RESEARCH PAPER

Phytochemical Screening and Charectrization of Poly Herabs

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ABSTRACT
The common cold has been one of the most widespread respiratory diseases with a significant morbidity and economic impact. The objective of the current research was to screen and extract phytochemicals and TLC profile of Curcuma zedoaria, Salvadora persica, Glycyrrhiza glabra, Andrographis paniculata, and Ocimum tenuiflorum as antitussives. Pharmacognostic analysis showed that the total ash content was 4.9-9.10% w/w, acid-insoluble ash was 1.02-1.75% w/w, and water-soluble ash was 1.2-2.17% w/w. The extractive values were 5.11-7.21-percent alcohol-soluble and 7.9-13.70-percent water-soluble. Loss on drying penetrated has been within 1.19-2.02% and foreign organic matter had been below the pharmacopeial limits. Different solvents have different extraction yields with the highest ethanol extractive values of 18.25% w/w and high phenols (19.25), flavonoids (18.12), alkaloids (17.9), and tannins (7.52). The developed linctus had reasonable physiochemical properties, specifically, pH 5.6 +- 0.1, viscosity 1850 CP, specific gravity 1.24, refractive index 1.412, total solids 64% w/v, microbial load within limits and 98% label claim assay value without any physical instability.

Keywords: *Antitussive activity; Polyherbal formulation; Curcuma zedoaria; Salvadorapersica; Glycyrrhizaglabra; Andrographispaniculata; Ocimumtenuiflorum*
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1. INTRODUCTION

One of the most widespread types of infections of the upper respiratory tract in the world is the common cold, and it is one of the leading causes of morbidity, absenteeism at work and in school, and healthcare expenditures [1]. It is generally related with the symptoms of cough, sore throat, nasal congestion and slight fever. Of these symptoms, the most painful is cough, which can last even after other symptoms have disappeared and negatively influence the quality of life [2]. Despite the fact that cough is a protective reflex mechanism used to clear the airways, long-term use is believed to cause adverse effects which include sedation, gastrointestinal discomfort, respiratory depression, and dependence [4].Cough management includes conventional antitussive drugs (codeine, dextromethorphan, and antihistamines) but their long-term use leads to adverse effects which include sedation, gastrointestinal discomfort, respiratory depression, and dependence [4]. Such restrictions have brought about more interest in herbal medicines, which are usually safer, less expensive and more tolerated. The polyherbal preparations have had a significant role in traditional medicine, specifically Ayurveda where poly-herbal combinations of various medicinal plants are thought to improve therapeutic efficacy through their synergistic activities and reduce toxicity [5].Polyherbal preparations have been used traditionally with centuries in the treatment of respiratory disorders, and they continue to become very popular due to their multifactorial pharmacological impacts. A number of medicinal plants have been scientifically reported to have antitussive, anti-inflammatory, expectorant, bronchodilator, and immunomodulatory, indicating that they are viable in the management of cough. The basal aroma is curcuma zedoaria (Zedoary) that is applied to inflammatory and infectious ailments. It is rich in curcuminoids and essential oils that have anti-inflammatory, antioxidant, and antimicrobial properties, which provide anti-inflammatory effects in the airways and calming effects on mucosa of the respiratory tract [7].

Glycyrrhizaglabra (Liquorice) has been a conventionally used medicine to relieve irritations of the throat and asthma related infections [8].Salvadorapersica (Miswak) is antimicrobial and anti-inflammatory that has traditionally been used to treat irritation of the throat and cough-related infections. Its key bioactive ingredient, glycyrrhizin, has a demulcent, expectorant, and antitussive effect due to the creation of a protective layer on the mucous membranes

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and the sensitivity of cough reflex [9]. Andrographispaniculata (Kalmegh) has strong immunomodulatory effects, antiviral effects and anti inflammatory effect that makes it useful in respiratory infections like common cold [10].

Tulsi (Ocimumtenuiflorum) is broadly applied to the traditional medicine in the treatment of cough, bronchitis, and asthma. In the light of therapeutic potential of these medicinal plants, the current study was conducted with an aim of conducting pharmacognostic, phytochemical screening, extraction, TLC characterization, and formulation of a polyherbal oral linctus designed to manage cough in common cold.

2. MATERIALS AND METHODS

Dried rhizomes of Curcuma zedoaria, mature leaves of Salvadorapersica dried roots of Glycyrrhizaglabra, Leaves of Andrographispaniculata and dried leaves of Ocimumtenuiflorum were all collected at the agriculture region of Rajsamand district. The plant was confirmed by the Dr. K.B. Sukla (botanist) Principal, Shrinathji Agriculture College, Nathdwara. The specimen of a voucher is also stored in our laboratory as a future reference (Voucher No.: DSPSC/2022-23/047) and stored in the institutional herbarium as a voucher specimen. The dried rhizomes of Curcuma zedoaria, mature of the leaves of the plants of Salvadorapersica dried roots, dry leaves of Andrographispaniculata as well as dried leaf of Ocumentenuiflorum have been studied in terms of morphological characteristics in terms of colour, shape, sizes and surface characteristics.

2.1 Powder microscopy

Polyherbs plants parts were dried in shade to fine powder with assistance of grinder and stored in airtight container to be used later on. Powder analysis is very important in analysis of crude medicine. With the help of these characteristics, it will be easier to find the appropriate variety and search adulterants. Powder microscopy [12] is one of the easiest and the least costly methods to commence deciding of the correct identify of the source materials.

The dried and stored powder of all parts of the plants was taken through different methods to determine the qualitative standards such as Ash Values, Acid insoluble ash value and Water soluble ash value as per standard method [13].

2.2 Preparation of Extract

The extraction yield of plant species extracts depends on the solvent polarity that determines the extracted chemicals either qualitatively or quantitatively. The most commonly used extraction solvents are ethanol and water used in different ratios because they are lowly toxic and yield high extraction, and their polarity can be varied using mixtures in various proportions [14-17]. The one kilogram of plant material was initially defeated with petroleum ether after which it was extracted. In this technique, Soxhlet is employed, the yield of the extracts produced by the plants of the ethanol (70%) and aqueous was approximately 20gm and 20gm respectively, following solvent evaporation with a water bath. Afterwards, the standard extracts of all the plant parts were stored in a refrigerator at 4degC to be used in pharmacological screening and phytochemical analysis [18-21].

Preliminary Phytochemical Screening 2.3 Introduction Preliminary phytochemical screening involves the examination of a variety of plants for their active compounds with the purpose of bioactive substance extraction and the application of extracts in therapy.<|human|>Introduction Preliminary phytochemical screening Preliminary phytochemical screening entails screening a diverse range of plants in search of their active compounds with the aim of extracting bioactive substances and using the extracts in medicine.

Various preliminary phytochemical screening alkaloid, glycoside, flavonoids, tannins have been performed as per standard procedure of identification test as well as the observation provided in result and discussion section [22] on the different extracts of polyherbs.

The quantitative analysis of extracts will be performed using the DASH method.

To occur the determination of total phenols, the amount of gallic acid used as a standard reacted with the total amount of phenols present in the crude ethanol extract to determine the total amount of alkaloid, total flavonoid and total tannin [23] using an official method [24].

The solution was applied to thin layer chromatography (TLC).

Chemicals in a mixture can be determined, isolated, separated, and quantified through chromatography. The TLC technique consists of placing a very thin uniform layer of alumina or silica gel onto that of a stiff piece of plastic, metal or glass. In order to spot on TLC plates, approximately 10 mg of the material was dissolved in the suitable solvents [25]. Once in a TLC chamber that was soaked with solvent vapour the plates were left to develop until the mobile phase had passed approximately 80% past the spotting line. They were then removed out of the developing chamber, and dried [26].

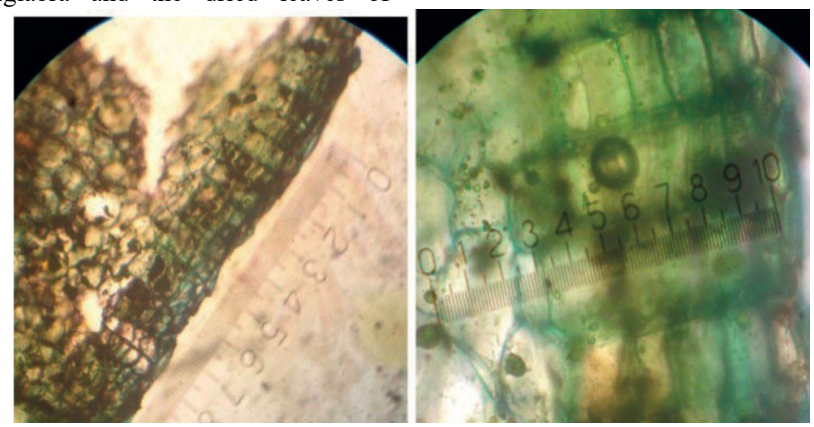
Table No. 1 Solvent system for different extracts

Types of extract	Ethanol extract	n-hexane extract	Aqueous extracts	Chloroform extracts	Ethyl acetate extracts
Solvent System Ratio	Toluene: Ethyl acetate: Methanol: Water (7:6:5:2)	Hexane: Methanol (7:3)	Ethyl acetate: Methanol: toluene: water (5:4:6:5)	Hexane: Ethyl acetate: Methanol (10:3:7)	Hexane: DCM: Ethyl acetate: Methanol (10:5:2:3)

3. RESULT AND DISCUSSION

3.1 Microscopic Studies

Five medicinal herbs selected to be used in the study were harvested, prepared, and confirmed successfully. The dried rhizomes of Curcuma zedoaria (Rosc.), the leaves of Andrographispaniculata and Salvadorapersica, the dried roots of Glycyrrhizaglabra and the dried leaves of Ocimumtenuiflorum were collected at their respective localities during the right time. The plant specimens were washed, shade dried and crushed in to a powder before extraction was performed [27]. Each plant material was authentic and verified by means of microscopy and macroscopy and with the regional floras and standard herbarium materials [28].



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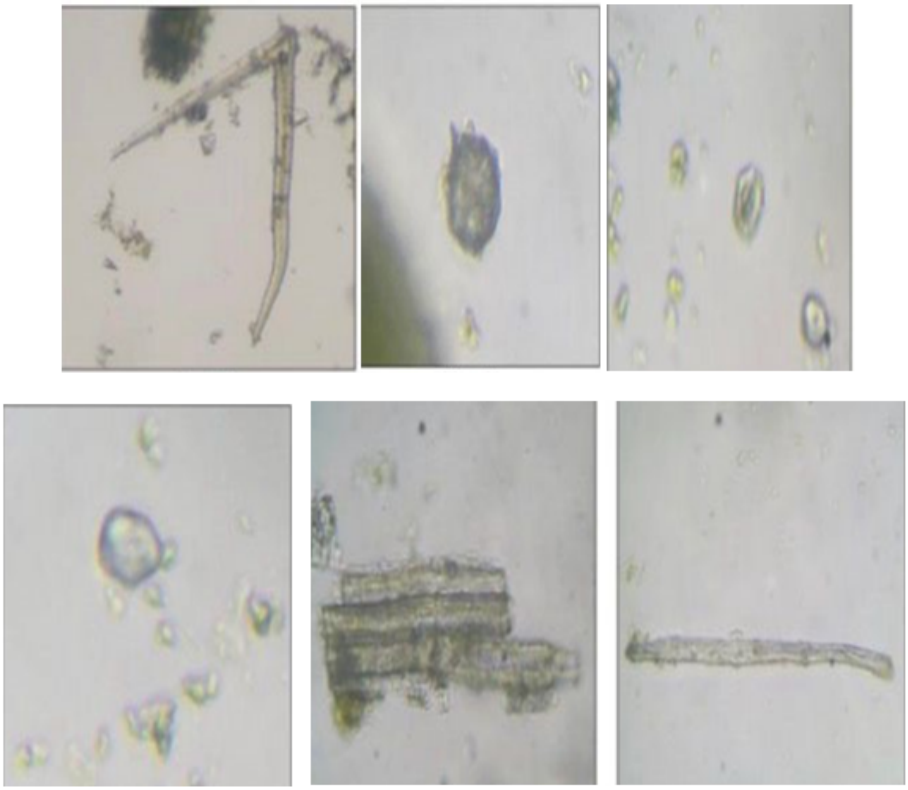

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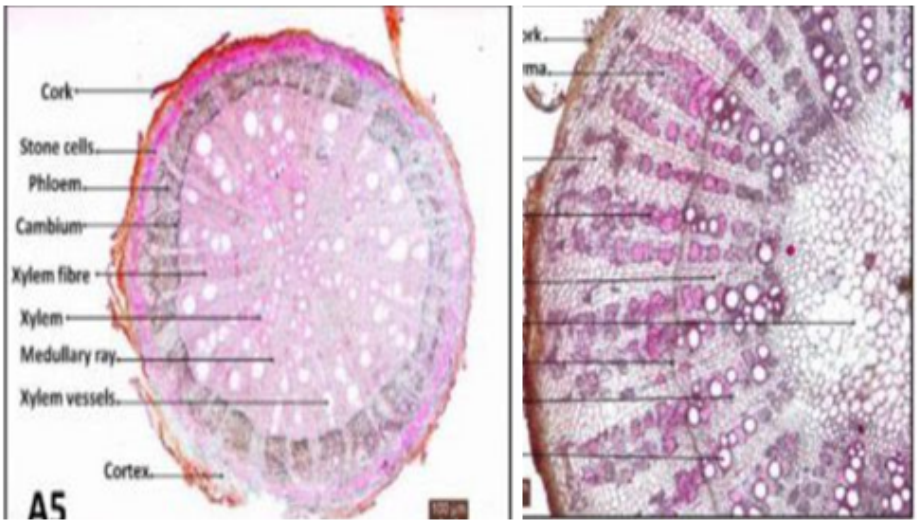
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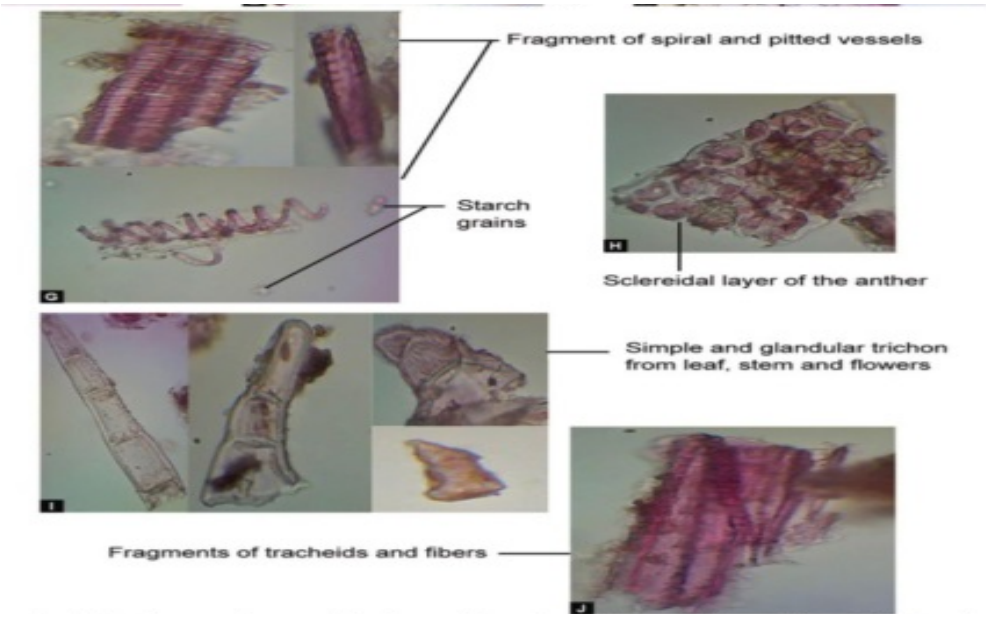
Cambium
Xylem fibre
Xylem
Medullary ray
Xylem vessels
Cortex
A5

(C)


Fragment of spiral and pitted vessels
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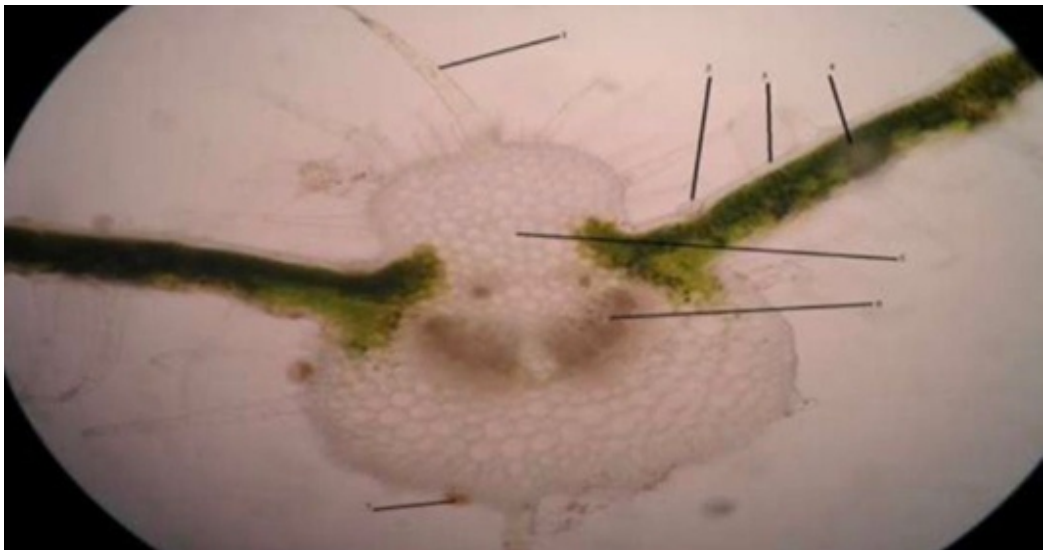
Sclereidal layer of the anther
Simple and glandular trichon from leaf, stem and flowers
Fragments of tracheids and fibers

(D)



(E)

Figure 1: Cross-section (A) Curcuma zedoaria (roots with dried rhizomes), (B) Salvadorapersica Leaves and twigs (miswak), (C) Dried roots of Glycyrrhizaglabra, or liquorice (D) Andrographispaniculata (Kalmegh) aerial parts (flowering tops, leaves, and stems) (E) Fresh or dried leaves of Ocimumtenuiflorum (Tulsi).

3.2 Analytical Parameter

3.2.1 Ash Value

Table 2: Ash Value of plant powder

S. No.	Name of the assay	Observation (%)				
		Curcuma zedoaria	***Salvadorapersica***	***Glycyrrhizaglabra***	***Andrographis paniculata***	***Ocimumtenuiflorum***
1	Total Ash content	8.27%	6.42 %	4.9%	9.10%	8.16 %
2	Acid insoluble Ash value	1.02 % w/w	1.16 % w/w	1.75% w/w	1.62% w/w	1.55% w/w
3	Water soluble Ash value	2.17 % w/w	1.6 % w/w	1.2% w/w	1.9% w/w	1.72% w/w

3.2.2 Extractive Value

Table 3: Extractive Value of plant powder

S. No.	Name of the assay	Observation (%)				
		Curcuma zedoaria	***Salvadorapersica***	***Glycyrrhizaglabra***	***Andrographis paniculata***	***Ocimumtenuiflorum***
1	Alcohol soluble extractive value	5.12 %	7.21 %	5.11 %	5.22 %	5.20 %
2	Water soluble extractive value	7.9 %	12.06 %	13.70 %	8.9 %	9.5 %

3.2.3 Loss on Drying

Table 4: Loss on drying of plant powder

S. No.	Name of the assay	Observation (%)				
		Curcuma zedoaria	***Salvadorapersica***	***Glycyrrhizaglabra***	***Andrographispaniculata***	***Ocimumtenuiflorum***
1	Loss on Drying	1.19 %	2.01 %	1.58 %	2.02 %	1.89 %

3.2.4 Foreign Organic Matter

Table 5: Foreign organic matter of plant powder

S. No.	Name of the assay	Observation (%)				
		Curcuma zedoaria	*Salvadorapersica*	*Glycyrrhizaglabra*	*Andrographispaniculata*	*Ocimumtenuiflorum*
1.	Mineral	Less than 2	Less than 2	Less than 2	Less than 2	Less than 2
2.	Animal	Nil	Nil	Nil	Nil	Nil

Table 6: Phytochemical screening of Polyherbs extracts *Curcuma zedoaria*

Chemical Constituents	Chemical Test	Extracts			
		Ethanol Extract	Chloroform Extract	n-hexane Extract	Aqueous Extract
Alkaloids	Mayer's	+	-	+	+
	Dragendorff's	+	-	+	+
Saponin	Foam forming test	+	+	+	-
Tannins	Ferric Chloride	+	+	+	+
	Dilute nitric acid	+	+	-	-
Proteins	Million's	-	+	-	+
	Biuret	-	+	-	+
Flavonoids	Shinoda	+	+	+	-
	Lead Acetate	+	+	+	-
Glycoside	Killer killani	-	+	+	-
Carbohydrate	Molisch's	+	+	+	-
	Fehling's	+	+	+	+
Triterpenes	Vanillin-sulphuric acid test	-	-	-	-
Amino Acids	Ninhydrin	-	+	+	-
Sterols	Liebermann-Burchard's	+	-	+	+
	Salkowski's	+	-	-	+
Phenol		+	+	+	+

Key (+) = Presence, (-) = Absent

Table 7: Phytochemical screening of Polyherbs extracts *Salvadorapersica*

Chemical Constituents	Chemical Test	Extracts			
		Ethanol Extract	Chloroform Extract	n-hexane Extract	Aqueous Extract
Alkaloids	Mayer's	+	-	+	+
	Dragendorff's	+	-	+	+
Saponin	Foam forming test	+	+	-	-
Tannins	Ferric	+	+	+	+

	Chloride				
	Dilute nitric acid	+	+	-	-
Proteins	Million's	-	-	-	+
	Biuret	-	-	-	+
Flavonoids	Shinoda	+	-	+	-
	Lead Acetate	+	-	-	-
Glycoside	Killer killani	-	+	-	-
Carbohydrate	Molisch's	+	+	-	-
	Fehling's	+	+	+	+
Triterpenes	Vanillin-sulphuric acid test	-	-	-	-
Amino Acids	Ninhydrin	-	+	-	-
Sterols	Liebermann-Burchard's	+	-	-	+
	Salkowski's	+	-	-	+
Phenol		+	+	+	+

Key (+) = Presence, (-) = Absent

Table 8: Phytochemical screening of Polyherbs extracts *Glycyrrhiza glabra (Liquorice)*

Chemical Constituents	Chemical Test	Extracts			
		Ethanol Extract	Chloroform Extract	n-hexane Extract	Aqueous Extract
Alkaloids	Mayer's	+	-	+	+
	Dragendorff's	+	-	+	+
Saponin	Foam forming test	+	+	-	-
Tannins	Ferric Chloride	+	-	+	+
	Dilute nitric acid	+	-	-	-
Proteins	Million's	-	-	-	+
	Biuret	-	-	-	+
Flavonoids	Shinoda	+	+	+	-
	Lead Acetate	+	+	-	-
Glycoside	Killer killani	-	+	-	-
Carbohydrate	Molisch's	+	+	-	-
	Fehling's	+	+	+	+
Triterpenes	Vanillin-sulphuric acid test	-	-	-	-
Amino Acids	Ninhydrin	-	+	-	-
Sterols	Liebermann-Burchard's	+	-	-	+
	Salkowski's	+	-	-	+
Phenol		+	+	+	+

Key (+) = Presence, (-) = Absent

Table 9: Phytochemical screening of Polyherbs extracts *Andrographispaniculata*

Chemical Constituents	Chemical Test	Extracts			
		Ethanol Extract	Chloroform Extract	n-hexane Extract	Aqueous Extract
Alkaloids	Mayer's	+	-	+	+
	Dragendorff's	+	-	+	+

Saponin	Foam forming test	+	+	-	-
Tannins	Ferric Chloride	+	+	+	+
	Dilute nitric acid	+	+		-
Proteins	Million's	-	+	-	+
	Biuret	-	+	-	+
Flavonoids	Shinoda	+	+	+	-
	Lead Acetate	+	+	-	+
Glycoside	Killer killani	-	+	-	+
Carbohydrate	Molisch's	+	+	-	+
	Fehling's	+	+	+	+
Triterpenes	Vanillin-sulphuric acid test	-	-	-	-
Amino Acids	Ninhydrin	-	+	-	-
Sterols	Liebermann-Burchard's	+	-	-	+
	Salkowski's	+	-	-	+
Phenol		+	+	+	+

Key (+) = Presence, (-) = Absent

Table 10: Phytochemical screening of Polyherbs extracts *Ocimumtenuiflorum* (Tulsi)

Chemical Constituents	**Chemical Test**	**Extracts**			
		Ethanol Extract	**Chloroform Extract**	**n-hexane Extract**	**Aqueous Extract**
Alkaloids	Mayer's	+	-	+	+
	Dragendorff's	+	-	+	+
Saponin	Foam forming test	+	+	-	-
Tannins	Ferric Chloride	+	+	+	+
	Dilute nitric acid	+	+		-
Proteins	Million's	-	+	-	+
	Biuret	-	+	-	+
Flavonoids	Shinoda	+	+	+	-
	Lead Acetate	+	+	-	-
Glycoside	Killer killani	-	+	-	-
Carbohydrate	Molisch's	+	+	-	-
	Fehling's	+	+	+	+
Triterpenes	Vanillin-sulphuric acid test	+	-	-	-
Amino Acids	Ninhydrin	+	+	-	-
Sterols	Liebermann-Burchard's	+	-	-	+
	Salkowski's	+	-	-	+
Phenol		+	+	+	+

Key (+) = Presence, (-) = Absent

3.3 Extract Preparation

The phyto-constituents were extracted using a variety of more polar solvents, including ethanol, water, n-hexane, and chloroform [29-32]. The extraction values of various polyherb extracts are expressed as follows.

Table 11: Extractive values of *Curcuma zedoaria* extract

S. No.	Extracts/ Fractions	Estimated percentage	Colour of extract
1.	n-hexane extract	11.21% w/w	Pale yellow to yellowish brown
2.	Chloroform extract	9.45 % w/w	Yellow to orange brown
3.	ethanol extract	13.73 % w/w	Dark yellow to brown
4.	Aqueous extract	4.52 % w/w	Light yellow to pale brown

Table 12: Extractive values of *Salvadorapersica* extract

S. No.	Extracts/ Fractions	Estimated percentage	Colour of extract
1.	n-hexane extract	10.11% w/w	Pale yellow to light brown
2.	Chloroform extract	8.45 % w/w	Yellowish brown to Brown
3.	ethanol extract	13.43 % w/w	Dark brown
4.	Aqueous extract	4.48 % w/w	Light brown to reddish brown

Table 13: Extractive values of *Glycyrrhiza glabra* extract

S. No.	Extracts/ Fractions	Estimated percentage	Colour of extract
1.	n-hexane extract	15.35% w/w	Pale yellow
2.	Chloroform extract	9.38 % w/w	Yellow to light brown
3.	ethanol extract	14.12 % w/w	Dark brown
4.	Aqueous extract	3.41 % w/w	Light brown to brown

Table 14: Extractive values of *Andrographis paniculata* extract

S. No.	Extracts/ Fractions	Estimated percentage	Colour of extract
1.	n-hexane extract	11.21% w/w	Pale yellow to light green
2.	Chloroform extract	9.45 % w/w	Yellowish brown
3.	ethanol extract	3.73 % w/w	Dark brown to greenish brown
4.	Aqueous extract	4.52 % w/w	Dark brown to greenish

Table 15: Extractive values of *Ocimum tenuiflorum* extract

S. No.	Extracts/ Fractions	Estimated percentage	Colour of extract
1.	n-hexane extract	16.02% w/w	Pale green to yellow green
2.	Chloroform extract	7.21 % w/w	yellowish Brown
3.	ethanol extract	12.51 % w/w	Dark green to brown
4.	Aqueous extract	4.03 % w/w	Light green to light brown

3.4 TLC Studies of n-hexane Etxract, chloroform extract, ethanolic extract, aqueous extract of polyherbs

Table 15: TLC Studies of *Curcuma zedoaria*

Extract	Solvent system	No of spots	TLC profile	
			R_f value	Colour
Ethanol extract	Chloroform: methanol (9:1)	5	0.78, 0.70, 0.55, 0.40, 0.22	Yellow, light orange, green, blue, violet
Chloroform extract	Toluene:ethyl acetate;:formic acid (5:4:1)	3	0.72, 0.53, 0.32	Yellow, blue green, faint violet
n-hexane extract	Hexane: ethylacetate (8:2)	2	0.75, 0.62	Light Yellow(terpenes) , faint spot
Aqueous extract	n-butenol:aceticacid:water (4:1:5)	2	0.32, 0.18	Blue, voilet

Table 16: TLC Studies of *Salvadorapersica*

Extract	Solvent system	No of spots	TLC profile	
			R_f value	Colour
Ethanol	Chloroform: methanol (9:1)	4	0.78;0.67;0.51; 0.32	Pink red, blue violet, purple pink, dark blue

extract				
Chloroform extract	Toluene:ethyl acetate;:formic acid (5:4:1)	3	0.80;0.65;0.45	Orange brown, light orange, brown spot
n-hexane extract	Hexane: ethylacetate (8:2)	3	0.82; 0.71;0.54	Violet purple, light blue, ink purple
Aqueous extract	n-butenol:aceticacid:water (4:1:5)	2	0.64;0.25	Blue black, light brown

Table 17: TLC Studies of *Glycyrrhizaglabra (Liquorice)*

Extract	**Solvent system**	**No of spots**	**TLC profile**	
			R_f value	**Colour**
Ethanol extract	Chloroform: methanol (9:1)	4	0.63;0.52;0.37;0.22	Pink red, purple violet, blue purple, dark blue
Chloroform extract	Toluene:ethyl acetate;:formic acid (5:4:1)	3	0.78;0.62;0.42	Dark green, green, light green, light yellow, brown
n-hexane extract	Hexane: ethylacetate (8:2)	3	0.82; 0.68;0.55	Purple violet, light blue, faint purple
Aqueous extract	n-butenol:aceticacid:water (4:1:5)	3	0.58;0.30;0.16	Blue black, brown, light yellow

Table 18: TLC Studies of *Andrographis paniculata*

Extract	**Solvent system**	**No of spots**	**TLC profile**	
			R_f value	**Colour**
Ethanol extract	Chloroform: methanol (9:1)	9	0.35;0.48;0.26;0.16	Blue green, purple blue, pink violet, dark blue
Chloroform extract	Toluene:ethyl acetate;:formic acid (5:4:1)	3	0.79;0.34;0.22	Purple blue, blue violet, light blue
n-hexane extract	Hexane: ethylacetate (8:2)	3	0.84; 0.69;0.51	Violet purple, blue violet , light purple
Aqueous extract	n-butenol:aceticacid: water (4:1:5)	3	0.30;0.18;0.10	Blue black, light brown, faint yellow

Table 19: TLC Studies of *Ocimumtenuiflorum (Tulsi)*

Extract	**Solvent system**	**No of spots**	**TLC profile**	
			R_f value	**Colour**
Ethanol extract	Chloroform: methanol (9:1)	4	0.48;0.30;0.22;0.14	Blue green , blue purple, purple pink, dark blue, yellow
Chloroform extract	Toluene:ethyl acetate;:formic acid (5:4:1)	4	0.76;0.45;0.32; 0.24	Purple violet, blue green blue, purple pink
n-hexane extract	Hexane: ethylacetate (8:2)	3	0.78; 0.63;0.51	Purple violet, light purple, light blue
Aqueous extract	n-butenol:aceticacid:water (4:1:5)	3	0.28;0.20;0.10	Blue black , brown, light yellow

Table 20: Percentages of phytoconstituents present in Polyherbs extracts

ExtExtracts	Constituents presents	*Curcuma zedoaria*	*Salvadorapersica*	*Glycyrrhizaglabra*	*Andrographis paniculata*	*Ocimumtenuiflorum*
		Qty. of Phytoconstituents in (%)				
n-h Hexane extract	Alkaloids	2.31	1.99	1.76	2.22	2.12
	Phenols	6.12	6.12	6.11	5.90	4.10
	Flavonoids	08.14	8.14	8.32	8.19	7.76
	Tannin	07.52	07.48	7.22	7.21	6.92
Chl Cholorform extracts	Alkaloids	5.17	4.99	4.25	4.96	5.05
	Phenols	2.02	3.05	1.08	1.26	2.09
	Flavonoids	09.16	9.15	9.88	9.82	8.92
	Tannin	06.20	05.25	5.26	6.48	6.12
Eth Phenol extract	Alkaloids	8.74	7.22	5.26	9.27	8.24
	Phenols	14.11	16.11	18.25	19.25	15.25
	Flavonoids	16.42	17.41	18.12	15.42	15.32
	Tannin	06.56	5.32	2.35	4.32	3.25
Aq Aqueous extract	Alkaloids	14.08	16.2	17.9	15.9	14.06
	Phenols	6.22	5.29	5.31	4.36	3.92
	Flavonoids	3.25	4.05	5.25	3.28	4.25
	Tannin	6.18	5.99	5.12	6.23	6.18

4. CONCLUSION

The current research was able to perform the phytochemical screening, extraction, and TLC characterization of Curcuma zedoaria, Salvadorapersica, Glycyrrhizaglabra, Andrographispaniculata and Ocimumtenuiflorum aimed at using as an antitussive agent. Pharmacognostic analysis was done to verify that all the plant materials met pharmacopeial standards of quality, purity, and identity. The extracts also had good extraction yields, especially when using ethanol, and were also identified to be high in bioactive phytoconstituents like phenols, flavonoids, alkaloids and tannins, which have been shown to have a role in cough-suppressive and anti-inflammatory effects. Altogether, the results indicate the possibility of the medicinal plants identified as a promising polyherbal antitussive preparation. Future pharmacological and clinical research is however needed to support its usefulness and safety in the treatment of cough related to common cold.

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