PHYTOCHEMICAL ANALYSIS AND FT-IR OF LEAF AND STEM EXTRACTS OF OLEA FERRUGINEA ROYLE

R. Rafique[1], Z. U.D. Khan[2], S. Iltaf [3], A. Habib[4], A. Riaz[5], S. Ali[6], M. Shaukat[7], H. Shaukat[8], M. A. Sindhu[9] and M. W. Sindhu[9]

[1]Department of Botany, Queen Mary College Lahore, Pakistan
[2]Department of Botany, Government College University Lahore, Pakistan
[3]Department of Botany, Govt. Associate College (Women) Gulshan-e-Ravi Lahore, Pakistan
[4]Laboratory of Molecular Immunology, School of Life Sciences, Fudan University, Shanghai, China
[5]Department of Political Science, University of the Punjab, Lahore, Pakistan
[6]Foot and Mouth Disease Research Center, Zarrar Shaheed Road, Lahore Cantt. Pakistan
[7]Laboratory for Molecular Genetic Diagnostics, Institute of Human Genetics, Heidelberg University, Heidelberg, Germany
[8]Department of Zoology, University of the Punjab, Lahore, Pakistan
[9]University of the Punjab, Lahore-54590, Pakistan

ABSTRACT: The latest study was performed to investigate the ethno pharmacological potential of ethnobotanical significant plant, *Olea ferruginea* Royle that is a member of the Oleaceae family. The stem of this plant and leaf powders were macerated in different (polar and non-polar) solvents. The phytochemical study showed the occurrence of saponins, alkaloids, anthraquinonines, flavonoids, minimizing sugars, cardiac glycosides, tannins and terpenoids in reasonable quantities in *Olea ferruginea*, as verified by Fourier Transform Infrared (FT-IR) analysis. Based on the findings of the current research, the traditional use of this targeted plant of the *Oleaceae* family as food, fodder, feed, and medicinal seems acceptable and therefore justifiable.

Key words: *O. ferruginea* Royle, FT-IR, Oleuropin, Spectroscopy, Antiviral potential, Cytotoxic activity, Cell culture technique.

(Received 08.07.2021 Accepted 25.11.2021)

INTRODUCTION

Ethnopharmacology is a branch of pharmacology concerned with the identification of medications from plants. Plants are used as renewable resources in pharmacology for a number of reasons, such as, bioactivities isolation, synthesis as well as pharmaceutical development. In the ethnobotanical field, the Indian Subcontinent is regarded as a crucial region. Pakistan is especially rich in medicinal plants and their development is aided by the country's diverse climate and biological zones. Medicinal plants have been identified in approximately 6000 species of plants (Mahmood *et al*., 2003).

Herbal medications have become extremely popular in both developing and underdeveloped nations as a result of their low negative effects and natural origins. (Verma and Singh, 2008). Plants are utilized in the medicine and the community health in a variety of different ways such as active antimicrobial compounds like Rauwolfia serpent is a resource of reserpine, a tranquilizer used to treat hypertension and anxiety, as a supplemental agents such as stabilizers and binders such as align by sea weeds used in tablets and ointments as binding agents. Plants offer building resources for pharmaceutical manufacturing, like steroidal sapogenins, which are taken from the Mexican Yam and used to make progestin, androgens, cortison and hydrocortisone (Basit *et al*., 2018). Contagious infections are quickly treated using soil medicines and antimicrobial medicine. A variety of phytoconstituents is applied in combination with organic herbal medications throughout the prevention of multiple contagious diseases (Khan *et al*., 2021).

Spectroscopy is used to check the existence of different plants secondary metabolites, providing useful information about the quantitative, subjective and composition characteristic of such biomolecules (Hussain *et al*., 2009). FT-IR is high-precision scientific approach for distinguishing compound components and clarifying structural compounds.

Olive tree and its descendants belong to the Oleaceae dicotyledonous class, which contains 29 genera including roughly 600 known species of the shrubs and deciduous trees. *Forsythieae, Fontanesieae, Jasmineae, Oleeae* and *Myxopyreae* are the tribes that make up the family. The Oleaceae family thrives throughout Malaysia and Asia particularly in temperate and tropical regions (Hashmi *et al*., 2015). It has eight genera and roughly 30

species in Pakistan, with around 22 of them being cultivated (Grohmann, 1974).

Olea ferruginea Royle, also known as an Indian Olive and Kao that grows upto 10 meters tall and is greyish green in color. Fresh leaf decoction strengthens gums and reduces hoarseness and toothache and pain in throat (Shabir *et al*., 2015). A large number of bioactive chemicals in olive plants may have good potential like antihypertensive and antioxidant agents (Hansen *et al*., 1996), anti-bacterial, anti-inflammatory (Nora *et al*., 2012).

MATERIALS AND METHODS

Physio-chemical Tests.

$AlCl_3$	Folin-Ciocalteu	Olive oil
NH_4OH	reagent	KCl
$C_{40}H_{56}$	$(HO)_3C_6H_2COOH$	KOH
$Bi_5O(OH)_9(NO_3)_4$	CH_3COOH	KI
$CHCl_3$	HCl	$KNaC_4H_4O_6.4H_2O$
$CuSO_4.7H_2O$	Iodine: I	Rutin: $C_{27}H_{30}O_{16}$
H_2O	$Pb(C_2H_3O_2)_2$	$CH_3CO_2Na.3H_2O$
C_2H_5OH	Mg	Na_2CO_3
$FeCl_3$	$HgCl_2$	NaOH
H_2SO_4	C_6H_{14}	$NaNO_2$

Plant specimens from the Oleaceae family, *Olea ferruginea* Royle, were taken from the Botanic Garden, Government College University, Lahore. Stem and leaves were used for analysis. Then plant sample was grounded to convert this into the powder form that was dipped into the solvents.

Maceration of Plant's Material

The estimated amount of finely ground organic material being homogeneously packed in impermeable glass vials and soaked into the corresponding solvent (non-polar and polar) termed menstruum in the maceration technique (Seidel, 2006 and Al-Dahmash, 2021). The plant portion chosen was crucial since it verifies the bioactive phytochemical components extracted.

The followings are the characteristics of a fantastic solvent for plant distillation:

- Negligible combustibility
- Minute toxic effects
- Little problem of the detonation
- Effortlessly reprocessed from evaporation
- Economical

Solvents utilized included the n-hexane, chloroform, ethanol with filtered water, which were ordered by divergence grade by the non-polar to polar. At room temperature the glass tank was kept for nearly 7 - 15 days. The constant shaking helps the solvents to release the relevant chemical ingredients. The substance was purified utilizing filter paper no. 4. Finally, the extracted materials were dried and concentrated using a magnetic stirrer for chloroform and n-hexane ethanol extracts and a lyophilized for the water distillates. After that, the extraction was kept at 20°C. The accompanying formula was used to calculate the percent extraction yield:

$$\% \text{ Extraction yield} = \frac{\text{Wt. of dried plant extract}}{\text{Wt. of powdered plant sample}} \times 100$$

Chemical Tests

The results of a thorough chemical investigation of the *Olea ferruginea* Royle liquid fuels macerated in various solvents based on their polarity grade were presented.

Qualitative Estimations of the Chemical Constituents:

(a) Test for the Alkaloids

Dragendorff's Experiment

Waldi's (1965) design was used to do with the essential premise that an atom of a heavy metal contained inside each individual reagent is coupled to nitrogen, forming a particle matching that is unneglectable. 2mL of the 2mg/mL of plant concentrated being taken to the reaction tube, then took into it from adding 2M HCl 0.2mL and the Dragendorff's 1mL. Presence of the alkaloids confirmed by the production of the orange-brownish precipitations.

Mayer's Testing

For the specific process, Sethi's (2003) technique was used. In a reaction tube, 1mL of the 2mg/mL plants concentrate being mixed with the 0.2 mL of the 2M hydrochloric acid (HCl) plus 1mL of Mayer's reagent. Occurrence of the alkaloids was confirmed by the production of the cream from the yellow color precipitate.

Wagner's Test

For alkaloid analysis, Wagner's technique (1993) was used. 1 mL of plant macerate being added to the test tube, followed by the 0.2 mL 2M HCl with 1 mL of Wagner's solution. The existence of alkaloids was confirmed by the formation of the rosy-cocoa precipitate.

(b) Test for the Anthraquinones

Born Trager's Testing.

After Evans, Born Trager's approach was utilized to detect anthraquinonoid (2009). 0.25g of plant extract dissolved in the 5mL diluted sulphuric acid (H_2SO_4), boiled for the 2 minutes until boiling point and sieved. Than 2.5mL of chloroform was added to the reaction tube, followed by agitation, resulting in the isolation of a specific natural layer. Finally, the stratification was removed to a new tube containing the 0.5mL of a 10 percent ammonium hydroxide (NH_4OH) concentration. Regular appearance of red, pink and violet tints demonstrates that plant macerates have anthraquinones.

(c) Cardiac Glycosides Test:

Keller-Killiani Test

Method employed from Onwukaeme *et al*. (2007) originally inspired by the Keller-Killiani testing, which was created in the nineteenth century by H. Kiliani and C.C. Keller. In a test tube consist of 0.5mL of 10mg/mL of Plant macerate, 2mL of glacial acetic acid through one strand of the ferric chloride ($FeCl_3$) was emptied. Finally, 1mL of the concentrated sulphuric acid was added to the test tube's edge. The existence of the deoxy-sugars was detected by a greenish-blue coloration in acidic corrosive phase, a cocoa brown band just at interface or a violet band beneath to brown ring.

(d) Test for Flavonoids

Shinoda Testing

Shinoda test was considered getting Jonathan (2009) plot also for impression of the flavonoids. If the presence of flavonoids was detected, the yellow tinting was gradually converted into the red. In test tube, the 1mL the10mg/mL of plant macerates poured, HCl, 5mL the 95 percent of ethanol and the 0.5 grams magnesium were taken. Existence of the flavonoid in the plant macerate being evaluated by the orangish tint towards the red and reddish to the blood red, then the red towards fuchsia coloration

Sodium Hydroxide Test

NaOH test was carried out after Bello *et al*. (2011) approach. 5 milligram of plant macerates in the 2mL of the refined water was taken. After a while, the 2mL of the 10% sodium was included in reaction tube. Yellowish shading shows the nearness towards flavonoids so it was next checked by adding diluted acid. Color was changed from yellowish to the vapid (colorless). 1mL of the 10mg/mL plant's macerate, 5mL of 95 percent ethanol, and 0.5g magnesium were placed into a test tube to protect against the enlargement of a few drops of concentrated HCl.

Ferric Chloride Test

Mace's approach was used to conduct the $FeCl_3$ test (1963). In the 2mL of ethanol, 5mg of plant material was got broken up. Few droplets of 10% of the ferric chloride sample were added in just this way. Greenish blue coloring shows presence of the flavonoid.

Lead Acetate Test

Ngameni *et al*. (2013) methodology was used. 5mg of plant's macerate was taken in the reactions tube that took from expansion by 10 percent lead acid liquid solutions. The growth of the yellow precipitates confirms nearness of the flavonoids

Test for Reducing Sugars

(e) Fehling's Test

The trial was presided over by German scientist Fehling (1849). In basic requirements, due to the presence of aldehyde, royal blue copper sulphate liquid was tinted to rosy red accumulates of intractable copper oxide during the assessment. 2mL Fehling's solution was poured into reaction tube along with three plant macerate pellets and test tubes were placed in a water shower at 60^{o}C for a few minutes. Yellow to the brown-red precipitations confirms the presence of the reducing sugar.

(f) Test for the Saponins

Frothing Testing

The Akinjogunla *et al*. (2010) approach was used to identify saponins in the plant specimens during investigation. 5ml distilled water plus 0.5g of plant macerate were placed in a test tube, warmed in the water shower and vigorously shaken. Saponins that are identified by bubbles are produced. The bubbles were mixed with three olive oil drops, which resulted in descriptions of the emulsion.

(g) Testing for Tannins

Ferric Chloride Testing

Evans (2009) has used to indicate the existence of the tannins in the plant material, with the hypothesis that Gallic and elegiac acid were supplied as a result of tannin hydrolysis, which had been transformed to the pyrogalol after sifting and then reacted with the $FeCl_3$ to produce a greenish to blue shade. 0.25g of plant extract was bubbled with the 5mL of the disinfected water in a test tube and three drops of the 0.1 percent ferric chloride were added to the filtrates. Growth of the tannish caramel is the greenish or the blue-dark tinting to confirms the nearness to the tannins.

Matchstick Test

Evans (2009) methodology was used for the individual trial when it was discovered that when matchstick wood is exposed to HCl, the tannins are hydrolyzed, resulting in pink coloration as a result of the phloroglucinol detailing. The matchstick's backside was soaked in the 10mg/mL of plant extract, blown dry and then soaked in concentrated HCl. Finally, the test piece was delivered close to soul's light. Productions of the pink to the hinder edge of the matchstick test is occurrence of tannins.

(h) Test for the Terpenoids

Salkowski Testing

Following Harborne, the Salkowski method, named for German scientist was considered (1973). 0.5g of plant concentration and 2mL of chloroform were added to the each reaction tube, followed by expansions of the 3mL concentration. H_2SO_4 form a layer. Yellow to the cocoa pigmentations showed the proximity of the torpenoid.

Attenuated Total Reflectance (ATR) Fourier Transform Infrared (FT-IR) Spectroscopy:

Procedure

Tiny quantity of the powder sample material deposited directly by germanium crystal like an infrared spectrometer with continuous pressure exerted, then infrared absorber data was acquired over a wavelength range of the 4000 cm^{-1} to the 550 cm^{-1}. Ultrasonic waves travel via an attenuated crystal then travel as traveling waves to that same sample

RESULTS

Table 1: Chemical analysis of the stem extract of *Olea ferruginea* Royle.

Constituent	Phytochemical Test	Stem extracts			
		***n*-hexane**	**Chloroform**	**Ethanol**	**Aqueous**
Alkaloids	Dragendorff's Test	+	+	+	+
	Mayer's Test	+	+	+	+
	Wagner's Test	+	+	+	+
Anthraquinones	Born Trager's Test	-	+	+	-
Cardiac glycosides	Keller-Killiani Test	-	+	-	+
Flavonoids	$FeCl_3$ Test	+	+	+	+
	Lead acetate Test	+	+	+	+
	NaOH Test	+	+	+	+
	Shinoda Test	Flavonoids	Flavonoids	Flavonoids	Flavonoids
		+	+	+	+
Reducing sugars	Fehling's Test	-	-	-	+
Saponins	Frothing Test	+	+	+	+
Tannins	$FeCl_3$ Test	Gallic	Gallic	Gallic	Gallic
		+	+	+	+
	Matchstick Test	+	+	+	+
Terpenoids	Salkowski Test	+	+	+	+

Anthraquinones, alkaloids, tannins, saponins, reducing sugars, flavonoids along with terpenoids were checked in all preparations of the *Olea ferruginea* Royle stem macerates. The phytochemical processing is carried out on all the fractions including its *Olea ferruginea* Royle leaf. The results showed that alkaloids, phenolic and flavonoids were present in chloroform, water soluble and ethanol (Mehmood, 2018). Cardiac glycosides are most abundant in chloroform, aqueous soluble and ethanol and least abundant in the n-hexane extracts. Saponins and sugars were found absent in the chloroform extract, although sugars were present in the aqueous macerate. The highest concentrations of terpenoids were found in the n-hexane solubility macerates, with lower levels in other extracts. In water extract terpenoids were observed absent.

FT-IR examination of the *Olea ferruginea* stem revealed numerous structural features at different peaks, including O-H (polyphenols) at the 3284 cm-1, at 2916 cm-1 C-H (phenols), C-O at 2848 cm-1, at 1730 cm-1 (saponins) and at 1631 cm-1 (flavonoids). Peak 1454 cm-1 showed presence of C-H (terpenes), nitro compounds were observed at 1360 cm-1. Glycosides and esters were confirmed at 2349 and at 1157 cm-1 to 1022 cm-1 esters were examined.

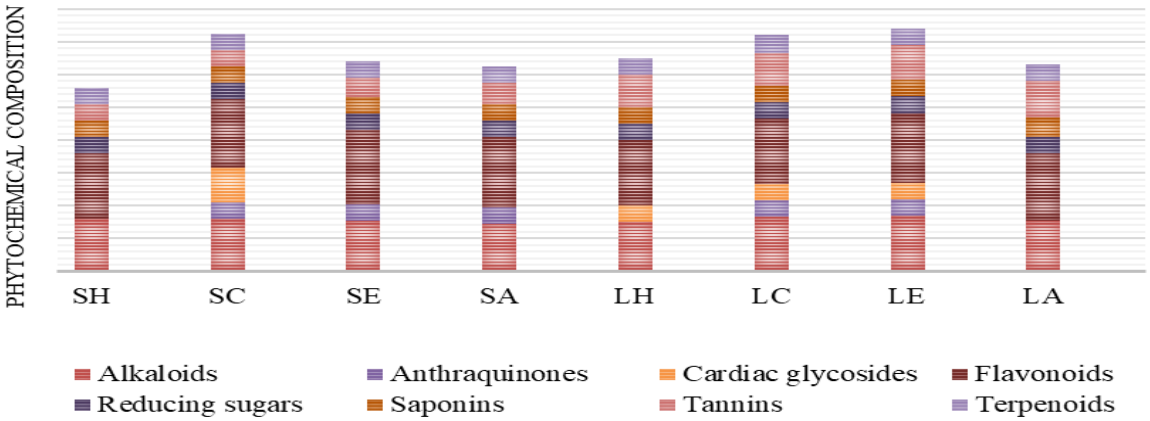

Figure 1: Profile of the phytochemicals in different extracts of *Olea ferruginea Royle* (stem & leaf)

Table 2: Analysis of chemicals in the leaf macerates of *Olea ferruginea* Royle

Constituent	Phytochemical Test	Stem extracts			
		***n*-hexane**	**Chloroform**	**Ethanol**	**Aqueous**
Alkaloids	Dragendorff's Test	+	++	+	++
	Mayer's Test	+	++	++	+
	Wagner's Test	++	++	+	+
Anthraquinones	Born Trager's Test	-	++	+	-
Cardiac glycosides	Keller-Killiani Test	+	+++	++	++
Flavonoids	$FeCl_3$ Test	++	+	++	+
	Lead acetate Test	++	++	++	++
	NaOH Test	+	+	+	+
	Shinoda Test	Flavonoids +	Flavonoids +	Flavonoids +	Flavonoids +
Reducing sugars	Fehling's Test	+	-	++	++
Saponins	Frothing Test	+	+	+	+++
Tannins	$FeCl_3$ Test	Gallic +	Gallic +++	Gallic +++	Gallic +
	Matchstick Test	-	-	+	+
Terpenoids	Salkowski Test	+++	+	+	-

Table 3: FT-IR Peak Values and Functional groups

Wave number	Bonds & compounds
3290	O-H Polyphenols
3280	-
3275	-
3273	-
2919	C-H Methylene alkanes
2918	Phenols
2916	Phenols
2850	C-H Terpenes
2848	C-O Carboxylic acid
2357	C=O Glycosides
2355	C=O Glycosides
2353	C=N Nitriles
2351	C=N Nitriles
1730	C=O Saponins
1728	Quinones
1633	Primary amines

1631	C=O Flavonoids
1612	Unknown
1602	Alkenes
1600	Primary amines
1514	N-H Alkaloids
1454	C-H Terpenes
1315	Nitro compounds
1305	S=O Sulphate esters
1234	C-N Amines
1232	C-N Amines
1157	C-O Esters
1155	C-O Esters
1012	C-O Esters

In leaf extracts *Olea ferruginea* FT-IR research revealed that the different functional sets such as the O-H at the peak 3273 cm^{-1}, C-H at 2918 cm^{-1}, at 2848 cm^{-1} carboxylic acid , C=N at 2351 cm^{-1}, C=O at 1728 cm^{-1}, C-N at 1633 cm^{-1} and N-H at 1514 cm^{-1} were stretched. Peaks at 1155 cm^{-1} to 1016 cm^{-1} indicated the presence of polyphenols and esters (Fig 4).

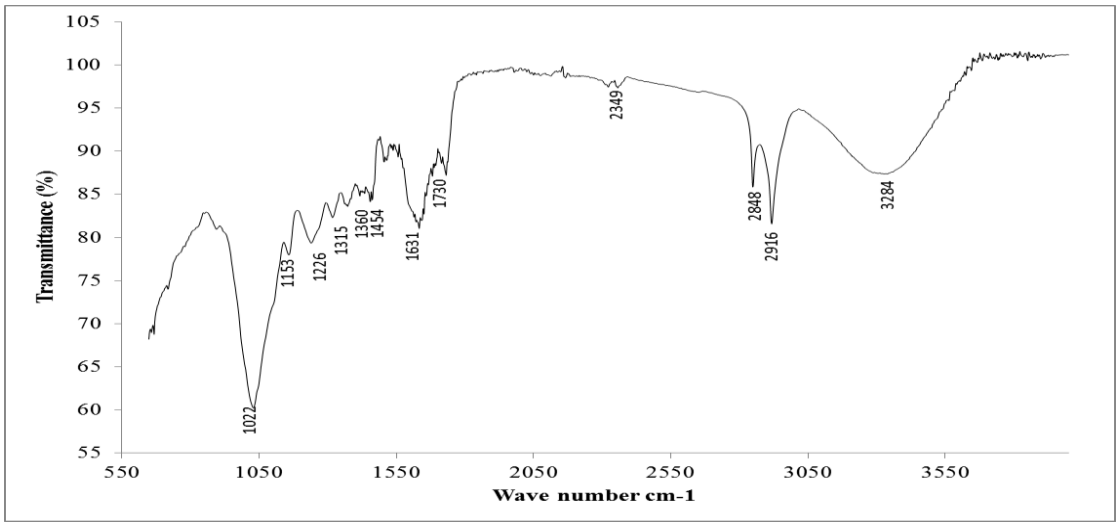

Fig 2: FT-IR spectra of *Olea ferruginea* stem

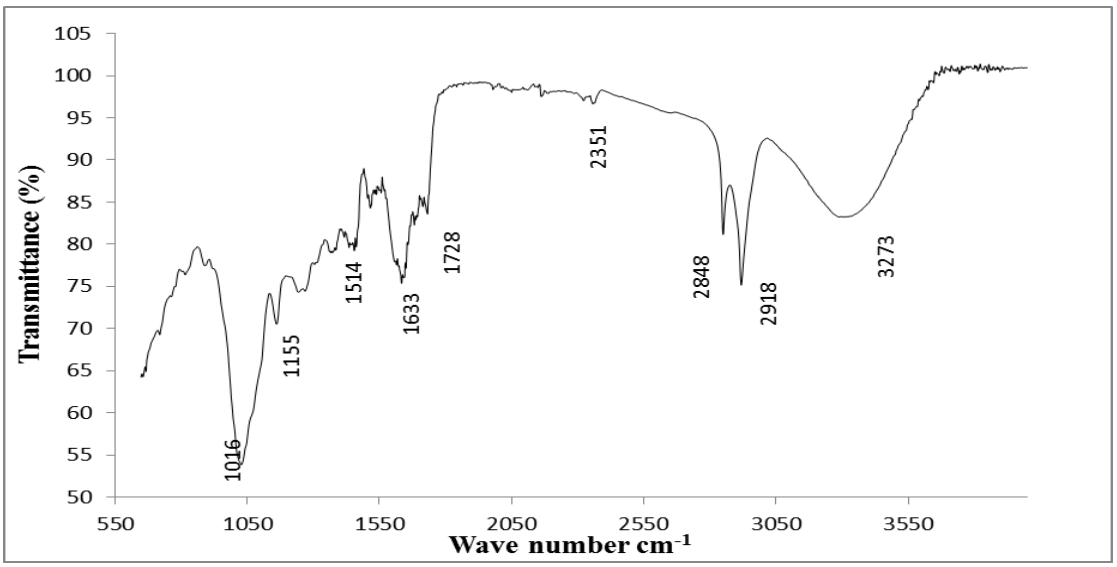

Fig 3: FT-IR spectra of *Olea ferruginea* leaf

Olea ferruginea Royle extract contained alkaloids, flavonoids, glucose and fructose, tannins and saponins but the degrees of the existence differed by one extract to the next (Malik, 2015). Alkaloids have been linked to pharmacological and biological activities like antibacterial, anticancer, spasmolytic, insecticidal, herbicidal, antiviral, anti-oxidant and anti-inflammatory properties, in addition to their cytotoxic effect (Kokoska *et al*., 2002). Because of their capacity to operate as free radical scavengers, metal chelating activities or the electron and the hydrogen donation capacity, alkaloids were known to have antioxidant properties (Singh *et al.*, 2012).

Flavonoids with a yellow tint can be applied to screen atherosclerosis and hypertension (Nailiet *et al*., 2010). Because of the placement of functional groups around the nuclear structure, flavonoids may be considered potent antioxidants (Montoro *et al.*, 2005). Tannins can be extracted from a variety of plant components and while a few can be found throughout the aqueous solution of certain plants, they are most commonly produced by treating them with less solvent. Tannins are employed in the leather industry and contain antiviral properties. (Lin *et al.*, 2004), antibacterial (Funatogawa *et al*., 2004). The interloping of tannin compounds with bacterial cell walls inhibited bacterial growth, causing bacterial colonies to disintegrate. (Erasto *et al*., 2004). Tannins are anti-inflammatory that work as an antidote in the treatment of alkaloid poisoning, gonorrhea, leucorrhoea, piles, diarrhea and burns (Akinmoladun *et al*., 2007). Saponins are present in the hemolytic and the antibacterial activates (Sparg *et al*., 2004). Saponins protect the membrane bilayer against free radicals that promote membrane integrity by inhibiting the generation of oxygen free radicals, preventing cellular malfunction (Akinpelu *et al*., 2014). Cardiac glycosides have been shown to apoptotic and anti-proliferative effects in cancer cell lines such as leukemia, melanoma and neuroblastoma, melanoma, renal adenocarcinoma, but with much less adverse aftershocks than typical cytotoxic medicines. (Lopez-Lazaro, 2005). Anthraquinons also reported as the antibacterial many times (Dastgir *et al*., 2012). Terpenoids have been shown to own the capacity to repair wounds and irritated mucus membranes as well as protect blood fluids from oxidative stress. (Okwu and Josiah, 2006).

The FT-IR analysis of the *Olea ferruginea* powders and the leaf were utilized to document the presence of the functional groups within those plant components. Similarity and variation seen between various portions of *O. ferruginea* are recognized based on functional categories and fingerprint traits of peak positions. In present research different function sets identified like as C=O, C-H, C-O, C-N, C=N, N=O and C-O at the different absorption peaks such as the 3290 cm^{-1}-3273 cm^{-1}, 2919 cm^{-1}- 2916 cm^{-1}, 2850 cm^{-1}-2848cm^{-1}, 2357cm^{-1}-2349 cm^{-1}, 1730cm^{-1}-1728cm^{-1}, 1633 cm^{-1}-1600cm^{-1}, 1514cm^{-1}-1454cm^{-1}, 1360cm^{-1}-1305cm^{-1}, 1234cm^{-1}- 1232cm^{-1} , 1157cm^{-1} and 1012 cm^{-1} are responsible for the formation of the deoxyribose, alcohols, anhydrides and alkyl groups (Sohrabi *et al*., 2005). Present investigation shows an agreement to Mariswamy *et al*., 2012 who studied the FT IR research on *Aervalanata* (L.) Juss.Ex Schulte. The current results are in line to the Maobe and Nyarango, 2013 and Bobby *et al*., 2012 who presented these functional sets in the *Utricadioica* and leave *Albizialebbeck* Bent had various relevant absorption edges respectively. *Oleuropein* is chemical in the Olea plant and related along with the antibacterial activities so it may be because of its surface-activity qualities which lead cell membrane to bacteria. Tannins may involve to inactivation of the microbial enzyme and proteins into the cell envelope with formation of the complex with the polysaccharides (Devprakash *et al*, 2011). Current studies of tannins present in the plant extracts can be considered to antibacterial action.

CONCLUSION AND RECOMMENDATIONS

The plant from the family Oleaceae, namely *Olea ferruginea* Royle was used in the current research. Maceration of the examined plants' stem and leaf powder was carried out using n-hexane, chloroform, alcohol, and distilled water as solvents. *O. ferruginea* stem aqueous extracts had the highest percent extraction yield of any plant. Different phytochemical analysis showed the presence of *alkaloids, anthraquinonines, tannins, flavonoids*, reducing sugars, cardiac glycosides, saponins, and torpedoed at higher concentrations in alcohol and aqueous extracts of *O. ferruginea*. FT-IR analysis revealed the functional groups of various compounds and verified the presence of all of these chemical components in the tested plant. In comparison to *O. ferruginea*, the stem ethanol and n-hexane extracts had the highest antibacterial activity. Different extracts of examined plants showed a negative association among inhibition zones and Minimum Inhibitory Level. At 1.25mg/mL, stem n-hexane extracts of *O. ferruginea* inhibited growth. The *O. ferruginea* that was shown to have higher antioxidant potential. The highest phenolic content was stable in the leaf n-hexane extract. *Olea ferruginea* leaf ethanol extract showed high total antioxidant activity. The current research has shown the significance of the herbal route for the efficient diagnosis of specific illnesses caused by bacteria and viruses due to their enormous potential pharmacological actions. The phytochemicals in the examined plant, *O. ferruginea*, need to be popularized for widespread use and adoption so that their maximum capabilities for livestock health and productivity may be achieved.

REFERENCES

Abad, M.J., J.A. Guerra, P. Bermejo, A. Irurzun and A.L. Carrasco. 2003. Search for antiviral activity in higher plant extracts. Phytother., Res., 14: 604-607.

Abdel-Shafi. 2013. Preliminary studies on antibacterial and antiviral activities of five medicinal plant. J. Plant Pathol. Microb., 4: 190.

Abeer, A. and H. Boseila. 2011. Preliminary in vitro study for using aqueous Cinnamon extract against Foot and Mouth Disease Virus. New York Science Journal, 4(11): 59-63.

Abiramasundari, P., V. Priya, G.P. Jeyanthi and S.G. Devi. 2011. Evaluation of the antibacterial activity of Cocculus hirstus. Hygeia. Journal for Drug and Medicines, 3(2): 26-31.

Khan, S.M., Kashif, R.A., Haq, Z.U., Ahmad, Z., Haq, A.U and Haq, M.A. 2021. Ethnobotanical Appraisal of Medicinal Plants from Bajaur; a Remote Area of the Khyber Pakhtunkhwa Province of Pakistan. Ethnobiology of Mountain Communities in Asia. 277-293.

Adedapo, A.A., F.O. Jimoh, S. Koduru, A.J. Afolayan and P.J. Masika. 2008. Antibacterial and antioxidant properties of the methanol extracts of the leaves and stems of Calpurnia aurea. BMC Complement Altern Med., 8: 53

Adnan, M., R. Bibi, S. Mussarat, A. Tariq and Z.K. Shinwari. 2014. Ethnomedicinal and phytochemical review of Pakistani medicinal plant used as antibacterial agents against Escherichia coli. Annals of Clinical Microbiology and Antimicrobials, 13(1): 40.

Ahmad, M., A.S. Shah, R.A. Khan, F.U. Khan, N.A. Khan, M.S. Shah and M.R. Khan. 2011. Antioxidant and antibacterial activity of crude methanolic extract of Euphorbia prostrata collected from District Bannu (Pakistan). African Journal of Pharmacy and Pharmacology, 5: 1175-1178.

Ahmad, S.S. F. Mahmood, Z. Dogar, Z.I. Khan, K. Ahmad and Muhammad. 2009. Prioritization of medicinal plant of Margala hills National park, Islamabad on the basis of available information. Pak. J. Bot., 41(5): 2105-2114.

Aji, S.B., M.S. Auwal, P.A. Onyeyili and C.J. Dawurung. 2010. Phytochemical screening and antibacterial evaluation of the leaves extracts of Olea hochstetteri. Research J. Pharmacology, 4(2): 26-30

Akhir, N.A.M., L.S. Chua, F.A.A. Majid and M.R. Sarmindi. 2011. Cytotoxicity of aqueous and ethanolic extracts of Ficus deltoidea on human ovarian a carcinoma cell line. British Journal of Medicine & Medical Research, 1(4): 397-409.

Akinjogunla, O.J., C.S. Yah, N.O. Eghafona and F.O. Ogbemudia. 2010. Antibacterial activity of leave extracts of Nymphaea lotus (Nymphaeaceae) on Methicillin resistant Staphylococcus aureus (MRSA) and Vancomycin resistant Staphylococcus aureus (VRSA) isolated from clinical samples. Ann. Biol. Res., 1(2): 174-184.

Akinmoladun, A.C., E.O. Ibuknn, E. Afor, E.M. Abuotor and E. Farombi. 2007. Phtyochemical constituents and antioxidant activity of extract from the leaves of Ocimum gratissimum. Sci. Res. Essay, 2: 163-166.

Akinpelu, A.B., O.A. Igbeneghu, A.I. Awot, E.O. Iwalewa and O.O. Oyedapo. 2014. Biological activities and distribution of plant saponins (Guill. and Perri.) stem bark extract. J. Ethnopharmacol., 9(18): 826-833.

Akinyemi, K.O., O.K. Oluwa and E.O. Omomigbehin. 2006. Antimicrobial activity of crude extracts of three medicinal plants used in South-West Nigerian folk medicine on some food borne bacterial pathogens. Afr. J. Trad., 3(4): 13- 22

Akter, K., E.C. Barens, J.J. Brophy, D. Harrington, Y.C. Elders, S.R. Vemuplad and J.F. Jamie. 2016. Phytochemical profile and antioxidant activities of medicinal plant used by aboriginal people of new South Wales, Australia. Evidence Based Complimentary and Alternative Medicine, I,D: 4683059.

Al-Dahmash, N.D., Al-Ansari, M.M., Al-Otibia., and Singh, A.J.A.R. 2021. Frankincense, an aromatic medicinal exudate of Boswellia carterii used to mediate silver nanoparticle synthesis: Evaluation of bacterial molecular inhibition and its pathway. Journal of Drug Delivery Science and Technology, 61.

Aliero, A.A., F.O. Jimoh and A.J. Afolayan. 2008. Antioxidant and antibacterial properties of Sansevieria hyacinthoides. International Journal of Pure and Applied Sciences, 3: 103-110.

Altinyay, C and M.L. Altun. 2006. HPLC analysis of Oleuropein in Olea europaea L. J. Fac. Pharm, 35(1): 1-11.

Amin, A., M.A. Khan, S. Shah, M. Ahmad, M. Zafar and A. Hameed. 2013. Inhibitory effects of *Olea ferruginea* crude leave extract against some bacterial and fungal pathogen. Pak J. Pharm. Sci., 26(2): 251-254.

Andrikopoulos, N., S. Antonopoulou and A. Kaliora. 2002. Oleuropein inhibits LDL oxidation induced by cooking oil frying by-products and platelet aggregation induced by platelet-activating factor. Food Science and Technologie, 35: 479- 484.

Anjana, G., D. Gupta and A.K Bhatia. 2011. Studies on antiviral properties of Acacia nilotica. Journal of

Environmental Research And Development, 5(1): 141-152.

Anwar, F., S. Latif, M. Ashraf and A.H. Gilani, 2007. Moringa oleifera: A Food Plant with multiple medicinal uses. Phytotherapy Research, 21(1): 17-25.

Aqeel, J., A. Abid and M. Ashraf. 2014. Antiviral properties of Medicinal plant against PPR and FMDVes. Lap Lambert Academic Pub., ISBN 13: 9783846510100.

Ashiq, S., M. Abubakar, S. Saleha, M.J. Arshed and Q. Ali. 2010. RNA extraction of peste des petitis ruminants virus (PPRV) from clinical samples using tri- reagent and acid guanidinum thiocyanate-phenol-chloroform methods. Pak. J. life Soc. Sci., 8(2): 156-158.

Auwal., M.S., I.A. Mairiga, A. Shuaibu, A. Ibrahim, I.A. Gulani, B. Wampana, G.I. Lateef, F.A. Lawan, K.A. Sanda, A.B. Thaluvwa, A.N. Njobdi and K.Z. Yagana. 2013. Preliminary phytochemical and in vitro antibacterial evaluation of crude pericarp extract of Hyphaene thebaica (Doumpalm). Journal of medicinal plant and herbal therapy research, 1: 1-7.

Awalellu, K., R.S. Thombre and A. Borate. 2013. Antibacterial activity of Crossandra infundibuliformis against cell phone bacteria. Central European Journal of Experimental Biology, 2(1): 7-11.

Azeem, S., M. Ashraf, M.A. Rasheed, A.A.Anjum and R. Hameed. 2015. Evaluation of cytotoxity and antiviral activity of ivermectin against Newcastle disease. Pak. J. Pharm. Sci., 28(2): 597-602.

Barakat, A., A. Bahieldin, H.M. Gebreel and Z.A. Rashad. 2004. Chromatographic fraction of antiviral principles depurinating plant ribosomes from certain seeds and leaf extracts. Egyptian J. Virol., 1: 383-391.

Bari, M.N., M. Zubair, K. Rizwan, N. Rasool, I.H. Bukhari, S. Akram, T.H. Bokhari, M. Shahid, M. Hameed and V. Ahmad. 2012. Biological activities of Opuntia monacantha cladodes. J. Chem. Soc. Pak., 34(4): 990-995.

Basit, A., Hayat, K.J., Ali1, K.A., Aqdus1, H., Muhammad, N., Khalid, J., Ahmad, J.S., Muhammad, J and Haris, K. 2018. Comparative effect of Acacia modesta and *Olea ferruginea t*rees on soil characteristics of Dharabi watershed, Chakwal, Pakistan. Range Management and Agroforestry. 39(1): 2249-5231.

Bashir., S.A. Erum, R. Kausar, U. Saleem, U. Tulain and Alamgeer. 2012. Antimicrobial activity of some ethno-medicinal plant used in Pakistan. Research in Pharmacy, 2(1): 42-45.

Bello, I.A., G.I. Ndukwe, O.T. Audu and J.D. Habila. 2011. A bioactive flavonoid from Pavetta crassipes K. Schum. Org. Med. Chem. Lett., 1(1): 14.

Betancur-Galvis, L.A., J. Saez, H. Granados, A. Salaza and J.E. Ossa. 1999. Antitumor and antiviral activity of Colombian medicinal plant extracts. Mem. Inst. Oswaldo Cruz, 94(4): 531-535.

Bhangale, S.C., V.V. Patil and V.R. Patil. 2010. Antibacterial activity of Ficus bengalensis Linn. bark on Actinomyces viscosus. Int. J. pharma sci., 2(1): 39- 43.

Bhanuprakash, V., H. Hosamani, V. Balamurugan, P.Gandhale, R. Naresh, D. Swarup and R.K. Singh. 2008. In vitro antiviral activity of plant extracts on Goatpox virus replication. Indian J Experimental Biol., 120-127.

Bobby, M.N., E.G. Wesely and M. Johnson. 2012. FT-IR studies on the leaves of Albizia Lebbeck Benth. International Journal of Pharmacy and Pharmaceutical Sciences, 4(3): 293-296.

Brown, F. 2003. The history of research in Foot and Mouth Disease. International Journal of Pharm. Tech. Research, 91: 3-7.

Cabell, C.H., J.G. Jollis, G.E. Peterson, G.R. Corey, D.J. Anderson, D.J. Sexton, C.W. Woods, L.B. Reller, T. Ryan and V.G. Fowler. 2002. Changing patient characteristics and the effect on mortality in endocarditis. Arch. Intern. Med., 162: 90-94.

Casal, M., M. Vaquero., H. Rinder, E. Tortoli, J. Grosset, J. Gutierrez and V. Jarlier. 2005. A case study for multi-drug resistant tuberculosis risk factor in four European countries. Microbial Drug Resistance, 11: 62-67.

Celik, H., H. Nadaroglu and M. Senol. 2014. Evaluation of antioxidant, antiradicalic and antimicrobial activities of Olives pits (Olea europaea L.). Bulgarian Journal of Agricultural Science, 20(6): 1392-1400.

Chambers, H.F. 2001. The changing epidemiology of Staphylococcus aureus. Emerging Infectious Diseases, 7: 178-182.

Chang, S.J., Y.C. Chang, K.Z. Lu, Y.Y. Tsou and C.W. Lin. 2012. Antiviral activity of Isatis indigotica extract and its derived indirubin against Japanese Encephalitis virus. Evidence-Based Complementary and Alternative Medicine, Article ID 925830.

Chattopadhyay, D. and T.N. Naik. 2007. Antivirals of ethnomedicinal origin: structure-activity relationship and scope. Mini Review of Medical Chemistry, 7: 275-301.

Chaudhry, N.M. and P. Tariq. 2006. Antimicrobial activity of Cinnamonum cassia against diverse

microbial flora with its nutritional and medicinal impacts. Pak. J. Bot., 38(1): 169-174.

Chiang, L.C., H.Y. Chemg, M.C. Liu, W. Chang and C.C. Lin. 2003. Anti Herpes Simplex Viruses and anti Adenovisrsues activity of twelve traditionally used medicinal Plant in Taiwan. Biology Pharma. Bulletin., 26: 1600-1604.

Chungsamarnyart, N., T. Sirinarumitr, W. Chumsing and W. Wajjawalku. 2007. In vitro study of antiviral activity of plant crude-extracts against the Foot and Mouth Disease Virus. Kasetsart J. (Nat. Sci.), 41: 97-103.

Corrado, G., M. Scarpetta, D. Aljoto, A.D. Maro, L. Polioto, A. Parente and R. Roa. 2008. Inducible antiviral activity and rapid production of the ribosome- inactivating protein 1 from Phytolacca heterotepala in tobacco. Plant Sci., 174: 467-474.

Cruick-Shank, R., J.P. Dugid, B.P. Marininon and R.H.A. Swain. 1975. Screening of some Greek aromatic plant for antioxidant activity. Phytother. Res., 17(2): 194-195.

Daoud, A., D. Malika, S. Bakari, K. Mnafgui, A. Kadri and N. Gharsallah. 2015. Assessment of polyphenol composition, antioxidant and antimicrobial properties of various extracts of Date Palm Pollen (DPP) from two Tunisian cultivars. Arab. J. Chem., doi. 1016.

Dastagir, G., F. Hussain and A.A. Khan. 2012. Antibacterial activity of some selected plant of family Zygophyllaceae and Euphorbiaceae. J. Med. Plant Res., 6(40): 5360-5368.

Dekanski, D., S. Janicijevic-Hudomal, V. Tadic, G. Markovic, I. Arsic and D. Mestrovic. 2009. Photochemical analysis and gastroprotective activity of an olive leaf extract. J. Serb. Chem. Soc., 74: 367-377.

Dekdouk, N., N. Malafronte, D. Russo and F. Immacolata. 2015. Antioxidant activity and inhibit carbohydrate metabolizing enzyme in vitro. Evidence-Based Complementry and Alternative Medicine, Article ID 684925.

Deshpande T.M. and S.R. Chaphalkar. 2013. Antiviral activity of plant extracts against FMDV in vitro a preliminary report. Int. J. Inst. Pharm. Life Sci., 3(4):1-18.

Devendra, B.N., N. Srinivas and S.S. Kusuma. 2012. A comparative pharmacological and phytochemical analysis of in vivo and in vitro propagated Crotalaria species. Asian Pacific Journal of Tropical Medicine. 5(1): 37-41.

Devprakash, K., K. Srinivasan, T. Subburaju and S.K. Singh. 2011. Antimicrobial activity of alcohol and aqueous extracts of Tephrosiapurpurea. Asian Journal of Biochemical and Pharmaceutical Research, 2(1): 2231-2560.

Dinis T.C.P, V.M.C. Madeira and M.L.M. Almeida. 1994. Action of phenolic derivate (acetoaminophen, salycilate and 5-aminosalycilate) as inhibitors of membrane lipid peroxidation and as peroxyl radical scavengers. Arch. Biochem. Biophys., 315: 161-169.

Dorman, H.J.D. and S.G. Deans. 2000. Antimicrobial agents from plant: antibacterial activity of plant volatile oils. Journal of Applied Microbiology, 88: 308-316.

Dragana, S., D. Mitc-Culafic, B. Vukovic-Gacic, D. Simic and J. Knezevic-Vukcevic. 2008. Evaluation of antiviral activity of fractionated extracts of Sage, Salvia officinalis L. (Lamiaceae). Arch. Biol. Sci., Belgrade, 60 (3): 421- 429.

Eble, P.L., M.G. Bruin, A. Bouma, F. Hemert-Kluitenberg and A. Dekker. 2006. Comparison of immune responses after intra-typic heterologous and homologous vaccination against Foot and Mouth Disease Virus infection in pigs. Vaccine, 24(9): 1274-81.

El., S.N. and S. Karakaya. 2009. Olive tree (Olea europaea) leaves: potential beneficial effects on human health. Nutrition Reviews, 67(11): 632-638.

Erasto, P., G. Bojase–Moleta and R.R.T. Majinda. 2004. Antimicrobial and antioxidant flavonoids from the roots wood of Bolusathus spesiosus. Phytochem., 65: 875-880.

Erturk, O., Z. Demirbag and A.O. Belduz. 2000. Antiviral Activity of some plant extracts on the Replication of Autographa Californica Nuclear Polyhedrosis Virus. Turk J. Biol., 24: 833–844.

Evans, W.C. 2009. Trease and Evans' Pharmacognosy. (16th Ed), Elsevier Ltd., London, pp. 219-225.

Eyong, U.E., M.A, Agiang , I.J. Atangwho, I.A. Iwara, M.O. Odey and P.E. Ebong. 2011. Phytochemicals and micronutrients composition of root and stem bark extracts of Vernonia amygdalina Del. Journal of Medicine and Medical Science, 2(6): 900-903.

Faiza, I., K, Wahiba, G Nassira, B, Chahrazed and B.F. Atik. 2011. Antioxidant potential of olive (Olea europaea L.) from Algeria. J. Nat. Prod. Plant Resour., 1(2): 29-35.

Fehling, H. 1849. Die quantitative Bestimmung von Zucker und Stärkmehl mittelst Kupfervitriol. Annalen der Chemie und Pharmacie, 72(1): 106-113. In: Lee, F.A. 1975. Basic Food Chemistry. Avi Publishing Co Inc., New York, pp. 77.

Fredrickson, W.R. 2000. Method and composition for antiviral therapy with olive leaves. US. Patent No: 6,117,844.

Freimoser, F.M., C.A. Jakob, M. Aeb and U. Tuor. 1999. The MTT 3-(4,4, Dimethythiazol-2-yl)-2,5-

Diphenyltertrazolium Bromide) assay is a fast and reliable method for colorimetric determination of fungal cell densities. Appl. and Envir. Microb., 65(8): 3727-3729.

Freshney, R.I. 2010. Culture of Animal Cells, A Manual of Basic Technique. 6th ed. Hoboken (New Jersey): Jhon Willey & Sons (U.S.A).

Funatogawa, K., S. Hayashi, H. Shimomura, T. Yoshida, T. Hatano, H. Ito and Y. Iria. 2004. Antibacterial activity of hydrolysable tannins derived from medicinal plant against Helicobacter pylori. Microbiol. Immunol., 48 (4): 251-261.

Furneri, P.M., A. Marino, A. Sarja, N. Uccella and G. Bisignano. 2002. In vitro antimycoplasmal activity of oleuropein. Int. J. Antimicrob. Agents, 20: 293- 296.

Gançalves, S., D. Gomes, P. Costa, and A. Romano. 2013. The phenolic content and antioxidant activity of infusions from Mediterranean medicinal plant. Industrial Crops and Products, 43(1): 465-471.

Gayathri M. and K. Kannabiran. 2009. Antimicrobial activity of Hemidesmus indicus, Ficus bengalensis and Pterocarpus marsupium roxb. Indian. J. Pharm Sci., 71(5): 578-581.

Ghimire . B.K., E.S. Seong, E.H. Kim, A.K. Ghimeray, C.Y. Yu, B.K. Ghimire and I.M. Chung. 2011. A comparative evaluation of the antioxidant activity of some medicinal plant popularly used in Nepal. Journal of Medicinal Plant Research, 5(10): 1884-94.

Ghurde, M.U., V.R. Deshmukh, P.V. Pulate and S.N. Malode. 2012. Cytotoxic and genotoxic potential assaessment of leaf extract of Jasminum officinale. Var. grandiflorum. International Journal of Innovations in Bio-Sciences, 2 (3): 112-117.

Goji, M., T.G. Marriam, K. Asres, H. Lemma, N. Gemeda and K. Yirsaw. 2006. Screening of the antimicrobial activities of some plant used traditionally in Ethiopia for the treatment of skin disorders. Ethiopian Pharmaceutical Journal, 24(2):130-135.

Golding, S.M., R.S. Hedger and P. Talbot. 1976. Radial immune diffusion and serum neutralization techniques for the assay of antibodies to swine vesicular disease. Res. Vet. Sci., 20: 142-147.

Goldsmit. D., V. Quan. I. Vuong, E. Costas, D. Paul, I. Roach and J. Christopher and I. Scarlett. 2014. Optimization of the aqueous extraction of Phenolic compounds from olive leaves. Antioxidants, 3: 700-712.

Gomez, L.A., A.E. Alekseev., L.A. Aleksandrova, P.A. Brady and A. Terzic. 1997. Use of the MTT assay in adult ventricular cardiomyocytes to assess viability: Effects of adenosine and potassium on cellular survival. J. Mol. Cell., Cardiol., 29(4): 1255- 1266.

Gopalakrishnan, S., R. Rajameena and E. Vadivel. 2012. Antimicrobial activity of the leaves of Myxopyrum serratulum A. W. Hill. Int. J. Pharma Sci and Drug Res., 4 (1): 31-34.

Greathead, W. 2003. Extraction and antimicrobial effect of Thai herbs and spices extracts. J.Agricultural and Food Chemistry, 43: 361-371.

Green, P.S. 2002. A revision of Olea L. (Oleaceae). Kew Bulletin, 57(1): 91-140.

Grohmann, F. 1974. Oleacceae. In: Flora of Pakistan. No. 59. Grover, A., B.S. Bhandari and N. Rai. 2011. Antimicrobial Activity of Medicinal plant-Azadirachta indica, Allium cepa and Aloe vera. International Journal of PharmTech. Research, 3(2): 1059-1065.

Grubman M.J. 2005. Development of novel strategies to control Foot and Mouth Disease marker vaccines and antivirals. Biologicals, 33: 227-234.

Grubman M.J. and B. Baxt. 2004. Foot and Mouth Disease. Clinical Microbiology Reviews, 17(2): 465-493.

Gulcin. I., R. Elias, A. Gepdiremen, L. Boyer, E. Koksal. 2006. A comparative study on the antioxidant activity of fringe tree (Chionanthus virginicus L.) extracts. African J Biotech. 6(4): 410-418.

Gupta. P., S.K. Bajpai, K. Chandra, K.L. Singh and J.S. Tandon. 2005. Antiviral profile of Nyctanthes arbortristis L. against encephalitis causing viruses. Indian journal of experimental Biology, 43: 1156-1160.

Halliwell, B. and J.M.C. Gutteridge. 2007. Free radicals in Biology and Medicine, (4th ed.), Clarendon Press, Oxford, UK.

Haloui, E., Z. Marzouk, B. Marzouk, I. Bouftira, A. Bouraoui and N. Fenina. 2010. Pharmacological activities and chemical composition of the Olea europaea leaf essential oils from Tunisia. Journal of Food, Agriculture & Environment, 2: 204-208.

Hamdi, H.K and R. Castellon. 2005. Oleuropein, a non-toxic olive iridoid is an anti- tumor agent and cytoskeleton distruptor. Biochem. Bioph. Res. Com., 334: 769-778.

Han, X., T. Shen and L. Hongxiang. 2007. Dietry Polyphenols and their biological significance. Int. J. Mol. Sci., 8(9): 950-988.

Hansen, K. 1996. Isolation of an Angiotensin Converting Enzyme (ACE) inhibitor from Olea europaea and Olea valancia. Phytomedicine, 2(4): 319-325.

Harborne, J.B. 1973. Phytochemical Methods. Chapman and Hall, Ltd., London, pp. 49-188.

Hashimoto, A. and T. Kameoka. 2008. Applications of infrared spectroscopy to biochemical, food and agricultural processes. Applied Spectroscopy Reviews, 43: 416-451.

Hausladen, A, and J.S. StamLer. 1999. Nitrosative stress. Method in Enzymology, 300: 389-395.

Hayouni, E.A., M. Abedrabba, M. Bouix and M. Hamdi. 2007. The effects of solvents and extraction method on the phenolic contents and biological activities in vitro of Tunisian Quercus coccifera L. and Juniperus phoenica L. fruit extracts. Food Chem., 105: 1126–1134.

Hindler, F.J., L. Hochstein and A. Howell. 2007. Preparation of routine media and reagents used in antimicrobial susceptibility testing. In: Isenberg, H.D. (Ed.), Clinical Microbiology Procedures Handbook. American Society for Microbiology (ASM), Washington DC, 2(2): 5.14.1.1-5.14.1.4

Huang, L.S., L. Zhang, P.L. huang, Y.T. Chang, P.L. Huang. 2003. Anti-HIV activity of olive leaf extract (OLE) and modulation of host cell gene expression by HIV-1 infection and OLE treatment. Biochem Biophys Res Commu., 307(4): 1029-37.

Huda-Faujan, N., A.S. Norrakiah and A.S. Babji. 2009. Antioxidant activity of plant methanolic extracts containing phenolic compounds. African J, Biotech., 8(3): 484-489.

Hue, N.D., H.T. Cam and H.L. Mai. 2008. Bioactivities and chemical constituents of a Vietnamese medicinal plant Che Vang, Jasminum subtriplinerve Blume (Oleaceae). Nat. Prod. Res., 22(11): 942-9.

Hung, C.Y., Y.C.Tsai and K.Y. Li. 2012. Phenolic antioxidants isolated from the flowers of Osmanthus fragrans. Molecules, ISSN: 1420-3049.

Hussain K., Z. Ismail, A. Sadikun and P. Ibrahim. 2009. Evaluation of metabolic changes in fruit of Piper armentosum in various seasons by metabolomics using Fourier Transform Infrared (FTIR) Spectroscopy. Intrenational Journal of Pharmaceutical and Clinical Research, 1(2): 68-71.

Hussain,M., H. Irshad and M.Q. Khan. 2008. Laboratory diagnosis of Transboundary animal diseases in Pakistan. Transbound. Emerg. Dis., 55: 190-195.

Hussein, G., H. Miyashiro, N. Nakamura, M. Hattori, T. Kawahata, N. Kakiuchi and K. Shimotohno. 2000. Inhibitory effects of Sudanese medicinal plant extracts on Hepatitis C virus (HCV) protease. Phytother Res., 14: 510-516.

Ibrar, M., S. Naveed, I. Khattak and I. Ahmad. 2013. Phytochemical investigation of wild olive leaf nut galls from the district of Karak, KPK, Pakistan. Topclass Journal of Herbal medicine, 2(1): 7-12.

Javeed, A., A. Ali and M. Ashraf. 2011. Antiviral properties of medicinal plant against PPR and FMDVes. ISBN: 978-3846510100.

Jhon, K.M., M. Ayyanar, S. Jeeva, M. Suresh, G. Enkhtaivan and D.H. Kim. 2014. Metabolic variations, antioxidant potential and antiviral activity of different extracts of Eugenia singampattiana leaf. BioMed Research International, 726145.

Jiang L.Q and H. Takamura. 2013. Radical-scavenging compounds in olive fruits and their changes during table olive preparation. Applied Mechanics and Materials, 295-298.

Jonathan, Y. 2009. Phytochemical analysis and antimicrobial activity of Scoparia dulcis and Nymphaea lotus. Aust. J. Basic Appl. Sci., 3(4): 3975-3979.

Jorgensen, J.H. and J.D. Turnidge. 2007. Susceptibility test methods: Dilution and disk diffusion methods. In: Murray, P.R., E.J. Baron, J.H. Jorgensen, M.L. Landry and M.A. Pfaller (Eds.), Manual of Clinical Microbiology. (9th Ed), ASM Press, Washington D.C., pp. 1152-1172.

Joy, P and D.P. Raja. 2008. Anti-bacterial activity studies of Jasminum grandiflorum and Jasminum sambac. Ethnobotanical leaflets, 12: 481-483.

Kalaiselvi, M and K. Kalaivani. 2011. Phytochemical analysis and antilipid peroxidative effect of Jasminum sambac (L.) Ait Oleaceae. Pharmacology, 1: 38-43.

Kararah, M.A., F.M. Barakat, M.S. Mikhail and H.M. Fouly. 1985. Pathophysiology in garlic cloves inoculated with Bacillus subtilis, Bacillus pumilus and Erwinia carotovora. Egypt. J. Phytopathol., 17(2): 131-140.

Kasumbwe, K., K.N. Venugopala, V. Mohanlall and B. Odhav. 2014. Antimicrobial and antioxidant activities of substituted halogenated coumarins. Journal of Medicinal Plant Research. 8(5): 274-281.

Kaur, M. and A.S. Maan. 2012. Preliminary pharmacognostic study and antimicrobial activity of aqueous leaf extract of Nyctanthes arbortristis LINN. Int. J. Nat. Prod Sci., 1: 173.

Majid, K., Muhammad, A., Rahmat, U., Latif, A and Muhammad, R. 2021. Ethnopharmacological treatment of Cough in Piran, Malakand, Pakistan. Boletín Latinoamericano y del Caribe de Plantas Medicinales y Aromáticas, 20(2): 203-214.

Khalid, A., A. Waseem, M. Saadullah, U.U. Rehman, S. Khiljee, A. Sethi, M.H.H.B. Asad, F. Rasool, M.K. Waqas and G. Murtaza. 2011. Antibacterial activity analysis of extracts of

various plant against Gram (+) and (-) bacteria. African Journal of Pharmacy and Pharmacology, 5(7): 887-893.

Khaliq, A., S.M. Sabir, S.D Ahmad, A.A. Boligon, M.L. Athayde, A. Jabbar, I. Qamar and A. Khan. 2014. Antioxidant activities and phenolic composition of Olive (Olea europaea) leaves. Journal of Applied Botany and Food Quality, 88: 16-21.

Khan, M.Y., S. panchal, N. Vyas, A. Butani and V. Kumar. 2015. Olea europaea: A phyto-pharmacological review. Pharmacognosy Review, 1: 1.

Khan, S., H. Khan, M.A.R. Shah, F.U. Khan, Shehnaz, R.U. Khan. 2013. Phytotoxic, antioxidant and cytotoxic effect of Holarrhena antidysenterica seeds extracts. International Journal of Advanced Research, 1(8): 28-33.

Khan, N.S., A. Ahmad and S.M Hadi. 2006. Evaluation anti-oxidant, pro-oxidant properties of tannic and its binding to DNA. Chem. Biol. Interact., 124: 177- 189.

Kim, M.S., S. Koppula, S.H. Jung, J.Y. Kim, H.R. Lee, S.R. Lee, T. K. Park and H.

Kang. 2013. Olea europea Linn (Oleacaea) fruit pulp extract exhibits potent antioxidant activity and attenuates neuroinflammatory responses in lipopolysaccharide stimulated microglial cells. Tropical J of Pharmaceutical Research, 12(3): 357-362.

Khoja, N., L.B. Makhlouf, K. Madani. 2014. Phytochemical screening of antioxidant and antibacterial activities of methanolic extracts of some Lamiaceae. Industrial Crops and Products, 61: 41-48.

Kokoska, L., Z. Polesny, V. Rada, A. Nepovim and T. Vanek. 2002. Screening of some Siberian medicinal plant for antimicrobaial activity. J. Ethnopharmacol., 82: 51-53.

Kontsekova, Z. Nagy and M. Mucaji. 2007. Ligustrum delavayanum Hariot: constituents and biological activities. Acta Facult. Pharm. Univ. Comenianae, 54: 14-20.

Koseki, I. I.C. Simoni, I.T. Nakamura, A.B. Noronha and S.S. Costa. 1990. Antiviral activity of Plant extracts against Apthovirus, Pseudorabies virus and Pestivirus in cell cultures. Microbios Letters, 44(173): 19-30.

Krishnaiah, D., R. Sarbatly and R.R. Nithyanandam. 2011. A review of the antioxidant potential of medicinal plant species. Food Bioprod. Process, 89: 217–233.

Kuete, V., E.J. Seo, B.Krusche, M. Oswald, B. Wiench, S. Schroder, H.J. Greten, I.S. Lee and T. Efferth. 2013. Cytotoxocity and Pharmacogenomics of Medicinal plant from traditional Korean Medicine. Evidence-Based Complementary and Alternative medicine. ID 341724.

Kumar, B.G., E.S. Seong, E.H. Kim and A.K. Ghimeray. 2008. A comparative evaluation of the antioxidant activity of some medicinal plant popularly used in Nepal. Journal of Medicinal Plant Research, 5(10): 1884-1891.

Kunhachan, P., C. Banchonglikitul, T. Kajsongkram, A. Khayung and W. Leelamanit. 2012. Chemical composition, toxicity and vasodilation effect of the flowers extract of Jasminum sambac (L.) Ait. Evidence- Based Complementary and Alternative Medicine, (4): 471312.

Lafka, T.I., A. Lazou, V. Sinanoglou and E. Lazos. 2013. Phenolic extracts from wild olive leaves and their potential as edible oils antioxidants. Foods, 2(1): 18-31.

Laube, S. and A.M. Farrell. 2002. Bacterial skin infections in elderly: Diagnosis and treatment. Drugs Aging, 19: 331-342.

Lee, J.H and H.J. Choi. 2015. Antiviral and antimicrobial activity of medicinal plant extracts. J. Microb. Biochem. Technol., 7:286-288.

Lee, K. and T. Shibamoto. 2001. Antioxidant property of aroma extract isolated from clove bud [Syzygiun aromaticum (L.) Merr. et Perry]. Food Chem., 74: 443- 448.

Lee, Y.M., H. Kim, E.K. Hong, B.H. Kang and S.J. Kim. 2000. Water extract of 1: 1 mixture of Phellodendron cortex and Aralia cortex has inhibitory effects on oxidative stress in kidney of diabetic rats. Journal of Ethnopharmacology, 73: 429-436.

Lee-Huang, S. P.L. Huang, D. Zhang, J.W. Lee, J. Bao, Y. Sun, Y.T. Chang and J. Zhang. 2007. Discovery of small-molecule HIV-1 fusion and integrase inhibitors oleuropein and hydroxytyrosol: Part II. integrase inhibition. Biochem. Biophys. Res. Commun., 354: 879-884.

Lee-Huang, S., Zhang, L., Huang, P. L. and Chang, Y. T. 2003. Anti-HIV activity of olive leaf extract (OLE) and modulation of host cell gene expression by HIV-1 infection and OLE treatment. Biochem. Biophys. Res. Commun., 307: 1029- 1037.

Lin, K.H., H. Yeh, S.Y. Lin, C. M. Yang, H.J. Tsai, J.J. Tsai and P.Y. Chao. 2014. Antioxidant activities of methanol extracts from selected Taiwanese herbaceous plant. Journal of Food and Nutrition. Res., 2(8): 435-442.

Lin, L.U., L. Shu-wen, J. Shi-bo and W. Shu-guang. 2004. Tannin inhibits HIV-1 entry by targeting gp41. Acta Pharmacol. Sin., 25 (2): 213-218.

Lopez-Lazaro, M. 2005. Digitoxin inhibits the growth of cancer cell lines at concentrations commonly

found in cardiac patients. J. Nat. Prod., 68, 1642- 1645.

Lu, Y.R and L.Y Foo. 2000. Antioxidant and radical scavenging activities of polyphenols from apple pomace. Food Chem., 68: 81-85.

Lucas, L., A. Russell and R. Keast. 2011. Molecular mechanisms of inflammation. Anti-inflammatory benefits of virgin olive oil and the phenolic compound. Curr. Pharm. Des., 17: 754-68.

Lyczak, J.B., C.L. Cannon and G.B. Pier. 2002. Lung infections associated with cystic fibrosis. Clin. Microbiol. Rev., 15: 194-222.

Ma, S.C., Z.D. He, X.L. Deng, P.P. Butt, V.E. Ooi, H. X. Xu, S.H. Lee and S.F. Lee. 2001. In Vitro evaluation of secoiridoid glucosides from the fruits of Ligustrum lucidum as antiviral agents. Chem pharm Bull., 49 (11): 1471-3.

Mace, G.S.L. 1963. Anaerobic bacteriology for clinical laboratories. Pharmacog., 23: 89-91.

Mehmood, A and Murtaza, G. 2018. Phenolic contents, antimicrobial and antioxidant activity of Olea ferruginea Royle (Oleaceae). BMC Complementary Medicine and Therapies, 18: 173.

Mahmood, A., M. Ahmad, A. Jabeen, M. Zafar and S. Nadeem. 2003. Pharmacognostic studies of some indigenous medicinal plant of Pakistan. Journal of Ethnobotanical Leaflets SIUC, USA.

Makkar, H.P.S., M. Blummel, N.K. Borowy and K. Becker. 1993. Gravimetric determination of tannins and their correlation with chemical and protein precipitation methods. J. Sci. Food Agric., 61: 161-165.

Malik, S.N. 2015. Antibacterial activity of Olive (Olea europaea) Leaves and Arugula (Eruca sativa) seed extract. International Journal of Pharmacognosy and Phytochemical Research, 7(2): 307-310.

Maobe, M.A.G. and R.M. Nyarango. 2013. Fourier Transformer Infra-Red Spectrophotometer Analysis of Urtica dioica Medicinal Herb Used for the Treatment of Diabetes, Malaria and Pneumonia in Kisii Region, Southwest Kenya. World Applied Sciences Journal, 21 (8): 1128-1135

Manokaran, K., R. Narmadha, P. Ragaavendran, D. Gomathi, P. Ravikumar, D. Sophia, C. Arulraj, C. Uma and K. Kalaivani. 2011. Acute and sub-chronic toxicity effect of Jasminum sambac Linn. Oleaceae flower in Swiss albino mice. Pharmacology, 3: 517-525.

Manokaran. K and Kalaivani. K. 2011. Phytochemicals analysis and antilipid peroxidative effect of Jasminum sambac (L). Ait oleaceae. Pharmacology online, 1: 38-43.

Marasini, B.P., P. Baral, P. Aryl, K.R. Ghimire, S. Neupane, N. Dahal, A. Sing, L. Ghimire and K. Sheshtha. 2015. Evaluation of antibacterial activity of some traditionally used medicinal plant against human pathogenic bacteria. Biomed, Res Int., I.D. 265425.

Mariswamy Y, Gnanaraj WE, Marimuthu J. 2012. FTIR spectroscopic studies on aerva lanata (L.) Juss. Ex schult. Asian journal pharmaceutical clinical research, 5: 82-86.

Maslow, J.N., M.E. Mulligan, K.S. Adams, J.C. Justic and R.D. Arbeit. 1993. Bacterial adhesins and host factors: Role in the development and outcome of Escherichia coli bacteremia. Clin. Infect. Dis., 17: 89-97.

Masoko, P. and D.M. Makgapeetja. 2015. Antibacterial, antifungal and antioxidant activity of Olea africana against pathogenic yeast and nosocomial pathogens. Complementary and Alternative Medicine, 15: 409.

Maurer, J.J. 2007. The proper conduct of research. Avian Dis. 51: 1-7.

Mekinic, I.G., M. Gotovac, D. Skroza, I. Ljubenkov, F. Burcul and V. Katalinic. 2014. Effect of the extraction solvent on the oleuropein content and antioxidant properties of olive leaf (cv. Oblica, Lastovka and Levantinka) extracts. Croat. J. Food Sci. Technol., 6(1): 7-14.

Micol, V., N. Chaturla, L.P. Fons, V. Mas, L. Perez, A. Estepa. 2005. The live leaf extract exhibits antiviral activity against viral haemorrhagic septicaemia rhabdovirus (VHSV). Antiviral Res., 66: 129-136.

Molan, A.D., A.M. Faraj and A.S. Mahdy. 2012. Antioxidant activity and phenolic content of some medicinal plant traditionally used in Northern Iraq. Phytopharmacology, 2(2): 224-233.

Molla, M.T.H., M.S. Ahsan, M.T. Alam and M.E. Haque. 2010. Antibacterial activity in the leaves of seven bitter medicinal plant of Bangladesh. J. Bio. Sci., 18: 128-133.

Montoro, P., P. Brace, C. Pizza and N. D. Tommari. 2005. Structure-antioxidant activity relationships of flavonoids isolated from different plant species. Food Chem., 92: 349-355.

Mouhajir F., J.B. Hudson, M. Rejdali and G.H.N. Tower. 2001. Multiple antiviral activities of endemic medicinal plant used by berber peoples of Morocco. Pharmaceutical Biology Formerly, IJPP. 39(5): 364-374.

Naczk, M. and F. Shahid. 2004. Extraction and analysis of phenolics in food. J. Chromatogr, 1054: 95-111.

Naili, M.B., R.O. Alghazeer, N.A. Saleh and A.Y. Al-Najjar. 2010. Evaluation of antibacterial and

antioxidant activities of Artemisia campestris (Asteraceae) and Ziziphus lotus (Rhamnaceae). Arabian Journal of Chemistry, 3(2): 79-84.

Nair, R., T. Kalariya and S. Chanda. 2005. Antibacterial activity of some selected Indian medicinal flora. Turk. J. boil., 29: 41-47.

Naithani, R., L.C. Huma, L.E. Holland, D. Shukla, D.L. MeCormick, R.G. Mehta and R.M. Moriaty. 2008. Antiviral activity of phytochemicals: a comprehensive review. Mini Rev Med Chem., 8(11): 1106-1133.

Nashwa, F.S. Morsy and M.E. Abdel-Aziz. 2014. Efficiency of olive (Olea europaea L.) leaf extract as antioxidant and anticancer agents. Journal of Agroalimentary Processes and Technologies, 20(1): 46-53.

Nasim, M.J., A.M.H. Hassan, S. Ashif, K.S. Ali, M. Amara, F. Kalsoom, R. Zarmina and M. Ghulam. 2013. Combating of scorpion bite with Pakistani medicinal plant having ethno-botanical evidences as antidote. Acta poloniae Pharmaceutica, 70: 3.

Nasopoulou, C., H.C. Karantonis, M. Detopoulou, C.A. Demopoulos and I. Zabetakis. 2014. Exploiting the anti-inflammatory properties of olive (Olea europaea) in the sustainable production of functional food and neutraceuticals. Phytochemistry Reviews, 13: 445–458.

Nastro, A., M.P Germano, V.D. Angelo, A. Marino and M.A Cannatelli. 2000. Extraction methods and bioautography for evaluation of medicinal plant antimicrobial activity. Lett. Appl. Microbiol., 30: 379-384.

Naz, S., S. Jabeen, S. Ilyas, F. manzoor, F. Aslam and A. Ali. 2010. Antibacterial activity of Curcuma longa varieties against different strains of bactreia. Pak. J. Bot., 42(1): 455-462.

Ngameni, B., G.W. Fotso, J. Kamgha, P. Ambassa, T. Abdou, A.G. Fankam, I.K. Voukang, B.T. Ngadjui, B.M. Abegaz and V. Kuete. 2013. Flavonoids and related compounds from the medicinal plant of Africa. In: Kuete, V. (Ed.), Medicinal Plant Research in Africa: Pharmacology and Chemistry. Elsevier Inc., London, pp. 301-344.

Nooman, A.K., A.K. Shakya, A.A. Othman, Z.E. Agbar and H. Farah. 2008. Antioxidant activity of some common plant. Turk. J. Biol., 32: 51-55.

Nora, N.B., K. hamid, M. Snouci, M. Boumedien and M. abdellah. 2012. Antibacterial activity and phytochemical screening of Olea europaea leaves from Algeria. The Open Conference Procedings Journal, 3: 66-69.

Obi, V.I. and C. Onuoham. 2000. Extraction and characterization method of plant and plant products. Biological and Agricultural Techniques, Websmedia publishers, Owerri. pp 271-286.

Obied, H.K., D.R. Bedgood, P.D. Prenzler and K. Robards. 2007. Bioscreening of Australian olive mill waste extracts: biophenol content, antioxidant, antimicrobial and molluscicidal activities. Food Chem. Toxicol., 45(7): 1238-48.

Okwu, D.E. and C. Josiah. 2006. Evaluation of the chemical composition of two Nigerian medicinal plant. Afr. J. Biotech., 5: 357-361.

Omar, S.H. 2010. Oleuropein in olive and its pharmacological effects. Scientia pharmaceutica, 78(2): 133-154.

Onwukaeme, D.N., T.B. Ikuegbvweha and C.C. Asonye. 2007. Evaluation of phytochemical constituents, antibacterial activities and effect of exudate of Pycanthus angolensis Weld. Warb. (Myristicaceae) on corneal ulcers in rabbits. Trop. J. Pharm. Res., 6(2): 725-730.

Paiva-Martins, F., J. Fernandes and S. Rocha. 2009. Effects of olive oil polyphenols on erythrocyte oxidative damage. Molecular Nutrition & Food Research, 53(5): 609-616.

Paiva-Martins, F., M.H. Gorden and P. Gameiro. 2003. Activity and location of olive oil phenolic antioxidants in liposomes. Chem. Phy. Lipids, 124: 23-36.

Panchawat, S., K.S. Rathore and S.S. Sisodia. 2010. A review on herbal antioxidants. International Journal of Pharm. Tech. Research, 2(1): 232-239.

Patel, V.R., P.R. Patel and S.S. Kajal. 2010. Antioxidant activity of some selected medicinal plant extracts. Mem. Inst. Oswaldo Cruz., 94(4): 531-535.

Pereira, A.P., I. Ferreira, F. marcelino, P. Valentao, P.B. Andrade, R. Seabra, L. Estevinho, A. Bento and J.A. Pereira. 2007. Phenolic Compounds and Antimicrobial Activity of Olive (Olea europaea L. cv. Cobrançosa) Leaves. Molecule, 12(5): 1153-1162.

Perez-Bonilla, M.S. Salido, A. Sanchez, T.A.V. Beek and J. Altarejos. 2013. Effect of extraction conditions on the antioxidant activity of Olive wood extracts. International journal of Food Science, Article ID: 719593

Phatak, R.S. and A.S. Hendre. 2014. Total antioxidant capacity (TAC) of fresh leaves of Kalanchoe pinnata. Journal of Pharmacognosy and Phytochemistry, 2(5): 32-35.

Philip, D., P.K. Kaleena, K. Valivittan and C. P. Girish Kumar. 2011. Phytochemical screening and antimicrobial activity of Sansevieria roxburghiana. Middle-East J. Sci. Research, 10 (4): 512-518.

Pintado, V., M.A. Meseguer, J. Fortun, J. Cobo and E. Navas. 2002. Clinical study of 44 cases of Staphylococcus aureus meningitis. Eur. J. Clin. Microbiol. Infect. Dis., 21: 864-868.

Prieto, P., M. Pineda and M. Aguilar. 1999. Spectrophotometric quantitation of antioxidant capacity through the formation of a phosphomolybdenum complex, specific application to the determination of vitamin E. Anal. Biochem., 269: 337-341.

Quispe-Condori, S., M.A. Foglio, P.T.V. Rosa and M.A.A. Meireles. 2008. Obtaining β-caryophyllene from Cordia verbenacea de Candolle by super crtitical fluid extraction. J. Supercrit. Fluids, 46: 27-32.

Qusti, S.Y., N.A. Ahmad, A. Mona and B. Lahwa. 2010. Screening of antioxidant activity and phenolic content of selected food items cited in the Holy Quran. E. J. B. S., 2: 40-51.

Rahman, A.S., S. Abd-Ellatif, S. Deraz and A. Khalil. 2011. Antibacterial activity of some wild medicinal plant collected from western Mediterranean coast, Egypt: Natural alternatives for infectious disease treatment. African Journal of Biotechnology, 10(52): 10733-10743.

Ranalli, A., S. Contento, L. Lucera, M. Difebo, D. Marchegiani and D.I. Fonzo. 2006. Factors affecting the contents of iridoid oleuropein in olive leaves (Olea europaea L). J. Agric. Food Chem., 54: 434-440.

Rashid, A. and M. Arshad. 2002. Medicinal plant diversity, threat interaction of a mountain people community. Ethnobotany Project, WWF Pakistan. 84-90.

Rath C., S. Devi, S. Dash and R. Mishra. 2008. Antibacterial potential assessment of Jasmine essential oil against E. coli.2008. Indian Journal of Pharmaceutical Sciences, 70(2):238–241.

Reed, L.J. and H. Munch. 1938. A simple method of estimating fifty percent endpoints. Am. J. Hyg., 27: 493-497.

Reid S.M., M.A. Forsyth, G.H. Hutchings and N.P. Ferris. 1999. Comparison of reverse transcriptase polymerase chain reaction, enzyme immunosorbent assay and virus isolation for the routine diagnosis of foot and mouth disease. J. Virol. Methods, 70: 213-217.

Reische, D.W., D.A. Lillard and R.R. Eitenmiller, R.R. 2008. Antioxidants. In Food Lipids Chemistry Nutrition, and Biotechnology, (3rd ed); Akoh, C.C., Min, D.B., Eds; CRC Press: New York, NY, USA, 409-433.

Renuka, D., S. Doraiswamy, S. Nakkeeran, R. Rabindran, T. Ganapathy, M. Ramiah and S. Mathiyazhagan. 2004. Antiviral action of Harpulia cupanioides and Mirabilis jalapa against tomato spotted wilt virus (TSWV) infecting tomato. Archive of Phytopath., 37: 341-346.

Reyes, F.J., J.J. Centelles, J.A. Lupianez and M. Cascante. 2006. (2Alpha, 3beta)- 2, 3-dihydroxyolean-12-en-28-oic acid, a new natural triterpene from Olea europaea, induces caspase dependent apoptosis selectively in colon adenocarcinoma cells, FEBS Letters 580: 6302–6310.

Richards, M.J., J.R. Edwards, D.H. Culver and R.P. Gaynes. 1999. Nosocomial infections in medical intensive care units in the United States: National nosocomial infections surveillance system. Crit. Care Med., 27(5): 887-892.

Richard, V., P. Van-der-Auwera, R. Snoeck, D. Daneau and F. Meunier. 1988. Nosocomial bacteremia caused by Bacillus species. Eur. J. Clin. Microbiol. Infect. Dis., 7(6): 783-785.

Roberts WK, Selitrennikoff CP. 1986. Isolation and characterization of two antifungal proteins from barley. Biochimica et Biophysica Acta., 880, 161–170.

Roos, K.L. and W.M. Scheld. 1997. The Staphylococcus in Human Disease. Churchill Livingstone, New York, pp. 413-439.

Rossi. R., C. Corino, G. Pastorelli, P. Durand and M. Prost. 2009. Assessment of antioxidant activity of natural extract. Italian journal of animal science, ISSN: 1828-051X.

Rowe, B. 1979. The role of Escherichia coli in gastroenteritis. Clin. Gastroenterol., 8: 625-644.

Rybalchenko, N.P., V.A. Prykhodko, S.S. Nagorna, N.N. Volynets, A.N. Ostapchuk, V.V. Klochko, T.V. Rybalchenko, and L.V. Avdeeva. 2010. In vitro antifungal activity of phenylheptatriyne from Bidens cernua L. against yeasts. Fitoterapia, 81: 336-338.

Sabharwal, S., M. Vats, S. Sardana and S. Aggarwal. 2013. Pharmacological, Physico and Phytochemical evaluation of the leaves of Jasminum sambac Linn. International Journal of Pharmacy and Pharmaceutical Science, ISSN: 0975- 1491.

Sabharwal, S.M. S. Vats, S. Sardana and S. Aggarwal. 2011. Pharmacognostical, physioco and phytochemical evaluation of the leaves of Jasminum sambac Linn. International Journal of Pharmacy and Pharmaceuical Sciences, 3(4): 237-241.

Sah, A.K and V.K. Verma. 2013. Phytochemical and pharmacological potential of Nyctanthes arbortristis. Int. Journal of research in Pharmaceutical and Biomedical sciences, ISSN: 2229-3701.

Sahreen, S., M.R. Khan and R.A. Khan. 2011. Phenolic compounds and antioxidant activity of Rumex hastatus D. Don leaves. J. Med. Plant Res., 5:2755-2765.

Salem, M.B., H.Affes, K. Ksouda, Z. Sahnoun, K.M. Zeghal and S. Hammami. 2014. Pharmacological activities of Olea europaea leaves. Journal of Food Processing and Preservation, ISSN: 1745-4549.

Samuelsson, G. 2004. Drugs of Natural Origin: a textbook of Pharmacognosy, 5th Swedish Pharmaceutical Press, Stockholm.

Sarwar, M. 2013. The theatrical usefulness of olive Olea europaea L. nutrition in human health. Sky Journal of Medicinal Plant Research, 2(1): 1-4.

Saetung, A., A. Itharat, C. Dechsukum, C. Wattanapiromsakul, N. keawpradub and P. Ratanasuwan. 2005. Cytotoxic activity of Thai medicinal plant for cancer treatment. Songklanakarin J. Sci. Technol., 27: 469-478.

Satyal, P., P. Paudel, B. Lamichhane and W.N. Setzer. 2012. Volatile constituents and biological activities of the leaf essential oil of Jasminum mesnyi growing in Nepal. J. Chem. & Pharma. Res., 4(1): 437-439.

Scalbert, A., C. Manach, C. Morand and C. Remsy. 2005. Ditary polyphenols and the prevention of diseases. Crit. Rev. Food Sci. Nutr., 45: 287-306.

Seidel, V. 2006. Initial and bulk extraction. In: Sarker, S.D., Z. Latif and A.I. Grey (Eds.), Natural Products Isolation (2nd Ed), Humana Press Inc., New Jersy, pp. 27-46.

Sethi, A. 2003. Systematic Lab Experiments in Organic Chemistry. New Age International publishers, New Dehli, pp. 471.

Sexena, G., M. Cutcheon, A.R. Farmer, S. Towers and G.H.N. Hancock. 1994. Antimicrobial constituents of Rhusglabra. J. Ethnopharmacol., 42: 95-99.

Shabir, H., M.S. Khan, H.U. Rehman, Z. Masood, T. Yousaf, A. Majid and R. Iqbal. 2015. Ethnomedicinal uses of xeric flora in tehsil Banda Daud Shah collected from district Karak, KPK Pakistan. World J. Zool., 10(2): 59-69.

Shakeri, A., N. Hazeri, J. Vlizadeh, A. Ghasemi and F. Tavallaei. 2012. Photochemical screening, antimicrobial and antioxidant activity of Anabasis aphylla L. extracts. Kragujevac J. Sci., 34: 71-78.

Sharififar, F., G. Dehghn-Nudeh and M. Mirtajaldini. 2009. Major flavonoids with antioxidant activity from Teucrium polium L. Food Chem., 112: 885-888.

Shekhar, S. and M.P. Prasad. 2015. Evaluation of antimicrobial activity of Jasminum species using solvent extracts against clinical pathogens. World Journal of Pharmacy and Pharmaceutical Sciences, 4(5): 1247-1256.

Shruti, N. and K.N. Varalakshmi. 2011. Anticancer, Cytotoxic potential of Moringa oleifera extracts on Hela cell line. Journal of Natural Pharmaceuticals, 2(3): 234-237.

Shuang-Cheng, M.A., Z.D. He, X.L. Deng, P.P. But, H.X. XU, S.H. Lee and S.F. Lee. 2001. In Vitro evaluation of Secoiridoid Glucosides from the fruits of Ligustrum lucidum as antiviral Agents. Chem. Pharm. Bull., 49(11): 1471- 1473.

Silva, S., L. Gomes, F. Leitão, A.V. Coelho, and L.V. Boas. 2006. Phenolic compounds and antioxidant activity of Olea europaea L. fruits and leaves. Food Science and Technology International, 12(5): 385-395.

Singh, A.K., R. Chawla, A. Rai, and L.D. Yadav. 2012. NHC-catalysed diastereoselective synthesis of multifunctionalised piperidines via cascade reaction of enals with azalactones. Chem Commun., 48: 3766-8.

Sohrabi M.R., M. Davall. F. Tadayyon. F. Nabipoor and A. Khamneifar. 2005. Simultaneous Determination of Acetyl Salicylic Acid and Acetaminophen in A.C.A Tablets by FT/IR/ATR Spectrometry with Multivariate Calibration Data Treatment, Asian Journal of Chemistry, 17(1): 541-547.

Soler-Rivas, C., J.C. Espin and H.J. Wichers. 2000. An easy and fast test to compare total free radical scavenger capacity of foodstuffs. Phytochem. Anal., 11: 330- 338.

Soobrattee, M.A., V.S. Neergheen, A. Luximon-Ramma, O.I. Aruoma and O.T. Bahorun. 2005. Phenolics as potential antioxidant therapeutic agents: mechanism and actions. Mutat. Res. Fundam. Mol., 579: 200-213.

Sousa, M., I.S. Sanches, M.L. Ferro and H. Lencastre. 2000. Epidemiological study of staphylococcal colonization and cross-infection in two West African hospitals. Microb. Drug Resist., 6: 133-141.

Sparg, S., M. Light and J.V. Staden. 2004. Biological activities and distribution of plant saponins. J. Ethnopharmacol., 94: 219-243.

Spencer, R.C. 1996. Predominant pathogens found in the European prevalence of infection in intensive care study. Eur. J. Clin. Microbiol. Infect. Dis., 15(4): 281-285.

Stankovic. M.S. and M.D. Topuzovic. 2012. In vitro antioxidant activity of extracts from leaves and fruits of common dogwood (Cornus sanguinea L.). Acta Bot. Gallica, 159: 79-83.

Steel, R.G.D., J.H. Torrie and D.A. Discky. 1997. Principles and Procedures of Statistics: A

Biometrical Approach. (3rd Ed), McGraw Hill Co., New York.

Su, G., Y. Cao, C. Li, X. Yu, X. Gao, P. Tu and X. Chai. 2015. Phytochemical and pharmacological progress on the genus Syringa. J. Chem. Cent., 9:2.

Sudjana, A.N., C.D. Orazio, V. Ryan, N. Rasool, J. Ng, N. Islam, T.V. Riley and K.A. Hammer. 2009. Antimicrobial activity of commercial Olea europaea (olive) leaf extract. International Journal of Antimicrobial Agents, 33(5): 461-463.

Sulaiman C.T. and V.K Gopalakrishnan. 2013. Radical scavenging and in vitro hemolytic activity of aqueous extracts of selected Acacia species. J. App. Pharm. Sci., 3(3): 109-111.

Sylvia, L., Z. Li, L.H. Philip, C. Young-Tae and L.H. Paul. 2003. Anti-HIV activities of Olive leaf extract (OLE) and modulation of host cell gene expression by HIV-1infection and OLE treatment. Biochemical and Biophysical Research Communications, 307: 1029- 1037.

Tang, S.Y., M. Whiteman, A. Jenner, Z.F Peng and B. Halliwell. 2004. Mechanism of cell death induced by an antioxidant extract of Cratoxylum cochinchinense in Jurkat T cells. Free Radical Biology and Medicine, 36: 1588-1611.

Therios, I. 2009. Olives. Crop Production Science in Horticulture 18. CABI, Wallingford, UK.

Thomas, I., J. Meulen, B. Marlis, K. Kritiane, D. Anrea, S.Judith, M. Cornelius, K. Kekoura, K. Lamine, S. Herbert, F. Bernhard and H. Achim. 2007. Characterization of Human CD4+ T-Cell clones recognizing conserved and variable epitops of the Lassa Virus Nucleoprotein. J. Virology, 74(5): 2186- 2192.

Thomas, M. and H. Whittet. 1991. A typical meningitis complicating a penetrating head injury. J. Neurol. Neurosurg. Psychiatry, 54(1): 92-93.

Tipu, M.A., M.S. Akhtar, M.I. Anjum and M.L. Raja. 2006. New dimensions of medicinal plant as animal feed. Pak Vet. J., 26(3): 144-148.

Tripathi L. and J.N. Tripathi. 2003. Role of biotechnology in medicinal plant. Trop. J. Pharm. Res., 2(2): 243-253.

Twentyman, P. and M. Luscomb. 1987. A study of some variables in tetrazolium dye (MTT) based assay for cell growth and chemosensitivity. Br. J. Cancer, 56: 276-285.

Valentao, P., E. Fernandes, F. Carvalho, P.B. Andrade, R.M. Seabra and M.L. Bastos. 2002. Antioxidative properties of Cardoon (Cyanara cardunculus L.) infusion against superoxide radical, hydroxyl radical and hypochlorous acid. J. Agric. Food Chem., 50: 4989-4993.

Vasconsuelo, A. and R. Boland, 2007. Molecular aspects of the early stages of elicitation of secondary metabolites in plant. Plant Sci., 172: 861-875.

Verma, S. and S.P. Singh. 2008. Current and future status of herbal medicine. Vet. World, 1: 347-350.

Vijayan, P., C. Raghu, G. Ashok, S.A. Dhanaraj and B. Suresh. 2004. Antiviral activity of medicinal plant of Nilgiris. Indian J. Med. Res., 120: 24-29.

Viljoen, A., S. Van Vuuren, E. Ernest, M. Klepser, B. Demirci, H. Basser and B.V. Wyk. 2003. Osmitopsis asteriscoides (Asteraceae) –the antimicrobial and essential oil composition of cape –Dutch remedy. J. Ethnopharmacol., 88, 137-143.

Vyas .A. and R.Sarin., 2013. Analysis of the phytochemical content and antimicrobial activity of Nyctanthes arbortristis. Int. J. Pharma. Sci., ISSN: 0975-6299.

Wachsman, M.B., V. Castilla and C.E. Coto. 1998. Inhibition of Foot and Mouth Disease virus (FMDV) uncoating by a plant-derived peptide isolated from Melia azedarach L leaves. Arch. Virol., 143(3):581-90.

Wagner, H. 1993. Pharmazeutische Biology. (5th Ed), Gustav fisher Vwelag, Stuttgart, pp. 184.

Wakte., R.S. and D.A. Patil. 2011. Antimicrobial and antioxidant activity of Averrhoa carambola L. fruit at various stages of ripening. J. Herbal Medicine and Toxicology. 5(2): 121-129.

Waldi, D. 1965. Spray Reagents for Thin Layer Chromatography: A Laboratory Hand Book. Acadmic Press Inc., New York, pp. 491.

Walker, T.S., H.P. Bais, E. Déziel, H.P. Schweizer, L.G. Rahme, R. Fall and J.M. Vivanco. 2004. Pseudomonas aeruginosa - plant root interactions: Pathogenicity, biofilm formation and root exudation. Plant Physiol., 134(1): 320-331.

Yang, D.P., D.X. Kong and H.Y. Zhang. 2007. Multiple pharmacological effects of olive oil phenols. Food Chem., 104: 1269-1271.

Yin, Y., X. Ying, H. Laun, Z. Zhao, J. Lou, D. Wang, H. Li and H. Wu. 2014. UPLC- DAD/Q-TOF-MS Based Ingredients Identification and Vasorelaxant Effect of ethanol extract of Jasmine flower. Evid. Based ComLement. Alternat. Med., doi: 707908.

Younus, I., A. Siddiq, T. Assad, S. Badar, S. Jameel and M. Ashraf. 2015. Screening antiviral activity of Moringa oliefera L. leaves against Foot and Mouth Disease Virus. Global Veterinaria, 15(4): 409-413.

Zahin, M., F. Aqil and I. Ahmad. 2009. The In vitro antioxidant activity and total phenolic contents

of four Indian medicinal plant. International Journal of Pharmaceutical Sciences, 1(1): 88-94.

Zhang, Z.Y.J., L.Y.Q. Liu, P.X. Pu and Y.C. Yang. 1995. Iridoidal glycosides from Jasminum sambac. Phytochemistry, 38(4):899-903.

Zhao, G., Z. Yin and J. Dong. 2009. Antiviral efficacy against hepatitis B virus replication of oleuropein isolated from Jasminum officinale L. var. grandiflorum. J. Ethnopharmacol., 125: 265-268.

Zu, Y., H. Yu, L. Liang, Y. Fu, T. Efferth, X. Liu and N. Wu. 2010. Activities of ten essential oils towards Propioni bacterium acnes and PC-3, A-549 and MCF-7 cancer cells. Molecules, 15, 3200-3210.