.03	2.34	0.13	8.65	1.85
72.	<i>Tribulus terrestris</i> Linn	Zygophyllaceae	Fr.	Narsapur	04	6.15	8.59	10.64	0.26	12.6	6.55
73.	<i>Vetiveria zizanioides</i> (Linn.)Nash	Poaceae	Rt.	Narsapur	21	7.71	5.66	11.13*	1.78	7.25	4.95
74.	<i>Withania somnifera</i> Dunal	Solanaceae	Rt.	Market	--	8.42	5.58	9.05*	0.61	5.4*	12.5
75.	<i>Woodfordia fruticosa</i> Kurz.	Lythraceae	Fl.	Narsapur	07	35.6	4.67	6.23	0.69	25.8*	8.4
76.	<i>Zingiber officinale</i> Rosc.	Zingiberaceae	Rz.	Market	--	8.68	7.17	4.99	1.41	10.25	5.05

Where, 1- Place of collection; 2- Voucher specimen number; 3 – Moisture content; 4 – pH (1% aqueous); 5 – Total ash; 6 – Acid insoluble ash; 7 – Water-soluble extractive; 8- Alcohol soluble extractive. * Values exceeding the Pharmacopeial limits.

Table – 2. Results of phytochemical study

S. No.	Botanical name	Family	Part used	1	2	3	4	5	6	7	8
1.	<i>Abutilon indicum</i> (Linn.) Sw.	Malvaceae	Rt.	+ve	+ve	+ve	+ve	+ve	-ve	-ve	+ve
2.	<i>Acorus calamus</i> Linn.	Araceae	Rz.	+ve	-ve	+ve	-ve	-ve	+ve	+ve	-ve
3.	<i>Aegle marmelos</i> Corr.	Rutaceae	Fr.	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve
4.	<i>Aegle marmelos</i> Corr.	Rutaceae	St. Bk.	+ve	-ve	-ve	-ve	-ve	-ve	+ve	-ve
5.	<i>Aerva lanata</i> (L.) Juss. ex. Schult	Amaranthaceae	Rt.	+ve	-ve	+ve	+ve	+ve	-ve	-ve	+ve
6.	<i>Ailanthus excelsa</i> Roxb.	Simarubaceae	St. Bk.	+ve	-ve	-ve	-ve	+ve	-ve	-ve	-ve
7.	<i>Aloe vera</i> Tourn.ex. Linn.	Liliaceae	Lf.Exd.	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve
8.	<i>Alpinia galanga</i> Willd.	Zingiberaceae	Rz.	+ve	+ve	+ve	+ve	+ve	+ve	-ve	+ve
9.	<i>Areca catechu</i> Linn. ex. Benth.	Palmae	Sd.	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve
10.	<i>Asparagus racemosus</i> Willd.	Liliaceae	Rt	-ve	-ve	+ve	-ve	+ve	+ve	-ve	-ve
11.	<i>Asteracantha longifolia</i> Nees	Acanthaceae	Rt.	+ve	-ve	+ve	-ve	+ve	+ve	+ve	-ve
12.	<i>Azadirachta indica</i> A. Juss	Meliaceae	St. Bk.	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve
13.	<i>Bacopa monnieri</i> (Linn.) Pennel	Scrophulariaceae	Pl.	+ve	+ve	+ve	+ve	+ve	-ve	+ve	+ve
14.	<i>Bambusa arundinacea</i> Willd.	Gramineae	S.C.	--	--	--	--	--	--	--	--
15.	<i>Berberis aristata</i> DC.	Berberidaceae	St.	+ve	-ve	-ve	+ve	-ve	-ve	-ve	+ve
16.	<i>Boerhaavia diffusa</i> Linn.	Nyctaginaceae	Wh. Pl.	+ve	-ve	-ve	-ve	-ve	-ve	+ve	-ve
17.	<i>Carum carvi</i> Linn.	Umbelliferae	Fr.	+ve	+ve	+ve	+ve	+ve	+ve	-ve	+ve
18.	<i>Cassia fistula</i> Linn.	Leguminosae	Fr.P	+ve	-ve	+ve	+ve	+ve	-ve	+ve	+ve
19.	<i>Centella asiatica</i> (L.) Urban	Apiaceae	Wh. Pl.	+ve	+ve	+ve	+ve	+ve	-ve	+ve	+ve
20.	<i>Cinnamomum camphora</i> Nees & Eberm	Lauraceae	Vol. Matter	--	--	--	--	--	--	--	--
21.	<i>Cinnamomum tamala</i> Nees & Eberm	Lauraceae	Lf.	+ve	+ve	+ve	+ve	+ve	-ve	+ve	+ve
22.	<i>Cinnamomum zeylanicum</i> Blume	Lauraceae	St. Bk.	-ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve
23.	<i>Commiphora myrrha</i> (Nees)Engl.	Burseraceae	Exd.	-ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve
24.	<i>Coriandrum sativum</i> Linn.	Umbelliferae	Fr.	-ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve

Physicochemical and Phytochemical Examination of Medicinal Plants

Contd...

25.	<i>Cuminum cyminum</i> Linn.	Umbelliferae	Fr.	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve
26.	<i>Curcuma longa</i> Linn.	Zingiberaceae	Rz.	+ve	+ve	+ve	+ve	-ve	+ve	+ve	+ve
27.	<i>Cymbopogon citratus</i> (DC.) Stapf	Gramineae	Rt.	+ve	-ve	+ve	+ve	-ve	-ve	+ve	+ve
28.	<i>Cyperus rotundus</i> Linn.	Cyperaceae	Rz.	-ve	+ve	-ve	+ve	-ve	+ve	+ve	+ve
29.	<i>Desmostachya bipinnata</i> Stapf.	Gramineae	Rt.	+ve	-ve	+ve	-ve	-ve	+ve	-ve	-ve
30.	<i>Elettaria cardamomum</i> Maton	Zingiberaceae	Sd.	+ve	-ve	-ve	-ve	+ve	+ve	+ve	-ve
31.	<i>Embelia ribes</i> Burm. f.	Myrsinaceae	Fr.	+ve	-ve	+ve	+ve	-ve	+ve	+ve	+ve
32.	<i>Emblica officinalis</i> Gaertn.	Euphorbiaceae	Fr.	+ve	+ve	-ve	+ve	+ve	+ve	+ve	+ve
33.	<i>Evolvulus alsinoides</i> Linn.	Convolvulaceae	Wh. Pl.	+ve	+ve	+ve	+ve	+ve	-ve	+ve	+ve
34.	<i>Ferula foetida</i> Regel	Umbellifereae	Exd.	-ve	-ve	+ve	-ve	-ve	+ve	+ve	-ve
35.	<i>Glycyrrhiza glabra</i> Linn.	Fabaceae	Rt.	-ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve
36.	<i>Hedychium spicatum</i> Ham. ex Smith	Zingiberaceae	Rz.	-ve	-ve	+ve	-ve	+ve	+ve	+ve	-ve
37.	<i>Hemidesmus indicus</i> R. Br.	Asclepiadaceae	Rt.	+ve	-ve	+ve	+ve	+ve	-ve	+ve	+ve
38.	<i>Holarrhena antidysenterica</i> Wall.	Apocynaceae	St.bk.	+ve	-ve	+ve	+ve	+ve	+ve	+ve	+ve
39.	<i>Mesua ferrea</i> Linn.	Clusiaceae	Fl.	+ve	+ve	-ve	+ve	+ve	+ve	+ve	+ve
40.	<i>Mucuna prurita</i> Hook.	Leguminosae	Sd.	+ve	-ve	+ve	+ve	+ve	+ve	+ve	+ve
41.	<i>Myristica fragrans</i> Houtt.	Myristicaceae	Aril	-ve	-ve	+ve	+ve	+ve	+ve	+ve	+ve
42.	<i>Myristica fragrans</i> Houtt.	Myristicaceae	Sd.	+ve	-ve	-ve	+ve	+ve	+ve	-ve	+ve
43.	<i>Nardostachys jatamansi</i> DC.	Valerianaceae	Rt.+Rz.	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve
44.	<i>Nelumbo nucifera</i> Gaertn.	Nymphaeaceae	Sd.	+ve	-ve	-ve	+ve	+ve	+ve	-ve	+ve
45.	<i>Nymphaea stellata</i> Willd.	Nymphaeaceae	Fl.	+ve	+ve	+ve	+ve	+ve	-ve	+ve	+ve
46.	<i>Oryza sativa</i> Linn.	Gramineae	Rt.	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve
47.	<i>Phaseolus trilobus</i> Ait.	Leguminosae	Pl.	+ve	+ve	+ve	+ve	+ve	-ve	+ve	+ve
48.	<i>Phyllanthus amarus</i> Schum & Thonn.	Euphorbiaceae	Pl.	+ve	+ve	+ve	+ve	+ve	-ve	-ve	+ve
49.	<i>Picrorhiza kurroa</i> Royle ex. Benth.	Scrophulariaceae	Rz.	-ve	-ve	+ve	+ve	-ve	+ve	-ve	+ve
50.	<i>Piper cubeba</i> Linn.f.	Piperaceae	Fr.	+ve	-ve	+ve	+ve	-ve	+ve	-ve	+ve
51.	<i>Piper longum</i> Linn.	Piperaceae	Fr.	+ve	+ve	-ve	+ve	-ve	+ve	+ve	+ve
52.	<i>Piper nigrum</i> Linn.	Piperaceae	Fr.	+ve	+ve	+ve	+ve	-ve	+ve	+ve	+ve

Contd...

53.	<i>Plumbago zeylanica</i> Linn.	Plumbaginaceae	Rt.	+ve	-ve	+ve	-ve	+ve	+ve	+ve	-ve
54.	<i>Prunus cerasoides</i> D. Don	Rosaceae	St.	-ve	+ve	+ve	+ve	-ve	+ve	-ve	+ve
55.	<i>Pterocarpus santalinus</i> Linn. f.	Fabaceae	Ht.Wd.	-ve	-ve	+ve	+ve	-ve	+ve	+ve	+ve
56.	<i>Pueraria tuberosa</i> DC.	Leguminosae	Rt.	-ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve
57.	<i>Punica granatum</i> Linn.	Punicaceae	Sd.	+ve	-ve	+ve	+ve	+ve	-ve	+ve	+ve
58.	<i>Rubia cordifolia</i> Linn.	Rubiaceae	St.	-ve	-ve	+ve	+ve	-ve	-ve	+ve	+ve
59.	<i>Saccharum spontaneum</i> linn.	Gramineae	Rt.	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve
60.	<i>Santalum album</i> Linn.	Santalaceae	Ht.Wd.	-ve	+ve	-ve	-ve	-ve	+ve	+ve	-ve
61.	<i>Scindapsus officinalis</i> Schott	Araceae	Fr.	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve
62.	<i>Sesbania bispinosa</i> (Jacq.) Fawett & Rendle	Leguminosae	Rt.	-ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve
63.	<i>Sida cordifolia</i> Linn.	Malvaceae	Rt.	+ve	-ve	-ve	+ve	+ve	-ve	-ve	+ve
64.	<i>Solanum xanthocarpum</i> Schrad & Wendl.	Solanaceae	Rt.	+ve	-ve	-ve	+ve	+ve	-ve	-ve	+ve
65.	<i>Syzygium aromaticum</i> (Linn.) Merr.&L.M.Perry	Myrtaceae	Fl.	+ve	+ve	-ve	+ve	+ve	+ve	+ve	+ve
66.	<i>Terminalia arjuna</i> W. & A.	Combretaceae	St. Bk.	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve
67.	<i>Terminalia bellerica</i> Roxb.	Combretaceae	Fr.	-ve	-ve	+ve	+ve	+ve	+ve	+ve	+ve
68.	<i>Terminalia chebula</i> Retz.	Combretaceae	Fr. P.	-ve	-ve	+ve	+ve	+ve	+ve	-ve	+ve
69.	<i>Tinospora cordifolia</i> (Willd.) Miers.	Menispermaceae	St.	+ve	-ve	+ve	+ve	+ve	+ve	+ve	-ve
70.	<i>Trachyspermum ammi</i> Spargue.	Umbelliferae	Fr.	-ve	-ve	-ve	+ve	+ve	-ve	-ve	+ve
71.	<i>Trapa bispinosa</i> Roxb.	Onagraceae	Fr.	+ve	-ve	-ve	+ve	-ve	-ve	+ve	+ve
72.	<i>Tribulus terrestris</i> Linn	Zygophyllaceae	Fr.	+ve	+ve	-ve	+ve	+ve	+ve	+ve	+ve
73.	<i>Vetiveria zizanioides</i> (Linn.)Nash	Poaceae	Rt.	-ve	-ve	+ve	-ve	-ve	-ve	-ve	-ve
74.	<i>Withania somnifera</i> Dunal	Solanaceae	Rt.	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve
75.	<i>Woodfordia fruticosa</i> Kurz.	Lythraceae	Fl.	-ve	+ve	-ve	+ve	-ve	+ve	+ve	+ve
76.	<i>Zingiber officinale</i> Rosc.	Zingiberaceae	Rz.	-ve	+ve	+ve	-ve	-ve	+ve	-ve	-ve

Where, 1 – Alkaloid; 2 – Flavonoid; 3 – Glycoside; 4 – Phenol; 5 – Saponin; 6 – Resin; 7 – Steroid; 8 – Tannin.

References

1. Karnick C R, *Nagarjun* 1978, **5**, 26-32.
2. Joshi M C and Sabnis S D, *B M E B R* 1989, **10**(1-2), 61-82.
3. Puri H S, *B M E B R* 1980, **1**(3), 384-392.
4. Agarwal R G, Pant P, Tiwari L C, Singh J, Pandey M J and Tiwary, D. N. *B M E B R* 1989, **10**(3-4), 176-186.
5. Tewari L C, Sanwal P, Singh J and Joshi P, *B M E B R* 1984, **5**(1-2), 71-81.
6. Ashok K S, *B M E B R* 1988, **9**(1-2), 68-77.
7. Ayurvedic Pharmacopoeia of India, Dept. of ISM&H, Ministry of Health and Family Welfare: New Delhi, 1989; Vol.-I.
8. Ayurvedic Pharmacopoeia of India, Dept. of ISM&H, Ministry of Health and Family Welfare: New Delhi, 1999; Vol.-II.
9. Ayurvedic Pharmacopoeia of India, Dept. of ISM&H, Ministry of Health and Family Welfare: New Delhi, 2001; Vol.-III.
10. Ayurvedic Pharmacopoeia of India, Dept. of ISM&H, Ministry of Health and Family Welfare: New Delhi, 2004; Vol.-IV.
11. Pullaiah T, Prabhakar C and Raviprasad Rao B, *Flora of Medak District (Andhra Pradesh)*; Daya Publishing House: Delhi, 1998.
12. Narasimha Rao, G. Studies on the floristics of angiosperms and the dermatypes of Acanthaceae of Narsapur taluk (Medak district, Andhra Pradesh); Ph. D. thesis, Osmania University: Hyderabad, 1986.
13. Quality Control Methods for Medicinal Plant Materials; WHO: Geneva, 1998.
14. Pharmacopoeial Standards for Ayurvedic Formulations; CCRAS: New Delhi, 1987.
15. Trease, G E, Evans W C *Pharmacognosy*; 11th Ed.; Bailliere Tindall: London, 1978.
16. Wallis, T. E. *Textbook of Pharmacognosy*; 5th Ed.; J & A Churchill Ltd.: London, 1967.
17. Alam M, Dasan K K S, Rukmani B and Rao R B, *Journal of Research in Ayurveda and Siddha* 1990, **11**(1-4): 56-60.