Anti-Viral Medicinal Plants & Their Chemical Constituents, Experimental and Clinical Pharmacology of Antiviral Plants

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Abstract: Almost more than thousand traditional plants show important role in the cure of health-related issues from the ancient times. Medicinal plants & the herbs effective for this purpose. These plants derivative medicine have potential against different problem. In this we discussed different medicinal plants like boerhavia diffusa, Phyllanthus amarus, eclipta alba, andrographics paniculate, curcuma longa, glycyrrhiza glabra and many more which shows antiviral activities. Important phytochemical constituents which derived from the different part of the plants possess flavonoids, alkaloids, lignin's, terpenes etc.

Key words: Antiviral medicinal plant, medicinal activity & chemical constituents

Introduction:

In all over the world from the previous 100 years the herbal therapy plays a significance role in the management of health of human beings. For the cure of different disease these herbs & their plant derived medicine is very effected. From the recent research & study concluded that alternative medicine is very effected then allopathy medicine and now a days mostly people prefer these medicines because of their less side effect. In the whole history of humans for their initial needs man depend on plant & their derivative [1]. From the world organization of health almost 80% of the population for their health requirements dependent on the traditional plants [2]. Many of the plants which used as a traditional medicine now a days gain more significance in the world health care system because these plants have unique ability to produce important component which shows health related benefits [3,4]. In the drug market industry, the plant & their derivative products include dietary supplements & nutraceutical show important impact on health [5,6]. The structural elucidation, evaluation & isolation of all the plant derivative constituents occurs efficiently in order to determine their pharmacological characteristics. These herbs effectively used for the treatment of hepatitis cirrhosis & hazardous diseases. For the maintenance of good health traditional medicine & medicinal plant are effectively used.

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Important chemical component is obtained from the plants which have potential to treat different illness & in these components two important component are glycosides & alkaloids. Almost 4000 species of plants more than 3000 identified as alkaloids. The difference of toxic effects of alkaloids & medicinal effect of alkaloids depend on the dosage of these drug. These plant derivative components possess different activities like anti-tumor, anti-oxidant, anti-viral, anti-microbial & immunomodulatory [7,8]. Many searches done on plant derived component to obtain their antiviral & anti-infective activities. From the experiment& research it was concluded that plant show various protective role for different virus-related infections [9,10]. After the all strategies now a days also viral infection become an important challenge all over the world. Due to drug resistance & unavailability & expensive medicine cause many problems the word mostly people did not afford all these expenses so, now a day's people prefer to use natural products [11]. In allopathy various anti-viral component used in clinical which shows narrow spectrum of characteristics with limited pharmacological use & more toxicity. While natural anti-viral medicine is viable alternative medicine which effectively used. Further, the production of suitable in vitro screening pharmaco-dynamic screening method could involve in the rapid detection of potential bio-active plants & also their standardization. Now a days the drugs facing difficulty in the production of viral resistant strains [12,13]. Viral infection is the 2nd important cause of human cancer [14]. For the replication of virus, they need host cell environment for survival. Number of chemical constituents present in medicinal plants which shows different pharmacological activities [15,16].

Anti-viral medicinal plants:

Plant	Part use	Medicinal activity
Ziziphus jujuba	roots	It effective against PED virus
Magnolia tree	Bark & roots	Against dengue virus
Phyllanthus urinaria	Whole plant	Effective against hepatitis C virus
Aglaia species	bark	Against retrovirus
Croton mauritianus	leaves	Chicken pox virus
Glycyrrhiza inflate	roots	Against influenza virus
Scutellaria baicalensis	roots	Against dengue virus
Humulus lupulus	Whole plant	Effective against BVD virus
Swertia mileensis	Whole plant	Effective against hepatais b virus
Tanacetum vulgare	rhizome	Against HSV2
Schisandra micrantha	roots	Against HIV 1
Foveolate aglaia	Bark & leaves	Effective for ebola virus
Palmatum rheum	roots	Effective for HIV 1
Bupleurum kaoi	roots	Against hepatais c virus

Embelia ribes	seeds	HCV
Camellia japonica	flowers	For PDE virus
Macrophylla swietenia	stem	Effective against hepatitis c virus

Viral infection & their control:

Both therapeutic & prophylactic method are affected the control of infection related to the virus. For the replication of virus require living cells these are not autonomous organism unlike parasite, fungal & bacteria. Mostly normal metabolic pathway involved in the replication.

Antiviral plants against some viruses:

From the research & experiment it is reported that almost various traditional medicinal plants are effectively used to show anti-viral activity. The keen interest of researcher for the development of anti-viral agent was initiated in Europe after the 2nd world war & in 1952 at Nottingham and England in which almost 288 plant effectively examined against influenza A related virus. From the previous last 25 years in all over the world different programmed which based on broad screening is imitated to evaluate the medicinal plants which shows antiviral characteristics. In 1970s the Canadian researchers proved that different fruit juices & fruit like apple, strawberry & grape shows antiviral activity against echovirus, poliovirus 1, coxsackievirus b5 & herpes simplex virus. Almost 100 different medicinal plants at british Columbian were screen as antiviral against 7 viruses. After the concentration tested it was observed that almost 12 extract of plant shows anti-viral properties. The extract which obtained from alnifolia Amelanchier & nutkana rosa effective against corona virus. Respiratory syncytial virus inhibition occurs through the extract of arguta potentilla & racemose sambucus. Lpomopsis aggregata extrct show good antiviral activity against parainfluenza type iii virus. Rotavirus inhibition effect shown through the root extract of dissectum lomatium. Anti-viral activity for herpes type 1 virus shows different plant extract include Thapsus verbascum, glycyrrhiza polypodium, americanum lysichiton, conocephalum conicum & angulate cardamine. Almost fourty traditional plant species effectively shows antiviral activity against different viruses include deoxyribonucleic virus, in human cytomegalovirus & two different ribonucleic virus include poliovirus 1 type & river ross virus. The most effective parts are roots of longifolia Dianella & aerial parts of sphacelatum pterocaulon which shows significant potential for poliovirus. Some other scienties experimentaly prove that the extract of australis euphorbia & spinescens scaevola active for human cytomegalo virus, some other species like latrobei eremophila, phylliraeoides pittosporum & microcarpa shows anti-viral properties for RRV. The liquid extract which obtained from the roots of senticosus eleutherococcus effective against influenza virus, human rotavirus & RSV. Ribonucleic acid ainfluenza show ihibit effect by using europaea sanicula soluble extract. The extract of these plants also effective against para-influenza type ii virus. For example, some other traditional plants include viscose dittrichia, magnolii minor

sanguisorba, tuberosa nepeta, nepitella nepeta, coerulea nepeta shows anti-viral characteristics against RNA & DNA viruses. The leaf extract of azadirachta indica effective against different viruses include herpes virus, poliomyelitis, poxvirus, chicken pox & smallpox. Influenza virus & HSV inhibit thorough the extract of integrifolia holoptelia, indicum Nerium & ligulate.

Plants	Chemical constituents	Mode of action
Houttuynia cordata	Quercetin rhamnoside 3	In the initial stage of virus infection, it inhibits the replication by indirect interection with the particles of virus.
radix glycyrrhiza	Glycyrrhizic acid	Glycyrrhiza radix interect with eary step of replication cycle of EB virus.
Amygdaloides euphorbia	Jatrophane esters	In human immunodeficiency virus it induces the down regulation & act as inhibitor in replication.
Citrus reticulate	Nobiletin & tangerctin	RSV intracellular replication affected by this plant & active component tangerctin do down regulation of RS virus expression of phosphoprotein.
Bupleurum kaoi	Terpenoid & saikosaponin	It prevents the attachment of virus & also inhibit the entry of human cytomegaly virus.
Artocarpus lakoocha	oxyresveratrol	It inhibits the late synthesis of protein, act as inhibitor in early & late phase of HSV 1 & 2.
Vulgare tanacetum	Ether spiroketalenol derivative	It blocks the entry of virus & stop the production of HSV1 &ii
Scutellaria baicalensis	Methoxyflavone 5,7,4 trihydroxy	It also reduces the replication of virus.
Scoparia l dulcis	B scopadulcic acid	It inhibits the replication of virus
Heptaphylla schefflera	di-caffeoyl quinic acids	In the early stage it inhibits the replication of virus
Saururus chinensis	B manassantin	In EBvirus lytic replication it

		shows inhibitory effect.
Ruta angustifolia	Pseudane & chalepin	During post entry step it inhibits the human cytomegalo virus
Limonium sinense	B samarangenin	Virus replication inhibit
Platyphylla liriope	LPRP	Inhibits the gene expression
Azedarach melia	di-hydroxymeliacarpin	Block entry of virus
Vulgaris prunella	Lignin complex carbohydrate	It blocks the binding of HSV1
Stenoptera pterocarya	A pterocarnin	It inhibits the penetration & attachement of HSV ii into cell [16].

For the establishment of curative characteristics traditional medicine is significant field for the research. Some important phytochemical is derived from these natural plants [27,28]. For the development of anti-viral agent natural product plays important role [17,18]. Almost 25% of dugs have plant origin [19]. Almost many of anti-infective & anticancer drugs have plant-based origin [20]. In Asia from the ancient times people used herbal products for different purpose [21], by using these products they not only heal the human health issue but also animal related problem [22]. Globally almost 2500 species of plants are originated [23,24]. To combat the viral infection important bio-active component are coumarins, thiol-sulfonates, steroids, tannins, lignin's, polysaccharides, terpenes, pro-anthocyanidins, saponins, quinones, alkaloids, flavonoids & polyphenols [25,29].

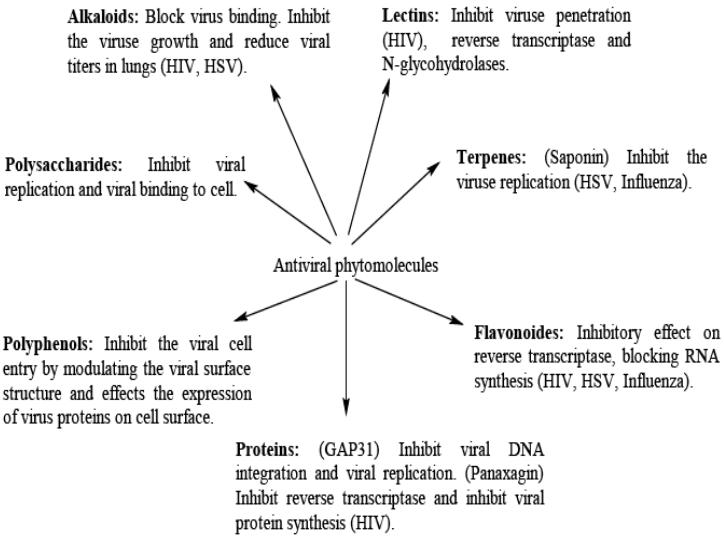

Figure 1: Major applications of antiviral phytomolecules.

Fig.1. Classification of anti-viral Phyto-chemical constituents:

Flavonoids:

In the whole kingdom of plants flavonoids which is a polyphenolic component contain 15C in their structure is a riches source against viral infections [30]. Aurone which is also known as furan form by the combination of two carbon atom with oxygen [31]. In addition, the different sub types of flavonoids done based on oxidation & the ring of carbon. Flavonoids & their biochemical effect shows the inhibition of number of enzymes include cyclooxygenase, lipoxygenase, two adenosine triphosphatase & calcium, phosphodiesterase, oxides of xanthine & aldose reductase. They also play important regulatory role on different hormones include thyroid, androgen & estrogen hormones [32,33]. Flavanols have more potential for viral infection as compared to flavones [34]. Polymer which are flavonoids base shows significant activity against herpes simplex virus type 1 & ii [35]. Flavan o1 &3 shows more effectiveness in the inhibition of HIV [36]. The precursor of isoflavonoids & flavonoids are chalcones important bioactive component which richly present in edible plants & shows significant pharmacological properties. These chalcones have potential against viral infections [37,38]. Millettia leucantha important medicinal plant from which dihydrochalcones are derived & shows antiherpes simplex virus characteristics [39]. The important component flavones present in different family include Astraea, apiaceous & lamiaceae. Phenolic component which obtained from the heart wood of artocarpus gomezianus shows anti-herpetic activity [40]. Many scientists used naringin for the cure of viral disease [41]. These flavones also possess antipicorna virus properties [42]. Flavanone ii abyssinone shows novel anti-viral activity [59], this is naturally present flavanone prenylated which inhibit the strains of herpes simplex type 1 virus [43]. The mixture of flavanol apply for the cure & prevention of autoimmune disease, inflammatory ailments, infection relate to mycotic, hepatitis b & protect the liver [44]. The various important dietary flavonoids like quercetin shows anti-viral activity [45]. An important bioflavonoid called myricetin have potential to inhibit coronavirus, influenza virus & hepatitis b virus [46,47]. Rotenone also effectively shows antiviral activity [48]. The two important derivatives of flavan which shows antiviral activity include galloyltricetifavan o-7 & galloyltricetifavan o-4,7 which isolated from the leaves of clypearia pithecellobium [39]. Inophyllum which isolated from the Malaysian tree called calophyllum inophyllum shows inhibitory activity against human immune deficiency virus [49].

Alkaloids:

Alkaloids produced through plants from A.A they usually contain N in their ring structure. Almost 36 alkaloids which derived from catharanthus lanceus & roseus which effective against polio type iii viruses. Around these 36 almost nine alkaloids act as antiviral agent in which pericalline have more effectiveness [50,51]. Various naturally present alkaloids chromone

inhibits the herpes simplex & human immune deficiency virus. The presence of free OH group & piperidine ring shows anti-human immune deficiency virus activity [52].

Terpenoids:

Terpenoids which also known as isoprenoids these are naturally present phytochemicals which obtained from 5C isoprene. These terpenoids effectively shows potential against coronavirus [53]. Almost more than 220 phytocomponent are obtained which shows ant corona virus activity.

Carotenoids:

Tetraterpenoids are the class from which carotenoids are derived. These carotenoids are obtained from the 40C chain of polyene. Mostly these carotenoids include xanthophylls, carotenes, zeaxanthin & lutein.

Organosulfur component:

Brasicaceae is the family in which all organo sulfur component present. The allium family is an important family which shows anti-viral agents [54]. Number of anti-viral organosulfur component which derived from the choy bok, kale, cauliflower, cabbage, cress water garden, brussels sprouts & radish mustard consist of number of organosulfur components [55].

Vitamins:

Vitamin C is very important against infectious related diseases. For the management & cure of hepatitis B vitamin E is a good supplement [56].

Selenium component:

Selenium component is an important anti-viral agent [57]. From the research & experiment it was concluded that selenium has potential to treat viral infections. Three important selenium derivatives are selenite, selenite & selenomethionine in all these antiviral activities shown by selenite [58].

Antiviral medicinal plants description:

Boerhavia diffusa:

In sanskrit the common name of this herbaceous plant is punarnava. This plant shows number of medicinal activities in all the subcontinent. Alkaloids are obtained from the roots of this plant which is known as punarnavine. This plant has potential against many viral diseases but it also effective for abdominal pain, dyspepsia, jaundice, enlargement of spleen and a good anti-stress agent. From the research & experiment it concluded that the root extract of boerhavia diffusa had a strong anti-hepatotoxic characteristic for the cure of viral hepatitis ailments. This

herbaceous plant mostly cultivated in Asia but also present in sudan, Egypt, china, united states of America, Australia, south Africa & Pakistan. Almost out of forty different species of boerhavia diffusa six species mostly cultivated in India include boerhavia rubicunda, rependa, repens, erecta & chinensis. It belongs to nyctaginaceae family. The important chemical constituents of this plants are which obtained from the root of boerhavia diffusa are methane propionyldiphenyl & hydroxy 5,4,2 glucopyranose. Mostly in this plant glycoprotein, carbohydrate, proteins, lipids, lignins, alkaloids, flavonoids, triterpenoids & steroids. The main important component which significant show antiviral activity include ursolic acid, liirodendrin, punarnavoside, boeravinone, L9 hypoxanthine arabinofuranoside & punarnavine. The presence of potassium nitrate is abundantly in boerhavia diffusa. The presence of fats & protein also observed. From the root of boerhavia diffusa fourteen amino acid are obtained out of which seven A.A are essential. From the roots of boerhavia diffusa isolated which shows anti-fibrinolytic activity is punarnavoside. After the phytochemical screening of roots maximum content of alkaloids are found. Boerhavia diffusa shows inhibiting effect against hypersensitive reaction. By The root extract of boerhavia diffusa the mosaic yellow disease controlled. Strong anti-microbial activity possesses through the glycoprotein of boerhavia diffusa. These anti-viral components active against tabacum nicotiana.

Phyllanthus amarus:

It is an important Indian herb which shows number of effectiveness against viral disease. It belongs to euphorbiaceae family. Some of the important secondary metabolites include polyphenols, tannins, flavonoids, hydrolysable, alkaloids & lignins derived from the amarus Phyllanthus. The aqous extract of p.amarus have potential to inhibit the anti-virus characteristics against herpes simplex virus 2 & 1. Phyllanthus urinaria & amarus possess anti-viral activity against herpes simplex virus at the early stage of replication & infection.

Eclipta alba:

In all over the world it usually grows as seed, mostly distributed in Thailand, brazil, china & India. It belongs to Asteraceae family. From this plant aldehyde are derived & their leaves contain wedelolactone, stigmasterol, glucosides o-7, me-de-wedelolactone, terthienyl 2 formyl & mathnol a terthienyl. Glucosides, a phytosterol, amyrin b, wedelolactone, 7 glucoside luteolin. The extract of alba eclipta shows anti-viral properties. The fresh juice of leaves of alba eclipta effective against blood borne hepatitis. Eclipta prostrate extract effective for human immune deficiency virus.

Andrographis paniculate:

The common name of this plant is king of bitters, it is an herbaceous plant which belongs to acanthaceae family & cultivated around the subtropical & tropical areas [1]. The extract of this plant shows different medicinal activities include immune-stimulatory [2], anti-inflammatory, anti-bacterial, anti-viral [3,4], anti-malarial, anti-tumor, hepatoprotective & anti-diabetic

characteristics [5]. Different part of paniculate Andrographis possess different important component which have potential against various diseases but the main important component which obtained from the leaves of A. paniculate is andrographolide. Andrographis paniculate shows anti-viral activity against human immune deficiency virus [67]. The extract of this plant effective against different viruses include pesti-viruses, flaviviruses [69,70] herpes simplex virus [62,68]. From the research & experiment it is proved that it is good antiviral medicinal plant which effective against dengue virus & Epstein bar virus [71].

Curcuma longa:

It is an important medicinal plant belong to zingiberaceae family and their botanical name is curcuma longa which commonly known as turmeric [72,90]. Number of phytochemical constituent present in different parts of curcumin which shows various pharmacological activities & have number of health beneficial effect [73]. The rhizome of this plant shows anti-fungal, anti-microbial, anti-bacterial, anti-malarial & anti-viral activities also good insect repellent [74]. Scientists done many experiments on different plants because of their rich phytochemical component which sows antiviral properties [75,76]. The derivative of curcuma longa have a wide range of anti-viral activities against different viruses. Different component of curcumin include curcumin di o decanoyl, curcumin di o pamitoyl, curcumin di-o-bis folyl, curcumin o y folyl 4 o ethyl, curcumin folyl y o C4 ethyl & tryptophanyl phenylalanine o di effective against different viruses include herpes simplex virus, stomatitis vesicular virus, peritonitis feline infectious virus, parainfluenza type 3 virus, syncytial respiratory virus & house flock virus. These curcumins derivative effective for all these viruses [77,89].

Antiviral substances of curcumin	viruses	activity
Curcumin allyl, curcumin boron complexes, tocopherol curcumin	Human immune deficiency virus	These substances induced inhibition of HIV I & ii at different integrate, protease & acetylation stage [78,79,80].
curcumin	influenza	It done inhibition of heam agglutination [81].
Cu & gallium curcumin	Herpes simplex virus I & ii	It reduces the replication of herpes simplex virus [82].
Aqueous extract of curcumin	HBV	It suppresses the replication of HBV by increasing the level of p53 [83].
curcumin	coxsackievirus	It also inhibits the replication [84].
curcumin	HPV	It inhibits the viral

		oncoprotein [85].
curcumin	HCV	It decreases the replication of this virus [86]
curcumin	JEV	It reduces the development of viral infective particle [87].
curcumin	HTLV 1	It downregulates the protein of HTLV1 in T infected cell [88].

Glycyrrhiza glabra:

It is also known as liquorice which is good medicinal herb. The demand of this herb increasing day by day due to its most used of herbal & health related product and lots of its pharmaceutical uses. The role of this plant in traditional medicine is more. The important chemical constituents of this plant are glabrin b & a, isoflavones, glycyrrhizin & glycyrrhizinic acid which possess different pharmacological properties like antioxidant, antitussive, antidiuretic, for skin whitening, antifungal, antibacterial, antidiabetic, antiviral, antiulcer & anti-inflammatory. It belongs to Leguminosae family. The extract of glycyrrhiza glabra is very effective against different viruses include influenza type A virus, stomatitis vesicular virus, encephalitis, herpes simplex & varicella zoster [92,93,94,95]. The important component glycyrrhizin has ability to inhibit the binding of virus cell so, it shows anti-viral properties. It is also effective for the cure of hepatitis c & human immune deficiency virus. Glycyrrhizin also possess anti-viral activity against respiratory acute syndrome severe virus. Besides the presence of other important component include mycophenolic acid, azauridine 6, ribavirin, pyrazofurin the anti-viral activity is more in glycyrrhizin. Glycyrrhizic acid effective for the cure of Kaposi sarcoma associated herpes virus [96].

Other medicinal plants:

Number of medicinal plant shows antiviral activities which we already discussed but some of these include honeysuckle flowers, isatis root, pueria, paudarc, st johns wort, green tea, olive leaf, elderberry, echinacea, garlic, colloidal silver, dandelion, ginseng, astragalus, sambucus, rosemary, peppermint, lemon balm, fennel, basil, sage, oregano all these medicinal plants possess different pharmacological characteristics. The medicinal activities occur due to presence of different component which obtained from the different parts of these plants. They show anti-bacterial, anti-fungal, anti-malarial, anti-inflammatory, anti-viral, anti-diabetic and many more.

Conclusions:

At the end we concluded from the discussion traditional plants have more potential to cure and ménage the different health related problem. These medicinal plants discussed already in detail. All these plants contain number of phytochemical constituents include flavonoid, alkaloids, tannins, lignin's & many more. Now a day's people prefer to use these traditional medicines because of their easily availability & less toxicity as compared to allopathy medicine.

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