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Phytochemical screening and reported biological activities of some medicinal plants of Gujarat region

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Abstract
Phytochemicals are found at different levels in many medicinal plants and are important compounds of human diet. They produce definite physiological action on the human body. They can be used to regulate oxidation and stress-related chronic diseases such as diabetes and cardiovascular diseases may be because possess powerful antioxidant activity. In the present study, some medicinal plants of Gujarat region (*Aerva lanata, Terminalia bellirica, Terminalia chebula, Terminalia catappa, Zea mays, Tribulus terrestris* and *Boerhaavia diffusa*) were selected for qualitative phytochemical screening and their reported biological activities. The screened plants were rich in flavonoids, tannins, steroids, cardiac glycosides and alkaloids. Out of the seven plants screened, Terminalia species were the best possessing rich source of phytochemicals and justify their traditional use. They can be therapeutically used individually or synergistically in combination with other extracts to treat any disease and disorder.

Keywords: phytochemical analysis, alkaloids, cardiac glycosides, T*erminalia*

1. Introduction
Herbal drugs are the potential source of therapeutic aid for the treatment and prevention of number of ailments. There have always been counting emphases on the herbal medicines as a potential pipeline for novel bioactive molecules. The rich biodiversity of plants make them a treasure house for obtaining new and novel compounds either themselves as drugs or lead molecules for drugs with different mechanism of action. Medicinal plants contain several different phytochemicals or secondary metabolites that may act individually, additively or in synergy to improve health [1]. The different plant extracts have different modes of action for curing diseases. They can also be applied as food preservatives [2].
The concentration of phytochemicals is different in different parts of the same plant and in different plants. The therapeutic efficacy of plants is because of these compounds which include alkaloids, flavonoids, saponins, terpenoids, steroids, phlobatannins, glycosides, tannins, etc. All these secondary metabolites are known for curing one or other diseases. For eg. Alkaloids are known for antispasmodic, antimalarial, analgesic, diuretic activity. Terpenoids are reported to have antiviral, anthelmintic, antibacterial, anticancer, antimalarial, anti-inflammatory properties. They are also known for inhibition of cholesterol synthesis and possess insecticidal properties hence useful for storing agricultural products. Saponins are known for anti-inflammatory, antiviral, plant defence and for cholesterol reducing property. Phlobatanins possess astringent properties. Glycosides are reported for antifungal and antibacterial properties. Phenols and flavonoids are known for their antioxidant, anti-allergic, antibacterial, etc [3, 4].
Knowing the phytochemical profile of different parts and different plants is desirable so that one can decide the part to be explored for any particular activity and it can also help one to decide the part(s) to be chosen for any synergistic evaluation. Knowing the phytochemical profile in the beginning of any experiment is desirable than random selection of the plants.
Considering the above, in the present study, seven plants which are traditionally used in curing or treating many diseases and disorders were screened for their preliminary qualitative phytochemical constituents.

***Aerva lanata* Linn.**

Family: - Amaranthaceae
Habit: - Suberect herb
Distribution: - Throughout India
Vernacular name: - Gorakhganjo
Parts used: - Leaf and stem
Constituents: - Active constituents Beta-sito sterol, palmitate and alpha- amrin
Constituents: - Active constituents Beta-sitosterol, palmitate and alpha- amrin
Action/Uses: - Treatment of headache, cough, Lithiasis, removal of kidney stone. It maintain blood sugar to optimum level
Commercial utility: - Leaves use as a vegetable.
Reported activities: -
Anticancer activity [5]
Antidiabetic activity [6]
Antiparasitic activity [7]
Antiurolithiatic activity [8]
Hepatoprotective activity [9]
Hypolipidemic activity [10]

***Terminalia bellirica* (Gaertn.) Roxb.**

Family: - Combretaceae
Habit: - Deciduous tree
Distribution: - Throughout India
Vernacular name: - Beheda
Parts used: - Leaf and stem
Constituents: - Chebulagic acid, ellagic and ethanedioic acid, palmitic acid, oleic acid and linolic acid
Action/Uses: - bark is useful in leucoderma. The fruits are useful in vitiated condition of vata and pitta, cough, bronchitis, insomnia, dipsia, dropsy, dyspepsia, pharyngitis, flatulence, vomiting, strangury, haemorrhages, ophthalmopathy, splenomegaly, cephalalgia, skin diseases, leprosy, ulcer, fever and general debility. The oil obtained from the seeds useful in skin diseases, leucoderma, dyspepsia and greyness of hair.
Commercial utility: - fruit sold in market, used extensively in preparing ayurvedic medicines
Reported activities:-
Acetylcholinesterase inhibitory activity [11]
Antidiabetic activity [12]
Antifertility activity [13]
Antioxidant activity [14, 15]
Reproductive activity [16]
Wound healing activity [17]

***Terminalia chebula* Retz.**

Family: - Combretaceae
Habit: - Deciduous tree
Distribution: - Throughout India
Vernacular name: - Harde
Parts used: - Leaf and stem
Constituents: - Chebulic acid, chebulinic acid, chebulagic, neochebulinic acid, punicalagin, corilagin
Action/Uses: - useful in vitiated condition of tridoshas, wounds, ulcers, inflammations, hepatopathy, gastropathy, anorexia, helminthiasis, flatulence, jaundice, hemorrhoids, hepatopathy, splenopathy, pharyngodynia, cough, hiccough, uropathy and general debility.
Commercial utility: - fruits contain tannin, used in tannery, used in preparing ayurvedic medicines.
Reported activities:-
Analgesic activity [18]
Antifertility activity [19]
Anti-inflammatory activity [20]
Antimicrobial activity [21]
Antioxidant activity [15]

Nephroprotective activity [22]
Plasmid curing activity [23]

***Terminalia catappa* L.**

Family: - Combretaceae
Habit: - Deciduous tree
Distribution: - Throughout India
Vernacular name: - Badam
Parts used: - Leaf
Constituents: - Bark rich in tannins, fruit rich in ascorbic acid, seed contain oil, vitamin B
Action/Uses: - fruit is useful in-biliousness, bronchitis and bowels. Juice of leaves is used in the preparation of the ointment for scabies, leprosy and other cutaneous diseases and also useful in headache and colic. The root bark is given in dysentery and diarrhea. The bark cures bilious fevers.
Commercial utility: - oil yield from kernels is substituted for almond oil.
Reported activities: -
Allelopathic activity [24]
Antibacterial activity [25]
Anticlastogenic activity [26]
Antioxidant and Antimicrobial activity [27]
Antiulcer activity [28]
Molluscicidal activity [29]

***Zea mays* L.**

Family: - Poaceae
Habit: - annual herb
Distribution: - Cultivated throughout India
Vernacular name: - Makkai
Parts used: - Corn hair
Constituents: - Starch, arginine, alanine, phenylalanine, histidine, aspartic acid, glutamic acid, pantothenic acid
Action/Uses: - useful in anorexia, emaciation, general debility, strangury, hemorrhoids, vitiated conditions of kapha and pitta. It is valuable article of diet for invalid and children
Commercial utility: - used as a fodder and grain and for preparing starch in industry.
Reported activities: -
Allelopathic activity [30]
Allelopathic activity [31]
Anthocyanins activity [32]
Anticarcinogenic activity [33]
Antioxidant activity [34]
Chemopreventive activity [35]

***Tribulus terrestris* L.**

Family: - Zygophyllaceae
Habit: - hairy herb
Distribution: - Throughout world
Vernacular name: - Gokhru
Parts used: - Fruit
Constituents: - Terrestroside A and B terrestrian B, terrestroneoside A, chloromalosides, tribulusamide, tribufuroside, terrestamide and pregnane glycosides
Action/Uses: - Used in strangury, dyspepsia, vitiated condition of vata and pitta, rinal and vasicular calculi, anorexia, asthama, consumption, haemoptysis, cardiopathy, anaemia and general weakness. The leaves are useful in ulitis, inflammation, gonorrhoea, gleet, strangury, leprosy, skin diseases, verminosis and general weakness. The seeds are useful in epistaxis, haemorrhages and ulcerative stomatitis. The ash of whole plant is good for external application in rheumar arthritis.
Commercial utility: - Used as ayurvedic medicine and tonic
Reported activities: -
Antibacterial and Antifungal activity [36]
Antidiabetic activity [37]
Antidiuretic and Contractile activity [38]
Antihypertensive activity [39]
Antihypertensive and Vasodilator activity [40]

Aphrodisiac activity [41]

***Boerhaavia diffusa* L.**

Family: - Nyctaginaceae
Habit: - Glabrous herb
Distribution: - Throughout India
Vernacular name: - Satodi
Parts used: - Root
Constituents: - Boeravinones G and H, palmitic acid, b-Sitosterol, urosilic acid, arachidic acid, Punarnavin
Action/Uses: - Used in asthama, kidney ailments, dropsy, jaundice, enlargement of liver
Commercial utility: - Dried roots used by ayurvedic pharmacies to prepare medicines
Reported activities: -
Anticonvulsant activity [42]
Antidiabetic activity [43]
Antioxidant and hepatoprotective activity [44]
Anti-peroxidative activity [45]
Anti-stress activity [46]
Immunomodulatory activity [47]

2. Material and Methods

2.1. *Plant collection*

A. lanata was collected from sea-shore region of Veraval; *Terminalia* species were collected from Jamnagar; *Z. mays* corn hair was collected from the local market of Rajkot, Gujarat, India. *T. terrestris* and *B. diffusa* were purchased from Rajkot, Gujarat, India. They were thoroughly washed, separated, and dried under shade. The dried plant parts were homogenized to fine powder and stored in air tight bottles which were later used for extraction.

2.2. *Qualitative phytochemical analysis*

The dry powder of seven plants was subjected to qualitative phytochemical analysis [48].

2.2.1. *Flavonoids*

Alkaline reagent test was performed for checking the presence of flavonoids. The crude powder was treated with a few drops of diluted sodium hydroxide separately. Formation of intense yellow colour which turned colourless on addition of a few indicated the presence of flavonoids.

2.2.2. *Tannins*

The crude powder was treated with alcoholic ferric chloride ($FeCl_3$) reagent colour Blue colour indicated presence of tannins.

2.2.3. *Phlobatanins*

The crude powder was boiled with 1% aqueous. Deposition of red precipitate was taken as evidence of the presence of phlobatanins.

2.2.4. *Saponins*

The presence of saponins was determined by Frothing test. The was vigorously shaken with distilled water and was allowed to stand for 10 minutes and classified for saponins content as follows: no froth indicates absence of saponins stable froth of more than 1.5 cm indicated the presence of saponins.

2.2.5. *Steroids*

Liebennann-Burchard reaction was performed for checking the presence of steroids. A chloroformic solution of the crude powder was treated with acetic anhydride and a few drops of concentrated H_2SO_4 was added down the sides of the test tube. A blue green ring indicated the presence of steroids.

2.2.6. *Cardiac glycosides*

Keller-kiliani test was performed for the presence of cardiac glycosides. The crude powder of was treated with 1 ml mixture of 5% $Fecl_3$ and glacial acetic acid to this solution. Few drops of concentrated H_2SO_4 was added. Appearance of greenish blue colour within few minutes indicated the presence of cardiac glycosides.

2.2.7. *Triterpenes*

Chloroform extract of the crude powder was treated with concentrated sulphuric acid. Appearance of reddish brown ring indicated the presence of triterpenes.

2.2.8. *Alkaloids*

The crude powder was dissolved in 2 N Hcl. The mixture was filtered and filtrate was divided into 2 portions. One portion was treated with few drops of Mayer's reagent and the other portion was treated with equal amount of Wagner's reagent. The creamish precipitate and brown precipitate indicate the presence of respective alkaloids. A (+) score was recorded if the reagent produced only a slight opaqueness; A (++) score was recorded if a definite turbidity but no flocculation was observed and A (+++) score was recorded if heavy precipitate of flocculation was observed.

3. Results and Discussion

3.1. *Qualitative phytochemical analysis*

Phytochemicals play an important role in the treatment of different types of diseases and disorders and are still used in both traditional and modern medicine. They are synthesized by specific biochemical pathways, for plant defense and adaptation to environmental stress. Bioactive compounds are generally accumulated as secondary metabolites in all plant cells but their concentration varies according to the plant part. The secondary metabolites range from medicinally useful agents to deadly poisons. Many of the secondary metabolites isolated from plants are used in pharmaceutical drug industry [49]. Such screening for phytochemicals have been done in many plants [4, 50, 51].

In *A. lanata* leaf, steroids were found in maximum amount. Flavonoids, tannins, cardiac glycosides and alkaloids by Mayer's reagent showed good but comparatively less than steroids. While, alkaloids by Wagner's reagent showed less content; phlobotanins, saponins, triterpenes were completely absent (Table 1). In *A. lanata* stem, steroids were found in maximum amount. Saponins, cardiac glycosides, alkaloids were less in content; while flavonoids, tannins, phlobotanins and triterpenes were completely absent (Table 1).

All the three *Terminalia* species showed comparatively similar results. In *T. bellirica*, *T. chebula* and *T. catappa* leaves, flavonoids, tannins, steroids, cardiac glycosides and alkaloids by Wagner's reagent were found in maximum amount. Saponins and alkaloids by Mayer's reagent showed good but comparatively less content than flavonoids, tannins, steroids, cardiac glycosides and alkaloids by Wagner's reagent. Phlobotanins and triterpenes were completely absent (Table 1). In *T. bellirica* and *T. chebula* stem, flavonoids, cardiac glycosides and alkaloids by Mayer's reagent were found in maximum amount; tannins, phlobotanins, steroids and alkaloids by Wagner's reagent showed good but comparatively less content than tannins, phlobotanins, steroids and alkaloids by Wagner's reagent. Triterpenes showed less content and saponins were completely absent (Table 1).

In *Z. mays* young corn hair, steroids and cardiac glycosides showed good but comparatively less content while, flavonoids, saponins, triterpenes, alkaloids were found in very less amount. Tannins and phlobotanins were completely absent. In *Z. mays* old corn hair, flavonoids were found in maximum amount; steroids, cardiac glycosides, triterpenes and alkaloids by Wagner's reagent showed good but comparatively less content than flavonoids; while alkaloids by Mayer's reagents showed very less content. Tannins, phlobotanins and saponins were completely absent (Table 1).

In *T. terrestris* fruit, alkaloids by Wagner's reagent were found in maximum amount. Steroids and alkaloids by Mayer's reagent showed good but comparatively less content than alkaloids by Wagner's reagent; while cardiac glycosides were found in less amount. Flavonoids, tannins, phlobotanins, steroids and triterpenes were completely absent (Table 1).

In *B. diffusa* root, alkaloids by Wagner's reagent were found in maximum amount. Triterpenes, steroids and alkaloids by Mayer's reagents showed good but comparatively less content than alkaloids by Wagner's reagent. Tannins and cardiac glycosides were found in less amount while flavonoids, phlobotanins and saponins were completely absent (Table 1).

In all the plants, phytoconstituents were part specific except *Terminalia* species. In *T. bellirica*, *T. chebula* and *T. catappa* leaf, flavonoids, tannins, steroids, cardiac glycosides and alkaloids by Wagner's reagent were maximum followed by alkaloids by Mayer's reagents. In *T. bellirica*, *T. chebula* and *T. catappa* stem, flavonoids, cardiac glycosides and alkaloids by Mayer's reagents were maximum followed by tannins and alkaloids by Wagner's reagent.

On the whole, the plants under study were rich in alkaloids, cardiac glycosides and steroids followed by tannins and flavonoids. Hence these plants possess promising biological activities like antibacterial, anti-inflammatory and antioxidant activity and justify their traditional use.

Table 1: Qualitative phytochemical analysis of dried powder of some medicinal plants

No.	Test	*A. lanata* leaf	*A. lanata* stem	*T. bellirica* leaf	*T. bellirica* stem	*T. chebula* leaf	*T. chebula* stem	*Z. mays* young hair	*Z. mays* old hair	*T. catappa* leaf	*T. terrestris* fruit	*B. diffusa* root
1	Flavonoids	++	-	++++	++++	++++	++++	+	++++	++++	-	-
2	Tannins	++	-	++++	++	++++	+++	-	-	++++	-	+
3	Phlobotanins	-	-	-	++	-	++	-	-	-	-	-
4	Saponins	-	+	++	-	+	-	+	-	-	-	-
5	Steroids	++++	+++	++++	++	++++	++	++	+++	++++	+++	++
6	Cardiac glycosides	++	+	++++	++++	++++	++++	++	+++	++++	+	+
7	Triterpenes	-	-	-	+	-	+	+	+++	-	-	+++
8	Alkaloids											
	Mayer's reagents	++	+	+++	++++	+++	++++	+	++	+++	+++	++
	Wagner's reagent	+	+	++++	+++	++++	+++	+	+++	++++	++++	++++

(++++) Maximum; (+++) Good; (++) Moderate; (+) Low; (-) Absent

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