Preliminary Phyto-chemical Screening of Selected Medicinal Plants from Shivalik Himalaya

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Abstract - There are numerous medicinal plants found in Shivalik Himalayan region, which have a long history of potential therapeutic role in folklore medicinal system. Medicinal plants play vital role in the livelihood of the native population and believed to prevent a number of diseases. The Himalayan state, Uttarakhand, is a hotspot for various such medicinal plants and species and therefore it is popularly known as " Indian Herbal State" or " Natures Warehouse" . The tribal and local population of this state used plants for their socio, economic and health care benefits. These plants have various therapeutically active and biologically superior chemical constituents belonging to various chemical categories of natural products like alkaloids, flavonoids, phenolic, triterpenoids which are popularly known to prevent various disease. The present study deals with the extractions and phytochemical evaluation of three selected indigenous medicinal plants belonging to different families i.e., *Potentilla fulgens, Berberis asiatica,* and *Zanthoxylum armatum.* Phytochemical analysis of different extracts disclose that all three plant contain alkaloids, flavonoids, polyphenolic acids, triterpenes, tannin foundin different ratio. High amount of polyphenolic and flavonoids compounds are present in ethanol extract of *Potentilla fulgens,* alkaloids and terpenes are present in large amount in ethanol extract of *Zanthoxylum armatum,* whereas large number of alkaloids are present in the ethanolic extract of *Berberis asiatica.* Other constituents such as tannins, resins, volatile oil, etc., are also present in the extract of these plant. Looking into the wide range of phytoconstituents available in these extracts, all these plants on systematic scientific examination can be exploited fir a long range of pharmacological effects.

Keywords - Phytochemical evaluation, extraction technique, botanical medicines, *Potentilla fulgens, Berberis asiatica, Zanthoxylum armatum*.

I. INTRODUCTION

Plants and their health care benefits are known to the mankind since its inception. People kepton exploiting them for prevention, cure and prophylaxy of numerous diseases. But due to renuavailability of standards for safety and efficacy of extraction techniques and thorough and systematic pharmacological evaluation, these could not be treated as substitution of allopathic medicines. Now, with the advancement of scientific and rational use of herbs for their therapeutic potential, the reputation of botanical medicines has improved to many folds[1]. Nowadays, about 80% of the medicines are either directly extracted from plants or derived from any phytoconstituent and worldwide market of these medicines has touched a level of approximate 120 billion US dollar [2].

Plant based medicines are considered as pharmacokinetically superior [3], cheaply available and believed to bear fewer side effects, however quackery in terms of all ululations and substitution of raw material and lack of strict standardization practices is a matter of serious concern before them, which needs to be addressed for their safe and harmonical use. Recently microbial infections are among the most common health related issue seen around us. It is commonly characterized by invasion of pathogenic, bacteria, fungal, viral and protozoal cellsin the host cell and developing a number of disorders. Covid, Zika virus, Ebola virus are few forms of these

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infections which have change our life style and continued to be a major concern for modern medicinal profession. Keeping this into consideration present study is carried out in order to investigate three medicinal plants viz., *Potentilla fulgens*, *Berberis asiatica* and *Zanthoxylum armatum*, which had very high reputation as anti-microbial agents in folklore medicines.

Potentilla fulgens (Fig.1) which belongs to the Rosaceae family has been used traditionally medicinal plant for ancient times. *Potentilla* is basically found in Himalaya' s region where all parts of plant have ethnomedicinal uses. Such as in plant *Potentilla fulgens*, whole herb is used as gum and tooth alignments (pyorrhoea, tooth decay), diabetes, stomach problems, cancer [4]; plant juice, root powder, root paste used as tooth infections, peptic ulcer, wounds and tiger bites, mouth ulcer, cough and cold; whole plant is used as stomatitis and aphthae [5]. In Nepal and Bhutan plant juice is taken for the treatment of stomach problems and respiratory complaints [6]. It contains rich number of polyphenols in stem, root and leaves. These polyphenols form stable complex with protein, metal ions, polysaccharides and help in healing of wounds, inflammations and burns, protect underlying mucosa from toxins and irritants, control dental carries and ameliorate degenerative diseases. Pharmacological studies report that *Potentilla fulgens* possesses hypoglycaemic, antitumour, anti- hyperglycemic [7] antioxidant, anti-inflammatory and antiulcerogenic, anthelmintics and anticancerous.

Fig1a.Potentilla fulgens whole plant,leaves, flower

Berberis asiatica (Fig.2) also called Indian barberry and in Hindi, known as Kilmore belongs to the family Berberidiaceae. Kilmore has been used for the treatment [8] of eye and ear diseases, rheumatism, diabetes, jaundice, skin disease and as tonic and so forth. Root contains large number of alkaloids in which major alkaloid berberine, known for its activity against cholera, latent malaria, diarrhoea, amoebiasis, and for the treatment of oriental sore caused by Leishmania tropica. However, decoction is also being used for piles, and gastric disorders.

Fig2.*Berberis asiatica* whole plant,leaves,seed,flower

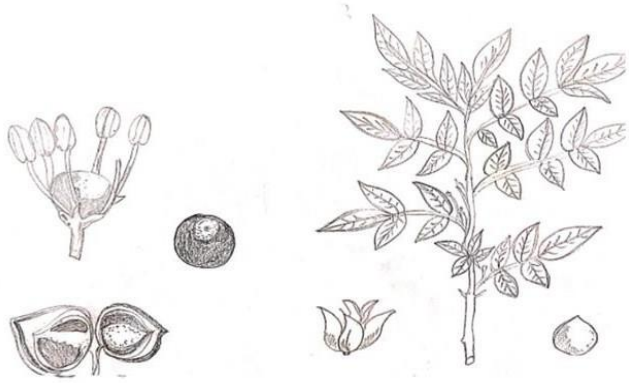

Fig3.Zanthoxylum armatum whole plant,flower,fruit,seed,leaves

Zanthoxylum armatum (Fig.3), known as Prickly ash and regionally known as Timru/ Timur belongs to family Rutaceae. It is well known medicinal plant from ancient times. It is used to treat disease viz., asthma, bronchitis, cholera, fever, fibrosis, skin disease, toothache. It is also used as rheumatism, cramp in leg, ulcers, low blood pressure and inflammation. The fruit and seeds are used to cure in fever dyspepsia and cholera; the bark is used for intoxicating fishes, clean teeth. The whole plant is used to cure scabies and also used for expelling worms from the infecting ear. It possess pharmacological activity such as hepatoprotective [9], anti- diabetic, anti-depressant, memory-inhancing property, cytotoxicity, anti-spasmodic, anti- proliferative [10], antimicrobial, anti-fungal [11], anti-convulsant, anti-inflamatory, and antioxidant [12], etc.

Objective:

The objective of the present work is to systematically screen the phytoconstituents available in the various extracts and to investigate the total alkaloid, flavonoid and phenolic content present in these extracts.

II. MATERIALS AND METHOD

Materials: Roots of *Berberis asiatica* and stems of *Zanthoxylum armatum* were collected from Tehri Garhwal District of Himalayas and whole plant of *Potentilla fulgens* was collected from Rudraprayag, Uttarakhand, India.

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Procurement and Authentication of Raw Material:

The parts of the plant used (stem and root) were washed and rinsed with distilled water to remove dust and other foreign matters, carefully dried in the shade, so that the chemical constituents present in the plant had no effect.

The specimen samples of *Berberis asiatica Zanthoxylum armatum* and *Potentilla fulgens* were identified and authenticated by Dr. Purushottam Kumar, Sr. Taxonomist at Botanical Survey of India, North Circle, Kaulagarh Road, Dehradun, India.

Preparation of Extract:

Properly dried and finely powdered plant materials were weight accurately and subjected to Soxhlet extraction using hot percolation technique.

Accurately weighed 500gm of plant part transferred into thimble (Soxhlet) and extraction was carried out with different solvents viz., petroleum ether, chloroform, ethanol and water in the increasing order of polarity.

Phytochemical Analysis:

Preliminary phytochemical evaluation of the plant extract (petroleum ether, chloroform, ethanol and water) was carried out as follows [13,14]:

i. Detection of Alkaloids:

Extracts were dissolved individually in dilute Hydrochloric acid and filtered.

Mayer' s Test: Filtrates were treated with Mayer' s reagent (Potassium Mercuric Iodide)Formation of a yellow-coloured precipitate indicates the presence of alkaloids.

Wagner' s Test: Filtrates were treated with Wagner' s reagent (Iodine in Potassium Iodide).Formation of brown/reddish precipitate indicates the presence of alkaloids.

ii. Detection of Carbohydrates:

Extracts were dissolved individually in 5 ml distilled water and filtered. The filtrates were usedto test for the presence of carbohydrates.

Fehling' s Test: Filtrates were hydrolysed with dil. HCl, neutralized with alkali and heated with Fehling' s A & B solutions. Formation of red precipitate indicates the presence of reducing sugars.

iii. Detection of Saponins:

Froth Test: Extracts were diluted with distilled water to 20ml and this was shaken in a graduated cylinder for 15 minutes. Formation of 1 cm layer of foam indicates the presence of saponins.

iv. Detection of Phytosterols:

Salkowski' s Test: Extracts were treated with chloroform and filtered. The filtrates were treated with few drops of Conc. Sulphuric acid, shaken and allowed to stand. Appearance of golden yellow colour indicates the presence of triterpenes.

v. Detection of Phenols:

Ferric Chloride Test: Extracts were treated with 3-4 drops of ferric chloride solution.Formation of bluish black colour indicates the presence of phenols.

vi. Detection of Flavonoids:

Lead Acetate Test: Extracts were treated with few drops of lead acetate solution. Formationof yellow colour precipitate indicates the presence of flavonoids.

vii. Detection of Proteins:

Xanthoproteic Test: The extracts were treated with few drops of conc. Nitric acid. Formationof yellow colour indicates the presence of proteins.

III. RESULT AND DISCUSSION

Roots of *Berberis asiatica* and stem of *Zanthoxylum armatum* were collected from Tehri Garhwal District at Chandrashila mountain (height 2277m) of Garhwal Himalayas and whole plant of *Potentilla fulgens* was collected from Rudraprayag District, Chaumsali Village at a height 3000m -3500m.

All the plant specimens were identified and authenticated by Dr. Purushottam Kumar, Sr. Taxonomist at Botanical Survey of India, North Circle, Kaulagarh Road, Dehradun, India.

Herbarium of *Berberis asiatica* [Voucher specimen no.768], *Zanthoxylum armatum* [Voucher specimen no. 769] and *Potentilla fulgens* [Voucher specimen no.] were deposited at Botanical Survey of India, North Circle, Kaulagarh Road, Dehradun, India.

The various extracts were obtained by the use of hot Soxhlet percolation method, where solvents were used in increasing order of polarity for gradual fractionation. The various percentage yield with different solvent is summarised in table 1.

Table 1: Percentage yield of different extracts

Raw Material	Extract	Quantity (g)	% Yield
Berberis asiatica (500gm)	Petroleum ether	1.25	0.25%
	Chloroform	1.3	1.62%

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	Ethanol	28.25	5.65%
	Water	31.8	6.37%
Zanthoxylumarmatum (500gm)	Petroleum ether	0.93	0.3%
	Chloroform	2.12	0.68%
	Ethanol	9.75	3.12%
	Water	27.5	8.8%
Potentilla fulgens (500gm)	Petroleum ether	5.0	1.0%
	Chloroform	13.0	2.6%
	Ethanol	15.0	3.0%
	Water	10.0	2.0%

Among all the extracts prepared in the previous step, ethanolic extract of *Berberis asiatica* (5.65%), aqueous extract of *Zanthoxylum armatum* (8.8%), and ethanolic extract of *Potentillafulgens* (3.0%) found to be were in highest concentration. This reflects that compound of intermediate polarity constituents most of the phytochemical distribution of these plant parts. On the other hand, Petroleum ether extract of *Berberis asiatica* (0.25%), *Zanthoxylum armatum*(0.3%) and *Potentilla fulgens* (1.0%) were found to be lowest, revealing minimum amount of non-polar compounds i.e., sterols, terpinols, saponins and amino acids. Due to presence of variety of phytochemicals, such as alkaloids, flavonoids, tannins, saponin, terpenes, and phenolic compounds available in a large amount in these plants, they bear significant medicinal and pharmaceutical applications.

Table 2 presents the preliminary phytochemical investigation of the extracts of *Berberis asiatica*, *Zanthoxylum armatum* and *Potentilla fulgens.* All the ethanolic extracts were found to be rich in alkaloid content whereas ethanolic extract of *Potentilla fulgens* was rich in saponins and phenolic compounds.

The results are in compliance with some previous reports where it was observed that the *Potentilla fulgens* contains high amount of tannins **[15]** polyphenols and flavonoids and lesserextent of triterpenoids [16]. Pradeep Kumar in 2021 reported that the different part of *Potentillafulgens* and their various extract have an active variety of triterpenes, triterpenoids, Potentene A, Potentene B, Novel bioflavonoid Potifulgene, and polyophenols. The study also revealed that the extracts of *Potentilla fulgens* is used as a potent source of antehelmintic, antioxidents,antihyperglycemic, anticancerous, antitumour, and molluscidies [16].

Table 2: Phytochemical Screening of Different Extract

Raw Material	Extract	Alkaloid	Flavonoids	Carbohydrate	Saponins	Sterols	Protein	Phenol & Tannins
Berberis asiatica (500gm)	Petroleum ether	-	-	-	-	+	-	-
	Chloroform	-	-	-	-	-	-	-
	Ethanol	+++	+	+	+	+	-	+
	Water	+	-	-	+	-	-	-
Zanthoxylum armatum (500gm)	Petroleum ether	-	-	-	-	+	-	-
	Chloroform	+	-	-	-	+	-	+
	Ethanol	+++	+	+	-	+	+	+
	Water	-	-	-	+	-	-	-
Potentilla fulgens (500gm)	Petroleum ether	-	-	-	-	+	-	-
	Chloroform	+	-	-	-	-	-	-

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	Ethanol	+++	-	-	++	+++	+	+++
	Water	+	-	-	++	+	+	+

+ = present

- = absent

In another study carried out by Jaitak et al., 2010 [17] reported that methanolic extract has a very significant antioxidant property, which is attributed due to the presence of phytoconstituent present in it. Again, the study confirmed that presence of epicatechin and bio flavonoid Potifulgene(1) established relation between these phytoconstituent and their antioxidant activity. The methanolic root extract of *Potentilla fulgens* reduces free-radical- mediated oxidative stress in diabetic mice [18].

In an another study carried out by Kaul et al., in 2010 was carried out two new triterpenes, Potentene A(2) and Potentene B(3) [19]. Also three new compounds i.e., afzelchin-4α-8"- catechin(4), epiafzelchin(5) (both flaval-3-ols) and rutin(6) a (falvan-4-one) were isolated from aerial part of *Potentilla fulgens* and characterized with antioxidant property. Structure of compounds (1-6) are shown in fig. 4.

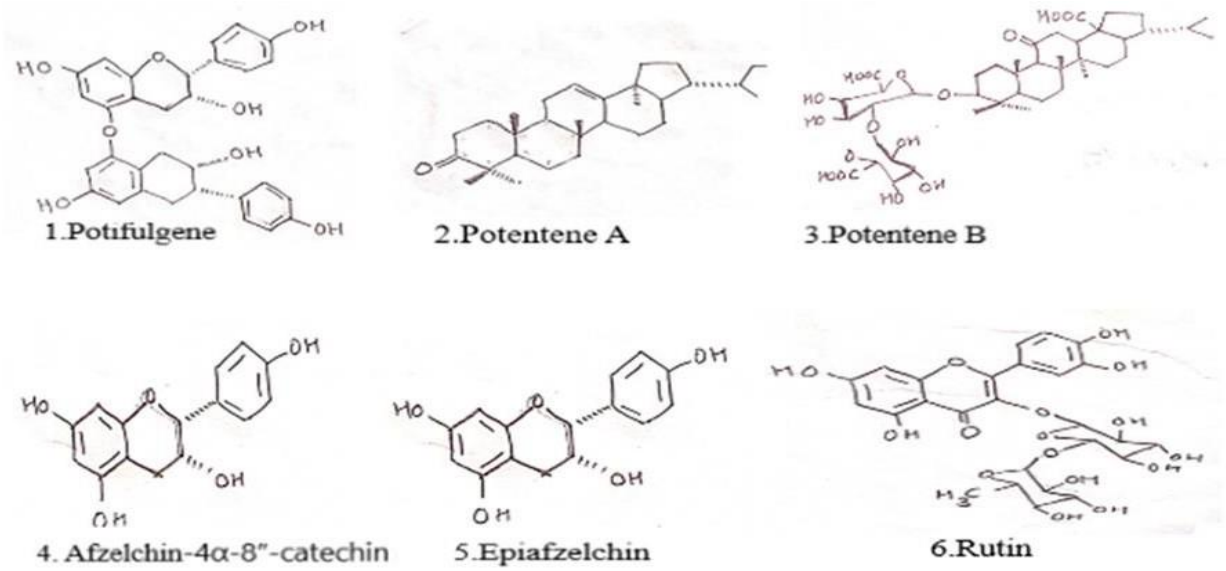

Fig4. Structures of phyto-constituents present in *Potentilla fulgens*

Some previous researchers [20] also reported antioxidant activity of the methanolic extract of the root of *Potentilla fulgens*. From their study, the methanolic root extract of this plant shows potent hepatoprotective effects, hence it can be used as a protecting agent against liver damage[21].

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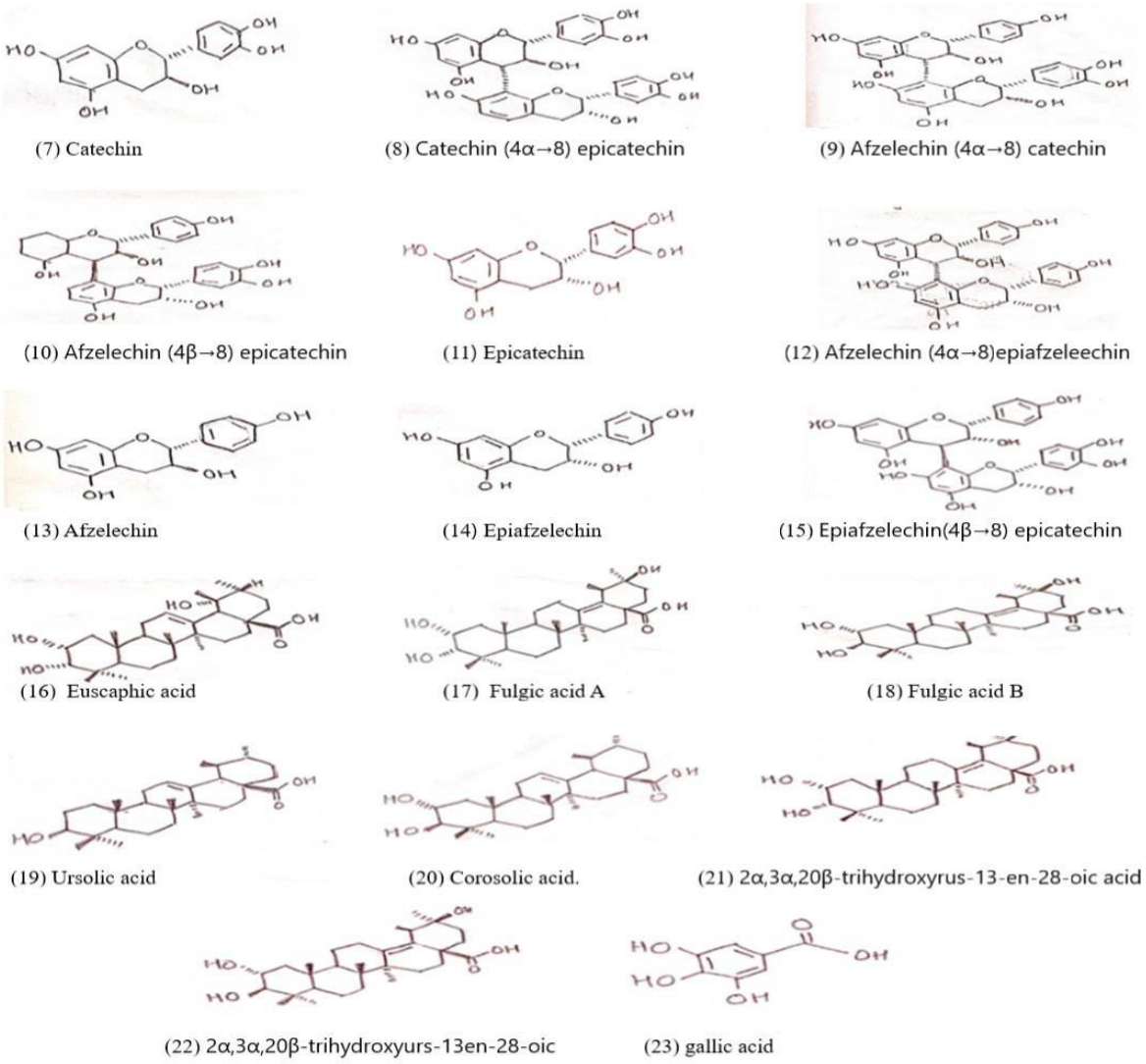

Fig5. Structures of phyto-constituents present in *Potentilla fulgens*

In 2018, CB Chandan and Nilofer Yasmin [22] isolated 14 chemical compounds in the methanolic extract of root of *Potentilla fulgens* which shows anti carcinogenic effect. These polyphenolic compounds were identified as: Catechin(7), Catechin (4α→8) epicatechin(8), Afzelechin (4α→8) catechin(9), Afzelechin (4β→8) epicatechin(10), Epicatechin(11), Afzelechin (4α→8)epiafzeleechin(12), Afzelechin(13), Epiafzelechin(14), Epiafzelechin(4β→8) epicatechin(15), Euscaphic acid(16), Fulgic acid A(**17**), Fulgic acid B**(**18**)**, Ursolic acid**(**19**)** and Corosolic acid(20).

Few more compounds were isolated from ethyl acetate extraction of the root of *Potentilla fulgens* known to exhibit good antioxidant activity such as 2α,3α,20β-trihydroxyrus-13-en-28- oic acid(21), 2α,3α,20β-trihydroxyurs-13en-28-oic(22), p-hydroxy benzaldehyde, gallicacid(23) [23] and structure of compounds (7-23) are shown in fig.5.

In the methanolic root extract of *Potentilla fulgens* some researchers [4] found anti-neoplasticactivity, which was found active against few tumours in a dose dependent manner, showing high antitumour activity on Daltons Lymphoma (DL) cells. In the year 2013 another study carried out by Choudhary at el.,[24] were isolated few chemical constituents from ethyl acetateextract of *Potentilla fulgens* roots. He studied to evaluates the anti-carcinogenic effect of the plant *Potentialla fulgens.* The name of these compounds are Epigallocatechin(24),Epigallocatechin gallate(25) shown in fig.6, Afzelechin, Epiafzelechin, Epicatechin, Catechin,

Aafzelechin(4β→8)epicatechin, Epifzelechin(4β→8)epicatechin, Catechin(4α→8)epiafzelechin, Afzelechin(4α→8)catechin, Afzelechin(4α→8) epiafzelechin.

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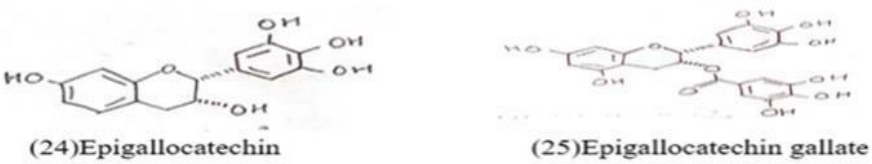

(24)Epigallocatechin (25)Epigallocatechin gallate

Fig6. Structures of phyto-constituents present in *Potentilla fulgens*

Some other activities also found in the different extract of roots of *Potentilla fulgens* were reported in different studies. The ethanolic extract of *Potentilla fulgens* have potential and anthelmintic activity against the cestode parasite [25].

The methanolic, butanoic and dichloromethane root extract of *Potentilla fulgens* have cytotoxicactivity against various have cytotoxicity activity against various human cancer cells line suchas ovary, liver, lungs and leukaemia [26].

The aqueous root extract of *Potentilla fulgens* is used in the treatment of intestinal parasitic infection [27]. As above discussion many researchers concluded that *Potentilla fulgens* has various pharmacological activity as shown on table 3.

Table 3: Medicinal part shown by different part of *Potentilla fulgens*

Activity	**Active parts**	**Extract**	**Reference**
Antioxidant	Root	Aqueous, Methanolic,Ethyl acetate Extract	19, 20,18,23
Antihelmintic i) against cestode ii) against trematodelarva iii) intestinal parasite	Root powder	Ethanolic Extract	25, 28,29 27
Anticancerous	Root	Methanolic, Butanoic,Aqueous Extract	26, 30
Antitumour	Whole plant, root	Methanolic, EthanolicExtract	29
Molluscicide	Root	Ether, Chloroform, Methanol and EthanolExtract	32,33

The phytochemical investigation of *Berberis asiatica* root extract carried out in the present study showed that the ethanolic extract is rich in alkaloid content. Other chemical constituents such as terpenoids, steroid, flavonoids, sterols, saponins etc., are also present in different extracts of *Berberis asiatica.*

The results are in compliance with some early reports, Srivastav et al.,[34] reported that ethanolic extract contains steroid, flavonoid, triterpenoids, alkaloids, sugar, tannins, gum, resins, and saponins.

Reports suggests that alkaloids are the main bioactive chemical constituents of *Berberis* species. Berberine(26) [35] and Palmatine(27), present as chloride salt, whereas two more alkaloids present in small amount Jatrorrhizine(28) and Columbamine(29)[36]. It also contains[37-38] tetrahydropalmatine(30), oxyberberine(31), berbamine(32) and oxyacanthine(33).

Other species of *Berberis* are reported to contain four monomeric isoquinoline alkaloids, the benzyl isoquinoline(34), (+)-N-methylcoclaurine(35) and the aporphines (+)-9- hydroxynuciferine which are separated from methanol extract of this plant [39] and structuresof these compounds (26-35) are shown in fig.7.

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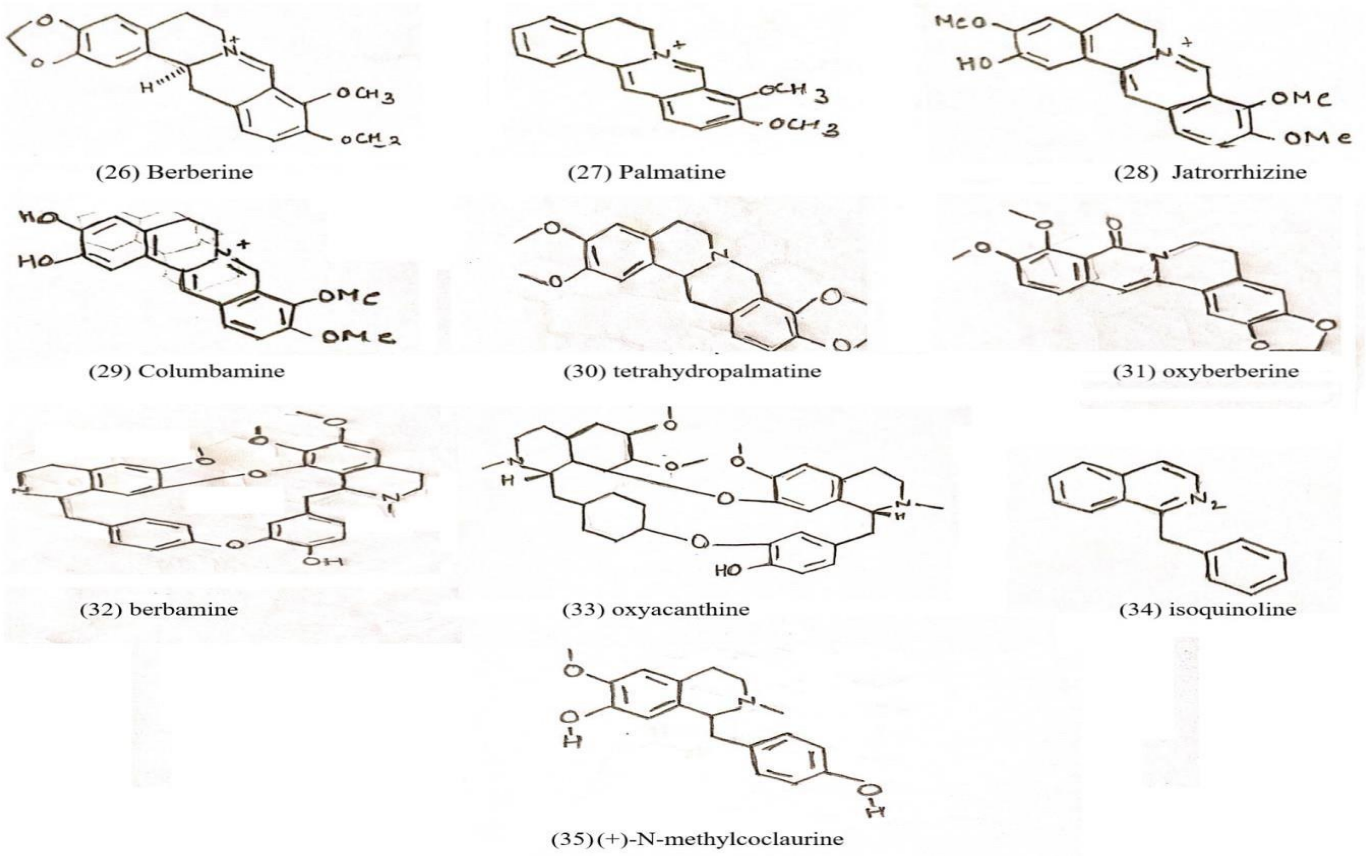

Fig.7 Structures of phyto-constituents present in *Berberis asiatica*

Alkaloids Berberin and Berbamine are the most biologically active alkaloid compounds [40]. These alkaloids are widely distributed in almost all Berberis content is accumulated in root part. Alkaloid berberin which is isoquinoline alkaloid, is known for its activity against cholera [41], malaria, diarrhea [42], amoebiasis. Many other pharmacological effects of Berberin described in both in-vivo and in-vitro research, including antidepressant [44-45], anti- convulsant [44], anti-alzheimer [43], antiviral [45], antineoplastic [46], anti-diabetic [47-48],

anti-bacterial [45] and anti-arrhythmic [44].

Joshi et al.,[49] during an in-Silico study in 2021 reported Berbamine, Oxyacanthine and Rutinfrom *Berberis asiatica* to be effective against SARS-CoV-2 virus.

Some other ethnomedical investigation revealed that the tribal Kuman and Garhwal regions use the decoction of root for treating eye troubles. However, decoction is also being word for piles, gastric disorders and other allied complaints by Tibetans was reported by Chauhan (1978-1979) [50].

Table 4: Phyto-pharmacological detail of various parts of *Berberis* species

Activity	**Berberis Species**	**Plant part**	**Extract**	**References**
Anti-inflammatory	*Berberis aristataBerberis vulgaris*	Root	Aqueous Methanolic,Ethanol extract	51 52
Anti-microbial	*Berberis vulgaris*	Root	Isolated berberine	53
Antipyretic	Berberis sp.	Root	Isolated Berberine sulphate	54
Hepatoprotective	*Berberis aristata*	Crude root	Ethanol extract	55

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Anti-diabetic	*Berberis vulgaris*	Fruits and Roots	Aqueous ethanol extract	47,48

The present results show that extracts of *Zanthoxylum armatum*, were found to contain alkaloids, flavonoids, glycosides, phenolics, sterols, terpenoids, and other chemical compoundsin significant amount.

Zanthoxylum armatum is an important medicinal plant and delicate twigs are commonly boughtin use as toothbrush by tribals and natives of summative Himalayas. Also, it is used as a medicine from ancient times for cure of number of diseases such as toothache and problem

related to tooth, gum bleeding etc. It' s stem, bark and seed used in the treatment of asthma, bronchitis, indigestion, toothache, diarrhoea, dyspepsia, cholera [56-57] The ethanolic extract of stem of *Zanthoxylum armatum show antioxident activity*.

The ethanolic extract contains numerous alkaloids [58] such as magnoflofrine(36), g- fagarine(37), b-fagarine(38) (skimmianine), nityidine(39), tambatarine(40), chelerythrine(41),laurifoline(42), candicmi etc., and structure of compounds (36-42) are shown in fig.8. Its barkcontains yellow crystalline compounds known as berberine [59].

Many chemical studies were done which introduced the isolation of two new phenolic compounds, 3-3',4'-dimethoxyflavone-5-β-d-xylopyronoside along with five known compounds: 1-hydroxy-6,13-anthraquinone; 1-methoxy-1,6,3-anthrasquinone; 2-hydroxy-4- methoxy benzoic acid; 2-hydropxybenzoic acid and stigmasta-5-en-3β-degucopyranoside on the basis of chemical analysis and spectral data [60].

In another study Krishnamurthi 1996 [45], reported two new phenolic glycosides were isolatedfrom the stem of *Zanthoxylum armatum*. Name of the compounds were threo-3-methoxy-5- hydroxy-phenylpropanetriol-8-O-β-D-glycopyranoside and 2-methoxy-4-hydroxylphenyl-1-O-α-L-rhamnopyranosyl-(1" →6')-β-D-glucopyranoside.

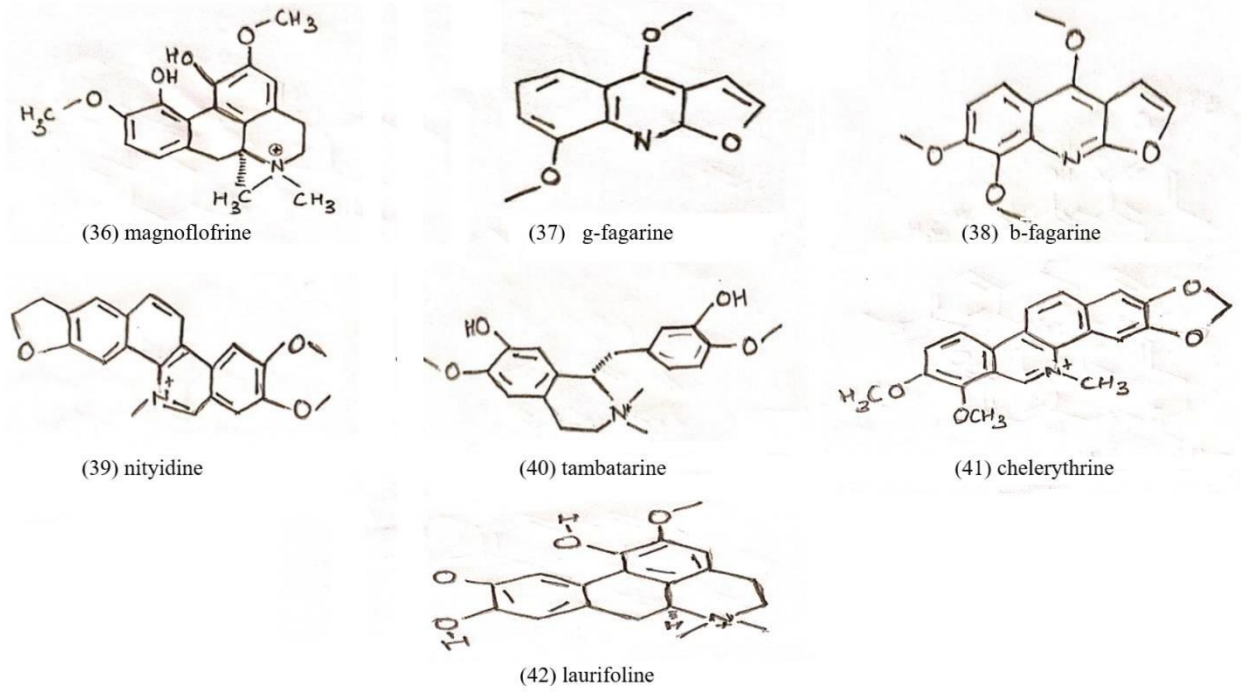

Fig8.Structures of phyto-constituents present in *Zanthoxylum armatum*

Various researchers identified that plant *Zanthoxylum armatum* also possess good anti- spasmodic activity [61], cytotoxicity [62], memory enhancing property [63], anti-depressant property [64], and provides good result in cardiovascular, respiratory disorder [65], anti- convulsant activity and anti-nociceptic. Methanolic extract show anti-proliferative activity.

In another study reported by Gilani et al., 2010 [66], shows stimulating effect upon circulation,lymphatic system and also act as stimulation. Crude extract of *Zanthoxylum armatum* useful in treatment of respiratory, gastrointestinal, resulted concentration effect on K^+ and Ca^{++} channel.The bark, fruit and seed of the plant *Zanthoxylum armatum* are widely utilised in indigenous medicine as carminative, stomachic, and antihelmintic. Various other studies, such as antioxidant, anti-tumour, anti-microbial, and anti-inflammatory action etc., shown in table 5.

Table 5: Medicinal part shown by different part of *Zanthoxylum armatum*

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Extract	Activity	Active plant part	Reference
Methanolic extract	Antioxidant	Fruit	67
Ethanolic extract	Antitumour, Anti-inflammatory,Analgesic,	Leaves/FruitsStem bark Stem/ Leaves	68 69 70
Petroleum ether extract	Anti-inflammatory	Roots	71

From the above discussion it is clear that plant *Zanthoxylum* contains important activecomponent such as lignin, alkaloids, coumarin, phenols, benzenoids, flavonoid [72]. Hence, this plant having many other biological active compounds which are responsible for various pharmacological activities and many more derivatives are found in other researches [73].

IV. CONCLUSIONS

Treatment of a variety of chronic diseases remains a major problem for contemporary medicine, and the World Health Organization has acknowledged that alternative medicines must need strength criteria in the treatment and cure of such complicated disorders. *Potentillafulgens, Berberis asiatica* and *Zanthoxylum armatum* are widely recognised for a number of phytopharmaceuticals that are employed by Ayurvedic and other traditional practitioners for their great medicinal capabilities. The present comprehensive research article highlights the distribution of phytochemicals in various extracts of *Potentilla fulgens, Berberis asiatica* and *Zanthoxylum armatum* which may be useful for further study into the development of more efficient and cost-effective bio-medicines.

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REFERENCES

[1] Maithani A, Parcha V, Fatima N and Kumar D. 2019. Phyto-pharmacological review of *Calotropis procera*- A natures drug house in tropical countries. *Journal of Herbal Drugs*; 10(4): 155-166.

[2] Kar PK. Chemical and pharmacological evaluation of ethno medicinal plants of Sikkim (Doctoral dissertation, University of North Bengal)

[3] Maithani A, Parcha V, Pant G, Kumar D, Dhulia I .2012. Evaluation of Anti-hyperglycamicAction of Different Fractions and Sub-fractions from Aqueous Extract of Aloe Vera Linn. Leafon Alloxan Induced Type 2 Diabetic Rats. *Asian Pac. J. Trop. Biomed*; 2(3): S1691-S1695.

[4] Kaul K, Jaitak V, Kaul VK. 2011. Review on pharmaceutical properties and conservation measures of *Potentilla fulgens* Wall. Ex Hook. A medicinal endangered herb of higherHimalaya. *Indian J. Nat. Prod. Resour*; 2:298-306.

[5] Pala NA, Negi AK, and Todaria NP. 2010. Traditional uses of medicinal plants of Pauri Garhwal, Uttarakhand. *New York Sci. J*; 3(6): 61-65.

[6] Manandhar NP and Manandhar S. 2002. Plants and people of Nepal (ed. Timber Press, Oregon, USA); 377.

[7] Jaiyati R, Rajdeo K, Ashish C. 2016. A survey to explore the herbal wealth and its utility as adibles, ethno-medicine and ethno-veterinary practices in Nanda devi biosphere reserve (NDBR), Uttarakhand as a Step to Bio Prospection, *Pharm.Anal.Acta*.; 7: 2-6.

[8] Annonymous .1998. The Wealth of India Berberis Linn. (Berberidaceae). New delhi;

Ambastha Sp Publication and Inforation Directorate, CSIR; 114-118.

[9] Mehta MB, Kharya MD, Shrivastva R, Verma KC. 1981. Antimicrobial and antihelminticactivities of the essential oil of *Zanthoxylum alatum Roxb. India Perfum*; 25: 19-21.

[10] Baquar SR. 1989. Medicinal and poisonous plants of Pakistan. Printad: Karachi; 478.

[11] Curtis CF, Lives JD, Baolib LU, Renu A. 1990. Natural and synthetic repellents, pp.75-

 DOI : 10.35291/2454-9150.2022.0441

92. In: Citrus CF, (ed.), Appropriate Technology in Vector Control. CRC, Boca Raton FL, Fradin MS. Mosquitoes and mosquito repellents*: a clinician Os guide*; 1998: *Ann. Intern. Med*;128: 931-940.

[12] Sati SC, Sati MD, Raturi R, Badoni P.2011. Anti-inflammatory and antioxidant activities of *Zanthoxylum armatum* Stem Bark. GJRE; 3: 11-21.

[13] Harborne JB. 1998. Phytochemical method, A Guide to Modern technique of Plant Analysis, 3rd Edition, Chapman and Hall, New York; 198

[14] Kokate CK. 2005. A text book of Practical pharmacognosy, 5th Edition, Vallabh Prakashan, New Delhi; 107-111.

[15] Kumar P. 2021. *World Journal of Advanced Research and Review*; 10(03): 141-145.

[16] Tomczyk M and Latte KP. 2009. *Potentilla*-A review of its phytochemical and pharmacological profile. *Journal of Ethnopharmacol*; 122(2): 184-204.

[17] Jaitak V, Sharma K, Kalia K, Kaul VK, et al., 2010. Antioxident activity of *Potentilla fulgens*: an alpine plant of Western Himalaya. *Journal of Food Composition and Analysis*; 23:142-147.

[18] Saio V, Syiem D and Sharma R. 2012. Effect of *Potentilla fulgens* on lipid peroxidation and antioxidant status in alloxan-induced diabetic mice. *Journal of Basic and Clinical Pharmacy*; 3(2): 249-254.

[19] Jaitak V, Kaul VK and Sharma OP et al., 2010. New hopane triterpenes and antioxidant constituents from *Potentilla fulgens. Natural Products Communications*; 5: 1561-1566.

[20] Syiem D, Sharma R, Saio V. 2009. In vitro study of the anti-oxidant potential of some traditionally used medicinal plants of North-East India and assessment of their total phenolic content. *Pharmacologyonline*; 3: 952-965

[21] Tiewlasubon Uriah, Patil M and Kummara S. 2019. *India Journal of Natural Products*; 33(1).

[22] Chandan CB and Yasin N. 2018. *Journal of Natural Products and Resources*; 4(1): 162- 170.

[23] Chaudhary A, Mittal AK and Banerjee UC et al., 2013. Two new stereoisomeric antioxidant triterpenes from *Potentilla fulgens. Fitoterapia*; 91: 290-297.

[24] Chaudhary A, Mittal AK and Chatterjee A et al., 2017. Anticarcinogenic potential of *Potentilla fulgens* extract and its chemical constituents, *International Journal of Phytomedicine*; 9: 83-91.

[25] Roy B, Swargiary A, Syiem D, Tandon V. 2010. *Potentilla fulgens* (Family Rosaseae), amedicinal plant of North-East India: a natural antehelmintic. *J. Parasitic Dis*; 34: 83-88.

[26] Bora M, Baruah D, Upadhyay SN, Lalrinpuia, Hazra J. 2017. Anticancer potential of some Ayurvedic plants of North Eastern India: A comprehensive Pharmacological Review. *Int. J. Res. Ayurveda Pharm*; 8(2): 4-8.

[27] Syiem D, Syngai G, Khup PZ, Khongwir BS, et al., 2002. Hypohlycemic effects of *Potentilla fulgens* L. in normal and alloxan-induced diabetic mice. *J. Ethnopharmacol*; 83; 55-61.

[28] Kumar P, Sunita K, Singh RN, Singh DK. 2002. Fasciola larva: Anthelmintic activity of medicinal plant *Potentilla fulgens* against sporocyst, redia and cercaria. *Asian Journal of Advances in Research*; 3(3): 24-30.

[29] Kumar P. 2021. Medicinal plant *Potentilla fulgens* and its effect in vitro against *Fasciolagigantica.* 24-30. *Insights in Clinical and cellular Immunology*; 004-007.

[30] Radhika M, Ghoshal N, Chatterjee A. 2012. Comparison of effectiveness in antitumour activity between flavonoids and polyphenols of the methanolic extract of roots of *Potentilla fulgens* in breast cancer cells. *J. Complement Integr. Med*; 9: 1644.

[31] Syiem D, Syngkai C, Kharbuli H, Khongwir BS. 2003. Anti-tumour activity of crude rootextract of *Potentilla fulgens. Indian Drugs*; 40: 124-125.

[32] Kumar P, Sunita K, Singh DK. 2018. Molluscicidal activity of different organic root extract of *Potentila fulgens* against liver fluke vector snail *Indoplanorbis exustus. Asian J. of Animal Science*; 12(1): 30-35.

[33] Kumar P. 2021. Effect of medicinal plant *Potentilla fulgens* against fecundity, hatchabilityand survival of Fasciola host snail *Indoplanorbis exustus.* Indian Journal of Scientific Research;11(2): 19-24.

[34] Srivastav SK et al., 2004. Pharmaceutical Biology;42(6):467-473.

[35] Bhakuni DS, Shoeb A, Popli SP (1968): Studies in medicinal plants: Part I – Chemical constituents of *Berberis*

 DOI : 10.35291/2454-9150.2022.0441

asiatica Roxb. *Indian J Chem*; *6:*123.

[36] Chopra, Nayar, and Chopra. 1956. Glossary of Indian Medicinal Plants;1:120.

[37] Chatterjee R. 1952. Plant alkaloids. Part I- *B. Floribunda* Wal. Ex. Don. *J. India Chem Soc*; 28: 225-228.

[38] Chandra P, Purohit AN. 1980. Berberine contents and alkaloids profile of *Berberis* species from different attitudes. *Biochem Syst Ecol*; 8:379-380.

[39] Cabezas NJ, Urzua AM, Niemeyer HM. 2009. Translocation of isoquinoline alkaloids to the hemiparasite, from its host, *Berberis montana. Biochem System Ecol*; 37:225-7.

[40] Dezfuli NM, Saeidnia S, Gohari AR and Mahmoodabadi MK. 2014. Phytochemistry and Pharmacology of *Berberis* Species.*Pharmacogen Rev*; 8(15): 8-15.

[41] Dutta NK, Panse MV. 1962. Usefulness of berberine (an alkaloid from *Berberis aristata*)in the treatment of cholera. *Indian J Med Res*; 50: 732-735.

[42] Lahiri SC, Dutta NK. 1967. Berberine and chloramphenicol in the treatment of cholera and severe diarrhoea. *J Ind Med Assoc*; 48: 1-11.

[43] Joshi RS, Jagdale SS, Bansode SB, Shankar SS, Tellis MB, Pandya VK, et al., 2021. Discovery of potential multi-target-directed ligands by targeting host-specific SARS-COV-2 structurally conserved main protease, *J. Biomol. Struct. Dyn*; 39: 3099-3114.

[44] Imenshahidi M, Hosseinzadeh H. 2016. *Berberis vulgaris* and berberine; an update review,

Phytother Res; 30:1745-1764.

[45] Slow YL, Sarna l, Karmin O. 2011. Redox regulation in health and disease Therapeutic potential of berberine, *Food Res. Int*; 44: 1409-2417.

[46] Cheng F, Li W, Zhou Y, Shen J, Wu Z, Liu G, et al., 2012. admetSAR: a Comprehensive Source and Free Tool for Assessment of Chemical ADMET Properties, *ACS Publications*.

[47] Yin J, Zhang H, Ye J. 2008. Raditional Chinese medicine in treatment of metabolic syndrome. Endocrine, metabolic & immune disorders-drug targets (formerly current drug targets-immune, *Endocrine Metabol. Disord*; 8: 99-111.

[48] Tabeshpour J, Imenshahidi M, Hosseinzadeh H. A review of the effects of *Berberis vulgaris* and its major component, berberine, in metabolic syndrome. *Iran. J. Basic Med. Sci*; 20: 557.

[49] Joshi T, Bhat S, Pundir H, Chandra S. 2021. Identification of Berbamine, Oxyacanthine and Rutin from *Berberis asiatica* as anti-SARS-CoV-2 compounds: An in *silico* study. *Journalof Molecular Graphics* and *Modelling*; 09: 108028.

[50] Chauhan NS, Uniyal MR, Sannad BN. 1978-1979. A preliminary study of the indigenous drugs used at the Tibetan Medicinal Center, Dharamsala (H.P.). *Nagarjun*; 22: 190-193.

[51] Akhter MH, Sabir M, Bhide NK. 1977. Anti-inflammatory effect of Berberine on rats injected locally with cholera toxin. *India J Med Res*; 65: 133-144.

[52] Invanovska N, Philipov S. 1996. Study on the anti-inflammatory action of *Berberis vulgaris* root extract, alkaloid fraction and pure alkaloids. *Int J Immunopharmacol*; 18:553- 561.

[53] Sack BR, Frochlich LJ. 1982. Berberine inhabits internal secretary response of *Vibrio cholera* and *E. coli* enterotoxins. *Infect Immunol*;35: 471-475.

[54] Sabir M, Akhter MH, Bhide NK. 1978. Further studies on pharmacology of Berberine.

Indian J Physiol Pharmacol;22: 9-23.

[55] Sohini YR, Kaimal P, Bhatt RM. 1995. The antiamoebic effect of a crude drug formulation of herbal extracts against Entamoeba histolytica in vitro and vivo. *J Ethnopharmacol*; 1: 43- 52.

[56] Kanjilal UN. 1997. The Flora of Assam. Vol. I (Part I, Omsons Publications, New Delhi)201.

[57] Kiritikar KR, Basu BD. 1933. *Ind. Med. Plan.* (Singh B, Singh MP, New Delhi) 1:463- 464.

[58] Akhtar N, Mohammad A, Mohammad AS. 2009. Chemical constituents from the seeds of

Zanthoxylum alatum. J As Nat Prod Res; 11(1): 91-95.

[59] Siddhanadham AS, Yejella R, Prava R. 2017. Isolation, characterization, biological evaluation of two new lignans from methanolic extract of bark of *Zanthoxylum armatum. Int JPharmacog Phytochem*; 9(3): 395-399.

[60] Krishnamurthi A. 1996. The Wealth of India: Raw Materials -Vol. VIII. India, New Delhi,Publications and Information

 DOI : 10.35291/2454-9150.2022.0441

Directorate, *Council of Scientific and Industrial Research*; 394.

[61] Matsumoto T, Horiuchi M, Kamata K. 2009. Effects of Bidenspilosa L. var. radiata SCHERFF treated with enzyme on histamine-induced contraction of guinea pig ileum and on histamine release from mast cells. *J Smooth Muscle Res*; 45(2-3):75-86.

[62] Barkatullah B, Ibrar M, Muhammad N. 2013. Chemical Composition and Biological Screening of Essential Oils of *Zanthoxylim armatum* DC Leaves. *J. Clin Toxicol*; 3:1-6.

[63] Saikai B, Barua CC, Sarma J. 2018. *Zanthoxylum alatum* ameliorates scopolamine- induced amnesia in rats: Behavioral, biochemical and molecular evidence. *Indian J Pharmacol*;50(1): 30-38.

[64] Barua CC, Haloi P, Saikia B. 2018. *Zanthoxylum alatum* aabrogates lipopolysaccharides- induced depression-like behaviours in mice by modulating neuroinflammation and monoamine neurotransmitters in the hippocampus. *Pharm Biol*; 56(1): 245-252.

[65] Saiki B, Barua CC, Haloi P. 2017. Anticholinregic, antahistiminic, and anteserotonergic activity of n-hexane extract of *Zanthoxylum alatum* seeds on isolated tissue preparations: An ex vivo study. *Indian J Pharmacol*; 49(1): 42-48.

[66] Gilani SN, Khan AU, Gilani AH. 2010. Pharmacological basis for the medicinal use of *Zanthoxylum armatum* in gut, airways and cardiovascular disorders. *Phyto.* Res;24(4): 553- 558.

[67] Upadhyaya K, Ashoka PK. 2010**.** Concentration dependent antioxidant activity of

Zanthoxylum armatum. J. Pharm. Res; 3(7): 1581-1582.

[68] Barkat U, Muhammad I, Muhammad N. 2011. Evaluation of *Zanthoxylum armatum* DC for in-vitro and in-vivo pharmacological screening. *Afr. J. Pharm. Pharmacol*; 5(14): 1718- 1723.

[69] Sati SC, Sati MD, Raturi R, Badoni PP. 2011. A New Flavonoidal Glycoside From stem bark of *Zanthoxylum armatum. IJPI' s J. Pharm. Herb. Form*; 1(2): 29-32.

[70] Guo T, Denq YX, Xie H, Yao CY, Cai CC, Pan SL, Wanq YL. 2010. Antinociceptive andanti-inflammatory activiyies of ethyl acetate fraction from *Zanthoxylum armatum* in mice. *Phytotherapy*; 82(3): 347-351.

[71] Kaur V, Kumar T, Bora SK. 2011. Pharmacological evaluation of *Zanthoxylum armatum*

root extract on analgesic and anti-inflammatory activity. *J. Pharm. Res*; 4(8):256.

[72] Gilani SN, Khan A, Gilani AH. 2010. Pharmacological basis for the medicinal uses of *Zanthoxylum armatum* in gut, airways and cardiovascular disorders. *Phyto. Other Res*; 54:553-558.

[73] Kala CP, Farooquee, NA, Dhar U. 2005. Traditional uses and conservation of Timur *Zanthoxylum armatum* DC) through social institutions in Uttaranchal Himalaya, India. *ConservSoc*; 3(1):224-230.

 DOI : 10.35291/2454-9150.2022.0441