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PHYTOCHEMICAL SCREENING OF SOME ANTIDYSENTERIC MEDICINAL PLANTS OF BANGLADESH

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Abstract

In this report, 40 antidysenteric medicinal plant species representing 24 families were considered for qualitative assessment of their secondary metabolites like alkaloids, flavonoids, glycosides, sterols and tannins. Alkaloids were present in all plant species, though in different degrees and the relative effectiveness of Dragendorffs' reagent was better than others. Distribution of flavonoids, glycosides, sterols and tannins was sporadic in different plant species except *A. cepa, A. marmelos, I. coccinea, M. indica, S. dulcis* and *Z. officinale*, where all these metabolites were present. Abundance and mode of distribution of secondary metabolites in different test plants and their organs were discussed.

Key words: Antidysenteric medicinal plants, Therapeutic principles, Secondary metabolites

Introduction

The use of medicinal plants has been a central component of health care in many cultures for centuries. The first recorded culturally significant plant residues of about 60000 years old were found in Iraq in 1960 at Neanderthal human burial site (Solecki and Shanidar 1975). About 30000 to 70000 plants are currently used by 80% of the rural people across the world for primary health care and WHO upholds quality, recommends and encourages the use of herbal drugs because of their easy availability, efficacy and, specially cost effectiveness compared to modern allopathic drugs (WHO 2002). More than 1000 plant species of Bangladesh are considered to have medicinal properties and about 455-747 have been described with their therapeutic uses for different diseases including dysentery (Mia 1990, Ghani 2003 and Yousuf *et al.* 2009).

Herbs which help in curing dysentery are antidysenteric and antidysenteric plants contain some active chemical agents, usually secondary metabolites, which function as therapeutic principles against dysentery. Dysentery is an inflammatory disorder of the lower intestinal tract, usually caused by microbial infection and resulting pain or fever or bloody diarrhoea. Dysenteric disease has long been recognized as a leading cause of morbidity and mortality among children (1-4 years) and aged people (≥60 years) in Bangladesh (Mitra *et al.* 1990).

Medicinal plants produce a diverse assortment of secondary metabolites of therapeutic importance (Croteau *et al*. 2000 and Terryn *et al.* 2006) and plants with antidysenteric and antidiarrhoeal properties were found to contain alkaloids, flavonoids, saponins,

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sterols, tannins and reducing sugars as well as show antibacterial and antiprotozoan activity (Longanga *et al.* 2000). However, phytochemical characteristics of many of the antidysenteric medicinal plants of Bangladesh are unknown. This paper deals with the phytochemical screening of antidysenteric medicinal plants available in the hilly area of Chittagong University campus and around.

Materials and Methods

During this investigation, 40 antidysenteric medicinal plant species, enlisted in different published literature (Ghani 2003 and Yousuf *et al*. 2009) were collected from the hilly area of Chittagong University campus and around covering different life forms such as herbs, shrubs and trees. Secondary metabolites like alkaloids, flavonoids, glycosides, sterols and tannins were analyzed qualitatively in the whole plant and plant parts within 6 h of collection. For alkaloids, a modified method (Amarasingham *et al.* 1965 and Apline and Cannon 1971) was followed. Dragendorff (D), Wagner (W), Mayer (M), Hager (H) and Tannic acid (T) were prepared following standard method (Cromwell 1955) and were used for alkaloid detection in 2% HCl extract of the plant. Ethanol extract was used for the detection of flavonoids (Wall *et al.* 1954 and Farnsworth 1964). Sterols (Bhattacharjee and Das 1969), tannins (Wall *et al*. 1954) and glycosides (Eyjolfesson 1970) were assessed following the reported methods. The absence, presence and abundance of different secondary metabolites in test samples were indicated by –, + and multiple of + signs, respectively. Each test was replicated thrice. The results are presented in Tables 1 and 2.

Results and Discussion

Qualitative analysis of alkaloids, flavonoids, glycosides, sterols and tannins of 40 antidysenteric medicinal plant species and/or their organs, e.g., root-rhizome, stem, bark, leaf, flower and fruit were carried out. From Table 1, it is apparent that alkaloids were present in all plant species and the extracts from various sources showed different responses to Dragendorff (D), Wagner (W), Mayer (M), Hager (H) and Tannic acid (T) reagents for alkaloids. Out of 225 tests by different reagents for alkaloids, 207 tests were positive indicating the presence of alkaloids in range of slight to abundant (1+ to 4+) and the number of positive response to reagents D, W, M, H and T were 45, 44, 39, 38 and 41, respectively. Negative response (-) in 18 tests indicated the inefficiency of the reagent used in the test. On the basis of alkaloid detecting efficacies, the relative effectiveness of the reagents may be graded as: D>W>T>M>H. While evaluating 102 plant species of 47 families, Pasha (1977) reported positive response for alkaloids in 48 plant species only. On the other hand, positive response for alkaloids in 32 out of 42 plant species was reported by Tariq *et al*. (1987). In the present work, the degrees of responses (1+ to 4+) of 40 plant species and their parts to different alkaloid detecting reagents were different but a large number of tests were appeared to be strong positive (3+ to 4+). Kapoor *et al*.

Table 1. Qualitative analysis of alkaloids in 40 antidysenteric medicinal plants.

Plant species	Family	Plant part used	Present+ / absent – abundant n+				
			Reagents used				
			D	W	M	H	T
Allium cepa	Liliaceae	bulb	+	+	+	+	+
Allium sativum	Liliaceae	bulb	3+	3+	2+	2+	2+
Alstonia scholaris	Apocynaceae	bark	2+	3+	3+	2+	3+
Andrographis paniculata	Acanthaceae	leaf	3+	2+	2+	2+	4+
Aegle marmelos	Rutaceae	fruit	3+	2+	+	-	+
Ageratum conyzoides	Asteraceae	leaf	2+	-	-	-	-
Anacardium occidentale	Anacardiaceae	bark	+	+	+	+	+
Barringtonia acutangula	Barringtoniaceae	leaf	4+	4+	2+	2+	2+
Calotrotropis gigantea	Asclepiadaceae	root	+	3+	+	+	+
Calotropis procera	Asclepiadaceae	root	+	3+	+	+	+
Catharanthus roseus	Apocynaceae	leaf	2+	3+	-	-	2+
Cassia fistula	Caesalpiniaceae	stem bark	2+	+	-	-	-
Centella asiatica	Apiaceae	whole plant	2+	+	+	+	4+
Cicer arietinum	Fabaceae	seed	3+	3+	3+	3+	3+
Cleome viscosa	Capparidaceae	leaf	3+	+	3+	2+	4+
Cuminum cyminum	Apiaceae	seed	3+	+	2+	2+	2+
Cocos nucifera	Arecaceae	flower	+	+	+	+	+
		kernel	+	+	+	+	+
Curcuma longa	Zingiberaceae	rhizome	2+	2+	+	+	+
Daucas carota	Apiaceae	rhizome	2+	+	+	+	2+
Dalbergia sissoo	Fabaceae	leaf	+	+	2+	2+	+
Eupatorium odoratum	Asteraceae	leaf	3+	2+	2+	2+	3+
Euphorbia hirta	Euphorbiaceae	leaf	4+	+	+	2+	2+
		stem	3+	+	-	+	+
		flower	4+	+	+	2+	2+
Ficus hispida	Moraceae	leaf	2+	2+	2+	3+	+
Holarhena antidysenterica	Apocynaceae	leaf	3+	+	2+	2+	+
		bark	4+	4+	3+	3+	+
Hibiscus rosa-sinensis	Malvaceae	flower	2+	+	2+	+	2+
Ixora coccinea	Rubiaceae	flower	2+	2+	+	2+	2+
Jatropa gossypifolia	Euphorbiaceae	leaf	+	+	+	+	+

(Contd.)

Kalanchoe pinnata	Crassulaceae	leaf	2+	+	+	+	2+
Melastoma malabathricum	Melasomaceae	leaf	3+	+	-	-	-
Mimosa pudica	Mimosaceae	root	+	+	+	+	+
Mikania cordata	Asteraceae	leaf	3+	2+	2+	2+	3+
Morinda citrifolia	Rubiaceae	fruit	2+	+	+	+	4+
Murraya koenigii	Rutaceae	leaf	4+	2+	2+	2+	3+
Mangifera indica	Anacardiaceae	bark	4+	3+	3+	3+	4+
Ocimum sp	Lamiaceae	leaf	+	+	+	+	+
Rauvolfia serpentina	Apocynaceae	leaf	3+	3+	2+	3+	3+
Scoparia dulcis	Scrophulariaceae	leaf	4+	3+	3+	3+	4+
Solanum nigrum	Solanaceae	leaf	+	+	+	+	+
		fruit	+	+	-	-	-
Tridax procumbens	Asteraceae	leaf	3+	3+	3+	3+	3+
Zinziber officinale	Zingiberaceae	rhizome	2+	+	+	+	2+

(1969) noted weak positive response for alkaloids while others (Pasha1977, Affandi *et al.* 2004) observed strong positive reactions (3+ to 4+) for alkaloids in a few plant species. The relative abundance of alkaloids found in the present work was higher in leaf, bark and rhizome than other organs of the test plants. With some minor exceptions leaf, stem and root of different medicinal plants were found to contain a broad spectrum of secondary metabolites including alkaloids, flavonoids, saponins etc. (Viji and Murugesan 2010, Pascaline *et al.* 2011). It appears that the distribution of alkaloids is uneven and sporadic within and among different antidysenteric medicinal plants of the present work. This finding supports the previous report (Chhetri *et al*. 2008) of a phytochemical screening for alkaloids and other bioactive chemicals.

Table 2. Qualitative analysis of flavonoids, glycosides, sterols and tannins in 40 antidysenteric medicinal plants.

Plant species	Family	Plant part used	Secondary metabolites: + present /-absent			
			Flavonoids	Glycosides	Sterols	Tannins
Allium cepa	Liliaceae	bulb	+	+	+	+
Allium sativum	Liliaceae	bulb	+	+	-	+
Alstonia scholaris	Apocynaceae	bark	-	+	+	-
Andrographis paniculata	Acanthaceae	leaf	+	+	+	-
Aegle marmelos	Rutaceae	fruit	+	+	+	+
Ageratum conyzoides	Asteraceae	leaf	+	-	+	-

(Contd.)

Anacardium occidentale	Anacardiaceae	bark	-	-	+	-
Barringtonia acutangula	Barringtoniaceae	leaf	+	-	+	+
Calotrotropis gigantea	Asclepiadaceae	leaf	-	+	+	-
Calotropis procera	Asclepiadaceae	leaf	-	+	+	-
Catharanthus roseus	Apocynaceae	leaf	-	+	+	-
Cassia fistula	Caesalpiniaceae	stem bark	+	+	-	-
Centella asiatica	Apiaceae	whole plant	-	+	+	+
Cicer arietinum	Fabaceae	seed	+	+	-	-
Cleome viscosa	Capparidaceae	leaf	-	-	+	-
Cuminum cyminum	Apiaceae	seed	+	+	-	-
Cocos nucifera	Arecaceae	kernel	+	-	+	-
Curcuma longa	Zingiberaceae	rhizo me	+	+	-	+
Daucas carota	Apiaceae	rhizo me	-	-	-	+
Dalbergia sissoo	Fabaceae	leaf	+	+	-	+
Eupatorium odoratum	Asteraceae	leaf	+	-	-	-
Euphorbia hirta	Euphorbiaceae	leaf	+	+	-	+
Ficus hispida	Moraceae	leaf	-	+	-	+
Holarhena antidysenter ica	Apocynaceae	leaf	+	-	+	+
Hibiscus rosa-sinensis	Malvaceae	flower	+	-	-	+
Ixora coccinea	Rubiaceae	flower	+	+	+	+
Jatropa gossypifolia	Euphorbiaceae	leaf	+	-	-	+
Kalanchoe pinnata	Crassulaceae	leaf	+	-	-	-

(Contd.)

Melastoma malabathricum	Melasomaceae	flower	-	-	-	-
Mimosa pudica	Mimosaceae	root	-	-	-	+
Mikania cordata	Asteraceae	leaf	+	-	+	-
Morinda citrifolia	Rubiaceae	leaf	-	+	+	+
Murraya koenigii	Rutaceae	leaf	-	+	+	-
Mangifera indica	Anacardiaceae	bark	+	+	+	+
Ocimum sp	Lamiaceae	leaf	-	+	+	-
Rauvolfia serpentina	Apocynaceae	leaf	-	-	+	-
Scoparia dulcis	Scrophulariaceae	leaf	+	+	+	+
Solanum nigrum	Solanaceae	leaf	-	+	+	-
Tridax procumbens	Asteraceae	leaf	+	-	+	-
Zinziber officinale	Zingiberaceae	rhizome	+	+	+	+

Results presented in Table 2 for 4 other metabolites (e.g., flavonoids, glycosides, sterols and tannins) show that all except the flower of *M. malabathricum* gave positive response to tests for one or more metabolites. Out of the total 160 tests, about 92 tests were positive. Among the lot, 6 plant species or plant parts (e.g., *A. cepa, A. marmelos, I. coccinea, M. indica, S. dulcis* and *Z. officinale*) gave positive response for all 4 metabolites (e.g., flavonoids, glycosides, sterols and tannins) while 9, 17 and 7 plant species or plant parts gave positive responses for 3, 2 and 1 metabolite, respectively. For each of flavonoids and glycosides, 24 plant species gave positive response whereas for sterols and tannins positive responses were in 25 and 19 species, respectively. It appears that the distribution of flavonoids, glycosides and sterols in the test plants and their parts was comparatively wider than that of tannin but all showed sporadic and uneven distribution in different plant species and their parts. Tariq *et al*. (1987) in his work with the members of Asteraceae, noted positive responses for flavonoids, sterols, tannins and saponins in 21, 22, 20 and 4 plant species, respectively. In the present work, 6 plant species, e.g., *A. cepa, A. marmelos, I. coccinea, M. indica, S. dulcis* and *Z. officinale* contained all 5 secondary metabolites but in the rest of the plants their distribution is uneven. The presence of alkaloids, flavonoids, glycosides and steroids in *Citrullus* seeds has been reported (Ambi1 *et al.* 2007). Ayoola *et al*. (2008) reported on the presence of flavonoids, terpenoids, saponins, tannins and reducing sugars in *Carica papaya,* *Magnifera indica, Psidium guajava,* and *Vernonia amygdalina* has been found. Cardiac glycosides and alkaloids were absent in *M. indica* while alkaloids and phenolic compounds, anthraquinones, were absent in *P. guajava* and *V. amygdalina*, respectively. Sivasankari *et al.* (2010) while examining the major metabolites like carbohydrates, tannins, saponins, flavonoids, alkaloids, betacyanins, quinones, terepenoids, phenols, glycosides and cardiac glycosides in *Caesalpinia pulcherrima* (a domesticated shrub) and *Caesalpinia bonduc* (a wild shrub) leaf extracts reported their uneven distribution in the plant species and the wild plants contributed high values for the secondary metabolites than the domesticated. A wide range of secondary metabolites were reported to be present in different antidysenteric, antidiarrhoeal and other medicinal plants (Longanga *et al.* 2000, Satyanarayana and Eswaraiah 2010 and Narayanasamy and Ragavan 2012). Therefore, the secondary metabolites identified in different medicinal plants of the present work may be considered as active therapeutic agents against the dysenteric disease.

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