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# Screening of anticancer medicinal plants for secondary metabolites

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**Abstract**
Anticancer medicinal plants contain cancer healing property due to their bioactive secondary metabolites. In the present work, 23 anticancer medicinal plant species representing 10 families of Metachlamydeae were considered for qualitative assessment of the secondary metabolites such as alkaloids, flavonoids, sterols, tannins, glycosides and saponins. All plant parts except the leaf of *Leucas aspera* gave positive responses to different alkaloid detecting reagents. For 6 other secondary metabolites 13, 14, 9, 15, 9 and 15 cases gave positive responses for flavonoid, sterol, resin, tannin, glycoside and saponin tests, respectively. Results of the screening work for secondary metabolites were discussed in relation to their abundance and distribution in different test plants and their organs.

**Keywords:** Anticancer, Metachlamydeae, secondary metabolites, screening work

## 1. Introduction
The use of medicinal plants has been an important component of health care in many countries and 80% of the world's rural people meet their needs of preliminary health care from medicinal plants because plant drugs are easily available and easily accessible to most people in the sense of price compared to modern allopathic synthetic drugs [1, 2]. More than 1000 species of medicinal plants grow in Bangladesh [3], but the majority of them have not yet undergone thorough phytochemical screening for their bioactive secondary metabolites. As per published reports, about 500-752 medicinal plant species of Bangladesh have so far been enlisted and out of them, about 64 plants of have been described to possess anticancer activity [4, 5]. Anticancer medicinal plants show cancer healing property due to their secondary metabolites [6-8]. The discovery and development of vinblastine and vincristine alkaloids from the *Catharanthus roseus* and several other compounds from other sources as efficacious anticancer agents provided convincing evidence that plant's secondary metabolites could be a potential source of anticancer agents and cancer chemopreventives [9, 10]. In the present work, 23 anticancer medicinal plant species of Metachlamydeae or Sympetalae were considered for phytochemical screening for their secondary metabolites.

## 2. Materials and Methods
Twenty three anticancer medicinal plant species representing 10 families of Metachlamydeae or Sympetalae, enlisted in different published literature [4, 5] were considered in the present work. These plants were collected from the hilly area of Chittagong University campus and around. They were considered in the phytochemical screening work for different secondary metabolites such as alkaloids, flavonoids, sterols, tannins, glycosides and saponins. For alkaloids, the modified method of Webb [11] was followed according to Amarasingham [12] *et al*. as well as Apline and Cannon [13]. Five alkaloid detecting reagents such as Dragendorff (D), Wagner (W), Mayer (M), Hager (H) and Tannic acid (T) were prepared following Cromwell [14] were used. Flavonoids were determined in the Et-OH extract following Wall [15] *et al*. and Farnsworth [16]. Sterols, tannins, glycosides and saponins were assessed following Bhattacharjee and Das [17], Wall [15] *et al*. and Eyjolfesson [18] respectively. The presence, absence and abundance of different secondary metabolites in the test samples were indicated by –, + and multiple of + signs, respectively. Each test was replicated thrice.

## 3. Results and Discussion

Results of the qualitative analysis of different secondary metabolites of 23 anticancer medicinal plants and their parts are given in Table 1 and 2.

**Table 1:** Alkaloid contents in different parts of 23 anticancer medicinal plants.

| | Scientific name | Family | Plant/plant parts | Alkaloid detecting reagents used | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | D | W | M | T | T |
| 1 | *Ageratum conyzoides* L. | Asteraceae | Flw-buds | 4+ | 4+ | 3+ | 2+ | 4+ |
| 2 | *Alstonia scholaris* R.Br. | Apocynaceae | Stem bark | 3+ | 2+ | 3+ | 3+ | 3+ |
| 3 | *Andrographis paniculata* (Burm. F) Wall | Acanthaceae | Leaf | 3+ | 2+ | 2+ | 3+ | 3+ |
| 4 | *Anthocephalus chinensis* (Lamk.) A. Rich. | Rubiaceae | Stem bark | 4+ | 2+ | 2+ | 2+ | 3+ |
| 5 | *Bacopa monniera* (L.) Pennel. | Scrophulariaceae | Leaf | 3+ | 3+ | 2+ | 2+ | 3+ |
| 6 | *Calotropis gigantean* (L.) Alt. f. | Asclepiadaceae | Leaf | 3+ | 2+ | 2+ | 2+ | 3+ |
| 7 | *Capsicum frutescens* L. | Solanaceae | Fruit | 3+ | 3+ | 2+ | 3+ | 3+ |
| 8 | *Eclipta alba* (L.) Hassk. | Asteraceae | Leaf | 2+ | + | + | 2+ | 2+ |
| 9 | *Elephantopus scaber* L. | Asteraceae | Leaf | 3+ | 2+ | 3+ | 2+ | 3+ |
| 10 | *Enhydra fluctuens* Lour. | Asteraceae | Leaf | 3+ | 2+ | 2+ | 2+ | 3+ |
| 11 | *Eupatorium odoratum* L. | Asteraceae | Leaf | 2+ | + | + | + | 2+ |
| 12 | *Leucas aspera* Spreng. | Lamiaceae | Leaf | - | - | - | - | - |
| 13 | *Lycopersicum esculentum* Mill. | Solanaceae | Fruit | 2+ | + | + | + | 2+ |
| 14 | *Mikania cordata* (Burm. f.) Rob | Asteraceae | Leaf | 3+ | 2+ | + | - | + |
| 15 | *Momordica charantea* L. | Cucurbitaceae | Fruit | 2+ | + | 3+ | + | + |
| 16 | *Ocimum sanctum* L. | Lamiaceae | Leaf | + | + | + | + | + |
| 17 | *Rauvolfia serpentine* (L.) Benth. Ex Kurz | Apocynaceae | Root | 4+ | 3+ | 3+ | 4+ | 4+ |
| 18 | *Scoparia dulcis* L. | Scrophulariaceae | Leaf | 3+ | 3+ | 3+ | 3+ | 3+ |
| 19 | *Solanum surattense* Bum. f. | Solanaceae | Leaf | + | + | + | + | + |
| 20 | *Tagetes erecta* L. | Asteraceae | leaf | 2+ | + | + | + | 2+ |
| 21 | *Vitex negundo* L. | Verbenaceae | Leaf | + | 2+ | + | + | 2+ |
| 22 | *Wedelia chinensis* (Osbeck) Merr. | Asteraceae | Leaf | 3+ | 3+ | 2+ | 2+ | 3+ |
| 23 | *Withania somnifera* (L.) Dunal | Solanaceae | Leaf | 3+ | 3+ | 2+ | 2+ | 3+ |

**Table 2:** Flavonoids, sterols, tannins, glycosides and saponins contents in different parts of 23 anticancer medicinal plants.

| | Scientific name | Family | Plant/plant parts | Six secondary metabolites | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Flavonoids | Sterols | Resins | Tanins | Glycocides | Saponins |
| 1 | *Ageratum conyzoides* L. | Asteraceae | Flw-buds | - | - | - | + | - | - |
| 2 | *Alstonia scholaris* R.Br. | Apocynaceae | Stem bark | + | - | - | + | - | + |
| 3 | *Andrographis paniculata* (Burm. F) Wall | Acanthaceae | Leaf | + | + | + | + | - | + |
| 4 | *Anthocephalus chinensis* (Lamk.) A. Rich. | Rubiaceae | Stem bark | + | - | - | + | - | + |
| 5 | *Bacopa monniera* (L.) Pennel. | Scrophulariaceae | Leaf | + | + | + | - | + | + |
| 6 | *Calotropis gigantean* (L.) Alt. f. | Asclepiadaceae | Leaf | - | - | + | - | - | - |
| 7 | *Capsicum frutescens* L. | Solanaceae | Fruit | - | + | + | - | - | + |
| 8 | *Eclipta alba* (L.) Hassk. | Asteraceae | Leaf | + | - | + | + | + | - |
| 9 | *Elephantopus scaber* L. | Asteraceae | Leaf | - | - | - | + | - | - |
| 10 | *Enhydra fluctuens* Lour. | Asteraceae | Leaf | - | + | + | + | + | + |
| 11 | *Eupatorium odoratum* L. | Asteraceae | Leaf | + | - | - | + | - | - |
| 12 | *Leucas aspera* Spreng. | Lamiaceae | Leaf | - | + | - | + | + | + |
| 13 | *Lycopersicum esculentum* Mill. | Solanaceae | Fruit | + | - | + | + | - | + |
| 14 | *Mikania cordata* (Burm. f.) Rob | Asteraceae | Leaf | - | + | - | - | - | - |
| 15 | *Momordica charantea* L. | Cucurbitaceae | Fruit | + | + | - | - | + | + |
| 16 | *Ocimum sanctum* L. | Lamiaceae | Leaf | - | + | - | + | + | + |
| 17 | *Rauvolfia serpentine* (L.) Benth. Ex Kurz | Apocynaceae | Root | - | + | - | - | - | - |
| 18 | *Scoparia dulcis* L. | Scrophulariaceae | Leaf | + | + | + | + | + | + |
| 19 | *Solanum surattense* Bum. f. | Solanaceae | Leaf | + | - | - | + | + | + |
| 20 | *Tagetes erecta* L. | Asteraceae | leaf | + | + | - | - | + | + |
| 21 | *Vitex negundo* L. | Verbenaceae | Leaf | - | + | - | + | - | - |
| 22 | *Wedelia chinensis* (Osbeck) Merr. | Asteraceae | Leaf | + | + | + | + | - | + |
| 23 | *Withania somnifera* (L.) Dunal | Solanaceae | Leaf | + | + | - | - | - | + |

Out of the total 115 tests done for alkaloids, 109 tests gave positive responses in different degrees (+ to 4+) with 5 different reagents in the following proportion: D-26, W-20, M-19, H-19 and T-25 (Table 1). On the basis of such responses of the reagents to plant extracts, the relative efficacies of the reagents for alkaloid detection appeared as: D> T> W>M>H. Pasha [19] reported positive response for alkaloids in 48 plant species out of 102 species of medicinal plants while Tariq [20] *et al*. noted 32 positive responses out of 42 they examined. In the present work, 3 plant species gave 4+, 14 gave 3+ 19 gave

2+ and 9 gave + responses. Kapoor [21] *et al*. noted weak positive response for alkaloids while others [19, 22] observed strong positive reactions (3+, 4+) for alkaloids in a few plant species. The relative abundance of alkaloids, as found in the present work, was higher in leaf, bark and rhizome than other organs of the test plants. According to Viji and Murugesan [23] as well as Pascaline [24] *et al.* the leaf and stem; and the leaf and root of medicinal plants, respectively contained a broad spectrum of secondary metabolites including alkaloids. It appears that the distribution of alkaloids is uneven and sporadic within and among different medicinal plants of the present work. Chhetri [25] *et al*. in a phytochemical screening for alkaloids and other bioactive chemicals, noted differences in the pattern of distribution of chemicals in different plant species and their parts. Pascaline [24] *et al*., however, reported the presence of alkaloids and some other metabolites in all 10 plants species they examined.

Results of the analysis of 6 other secondary metabolites presented in Table 2 show that out of the total 138 tests there were 13, 14, 9, 15, 9 and 15 positive responses for flavonoids, sterols, resins, tannins, glycosides and saponins respectively. Pasha [19] reported the presence of saponins in 14 plant species while Tariq [20] *et al*. noted the presence of flavonoids in 21, sterols in 22, tannins in 20 and saponins only in 4 species among the lot of 23 species of Compositae. In the present work, *A. paniculata, B. monniera, E. fluctuens, S. dulcis* and *W. chinensis* gave maximum positive responses to spot tests done for these secondary metabolites. In a phytochemical screening work Ambil [26] *et al*. reported the presence of steroid glycosides and flavonoids along with alkaloids in *Citrullus* seeds while Ayoola [27] *et al*. noted the presence of flavonoids, terpenoids, saponins, tannins and reducing sugars in *C. papaya, M. indica, P. guajava* and *V. amygdalina,* but cardiac glycosides and alkaloids in *M. indica* as well as alkaloids and anthraquinones in *P. guajava* and anthroquinones in *V. amygdalina* were absent. Sivasankari [28] *et al.* 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 prepared with 4 different solvents reported their uneven distribution in the plant species and the wild plants contributed high values for the secondary metabolites than the domesticated. The occurrence of different secondary metabolites suggests a wide range of therapeutic application of medicinal plants as they show anti-oxidant, antiallergic, anti-inflammatory, antimicrobial, anticancer activities [29-33].

## 4. Conclusion

The phytochemical screening of the medicinal plants showed the presence of various secondary metabolites which is the primary confirmation of anticancer plants. This increased the prospect for the efficient therapeutic principles of cancer treatment as most of the anticancer drugs are secondary metabolites in nature. So, further bioassay guided screening is necessary to isolate and identify the anticancer drug principals of these plants which may also be useful against other diseases.

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