International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 15-03-2021; Accepted: 08-04-2021: Published: 21-04-2021
Volume 6, Issue 2, 2021, Page No. 577-581

Memecylon randerianum: A natural source of bioactive phytochemicals

Lakshmi MV[1], Swapna TS[1*]
Department of Botany, University of Kerala, Thiruvananthapuram, Kerala, India

Abstract
Metabolomic studies on plants became very relevant and attractive for the entire society. There are many advanced and sophisticated analytical methods for the discovery of several bioactive metabolites from natural extracts. The chemical composition of various plant extracts was detected using these techniques. *Memecylon randerianum* S.M.Almeida & M.R.Almeida is a unique medicinal plant used in traditional medicine for the treatment of bacterial infections and skin infections like herpes, chickenpox, and psoriasis. This plant is rich in secondary metabolites such as flavonoids, glycosides, phenols, saponins, and tannins. One novel compound, namely Memecylaene has been isolated from this species. The current study is conducted for the chemical profiling of *Memecylon randerianum* through GC-MS and HR- LCMS-QTOF analysis. Majority of the identified compounds have antiviral properties.

Keywords: skin infections, memecylaene, gcms, lcms-qtof, antiviral property

Introduction
There has been a growing interest in the use of plant resources for the treatment of various viral infections in the past decades around the world. Viral infections are one of the most concerning threats to the global public health systems. Many medicinal plants were screened for the identification and isolation of antiviral compounds. Like all other medicines, antiviral drugs can cause some side effects. But the use of herbal medicine for viral treatment reduces the common side effects. *Memecylon randerianum* S.M.Almeida & M.R.Almeida is an endemic medicinal plant widely distributed in evergreen and semi-evergreen forests of Western Ghats. The occurrence of the plant is also reported from some of the sacred groves of Kerala. It is a large woody shrub that belongs to the family Melastomataceae that grows up to 5-6 m tall. The plant is locally known as 'Kashavu or Koovachekki' in Malayalam. Flowering and fruiting of the plant are predominantly observed during the summer season (February to May). This plant is used in folk medicine for the control of diarrheal, bacterial infections, inflammatory and skin disorders including herpes and chickenpox. The leaves are used in the treatment of psoriasis [1]. The roots of the plant act as ecbolic [2, 3]. So the present study aims to find out the bioactive phytochemicals of the methanolic extract of leaves, stem, and root of *Memecylon randerianum* through GC-MS and HR- LCMS-QTOF analysis.

Materials and Methods
The plant parts were collected from the Campus of the University of Kerala, Thiruvananthapuram. The collected plant material was botanically identified and submitted to KUBH (Kerala University Botany Herbarium) for further reference. The collected leaves were shade-dried and finely powdered by using a pulverizer. The coarse powder was then subjected to continuous extraction with organic solvents of increasing polarity by Soxhlet method. Then the extract was filtered and stored at 4ºC. It is then used for phytochemical screening, GC-MS and LC-MS-QTOF analysis. All the dried extracts were dissolved in respective solvents, and qualitative tests were conducted for the preliminary screening of phytoconstituents as per standard methods described by Harborne and Tiwari *et al* [4, 5]. The quantitative determination of the phytoconstituents such as Alkaloids [6], Phenol [7], Flavonoid [8], Saponins [9], Tannins [10], Terpenoids [11], Steroids [12], Glycosides [13] was carried out using standard procedures.

GC-MS Analysis
The GC-MS analysis of the methanolic extract of leaf, stem, and root of *Memecylon randerianum* was determined on a Shimadzu GC-MS QP2010S system. The interpretation of the mass spectrum of GC-MS was made using the library of NIST 11 & WILEY 8.

HR-LCMS-QTOF Analysis
HR-LCMS-QTOF analysis of plant parts was carried out on Agilent high-resolution liquid chromatography and mass spectrometry model- G6550A with 0.01% mass resolution. The data contains m/z values, retention time, and abundance of the compounds.

Results and Discussion
The phytochemical screening of the methanolic extract of the plant parts such as leaf, stem, and root revealed the presence of valuable bioactive compounds. All the plant parts of *M. randerianum* showed a considerable number of phytochemicals such as Alkaloids, Flavonoids, Terpenoids, Glycosides, Tannins, Steroids, Coumarins, Phenols, etc. The methanolic leaf extract possesses the highest number of phytochemicals, including Alkaloids, Flavonoids, Terpenoids, Glycosides, Tannins, Steroids, Coumarins, Phenols, etc.

Phytochemical Screening
In the quantitative phytochemical analysis of the methanolic extract of each plant parts, the values are expressed in mg/g. The findings were given in Table.1. Saponins and

flavonoids were seems to be more in the leaf, stem, and root extract. The presence of these bioactive compounds in the plant might be responsible for multiple biological activities. Saponins (240.03±0.55mg/g) and flavonoids (271.35±1.32mg/g) showed the highest presence in the root extract of the plant. Tannins (161.69±6.55 mg/g) were also showed considerable quantity in the root extract of the plant. In comparison, phenolics were found to be higher in the stem extract of the plant.

Table 1: Quantitative analysis of Phytochemicals of the different parts of *Memecylon randerianum*

Sl No.	Phytochemicals	Leaves (mg/g)	Stem (mg/g)	Root (mg/g)
1	Alkaloids	145.38±3.09	45.97±2.03	38.95±2.03
2	Flavonoids	209.74±2.12	201.33±0.86	271.35±1.32
3	Glycosides	3.79±0.09	2.87±0.10	4.35±0.06
4	Terpenoids	21.42±0.15	6.68±0.25	11.86±0.27
5	Tannins	111.3±3.10	73.36±3.08	161.69±6.55
6	Steroids	21.88±0.20	6.42±0.06	9.06±0.08
7	Phenols	96.75±7.29	162.47±23.79	18.14±2.24
8	Saponins	211.16±1.9	203.81±2.69	240.03±0.55

Values are expressed in Mean ± Standard error

GCMS and LCMS-QTOF Analysis

The GCMS and LCMS-QTOF analysis also show the presence of major known compounds in the crude extract of the plant parts. GC-MS analysis of the methanolic extract of all the parts showed the presence of many different pharmacologically important compounds.

GC-MS Chromatogram of the methanolic root extract of *Memecylon randerianum* (Figure.1) showed twenty peaks with the presence of twenty different compounds at different retention times. The compounds identified are 1, 2-Benzenedicarboxylic acid (73.10%), Hexadecanoic acid,methyl ester (5.40%), 2,4-Ditert-Butylphenol (2,64%), Octadecanoic acid,methyl ester (2.59%), 1,2-Benzenedicarboxylic acid, Bis (2-Methylpropyl) ester (2.12%), Squalene (1.90%), Diphenylamine (1.76%). Besides these compounds, many peaks with a very narrow retention time have a very low percentage.

GC-MS Chromatogram of the methanolic stem extract of *Memecylon randerianum* (Figure.2) showed twenty peaks with the presence of eighteen different compounds at different retention times. The compounds identified are Hexadecanoic acid,methyl ester (32.35%), Octadecenoic Acid, Methyl ester (21.70%), 2,4-Ditert-Butylphenol (6.77%), Squalene (6.47%), Methyl (7E)-7-hexadecenoate (6.42%), 1,2- Benzenedicarboxylic acid, Diisooctyl ester (5.77%).

GC-MS Chromatogram of the methanolic leaf extract of *Memecylon randerianum* (Figure.3) showed twenty peaks with the presence of twelve different compounds at different retention time. The compounds identified are 1,2-Benzenedicarboxylic acid (70.69%), Hexadecanoic acid, methyl ester (9.42%), Octadecenoic Acid, Methyl ester (5.70%),Di-isobutyl Phthalate (4.46%), Neophytadiene (3.71%), 7-Hexadecenoic acid, methyl ester, (Z)- (1.84%), Phytol(1.60%).

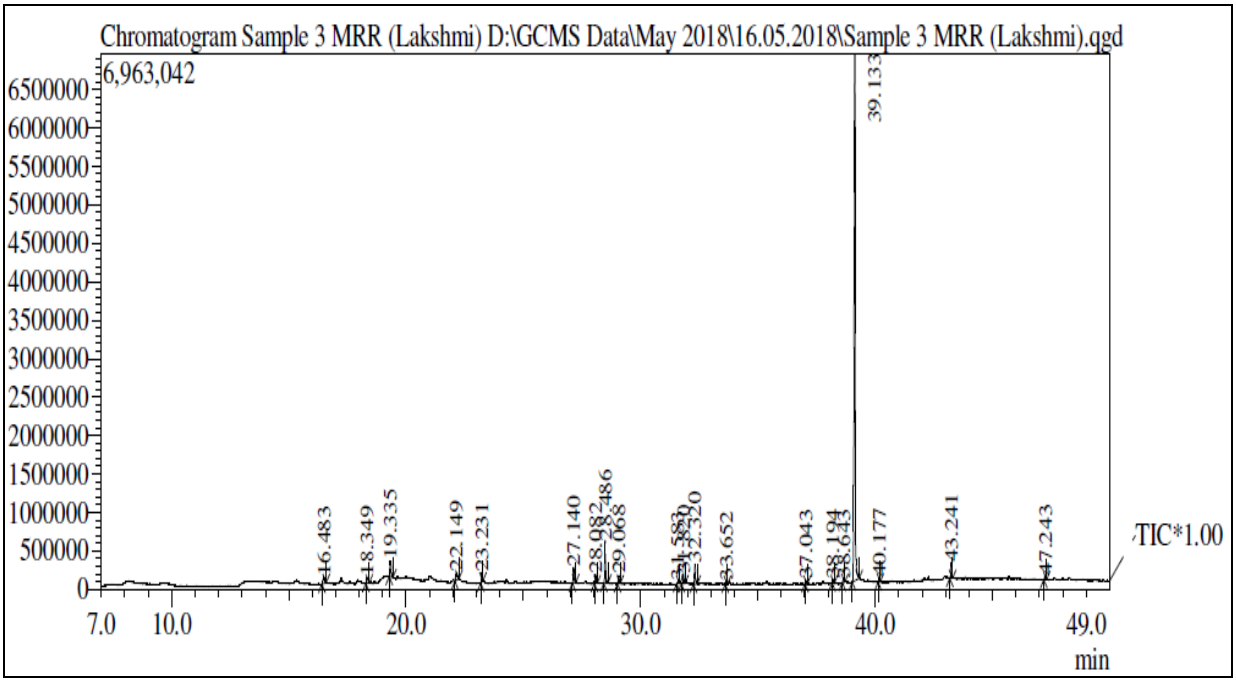

Fig 1: GC-MS Chromatogram of Methanolic root extract of *Memecylon randerianum*

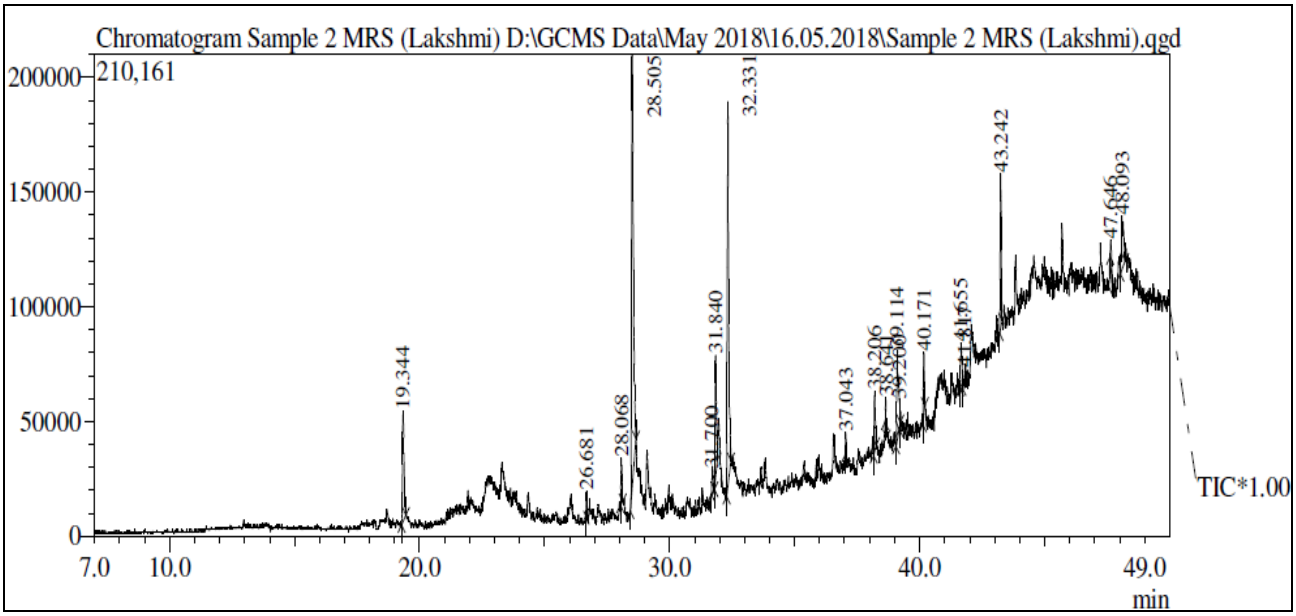

Fig 2: GC-MS Chromatogram of Methanolic stem extract of *Memecylon randerianum*

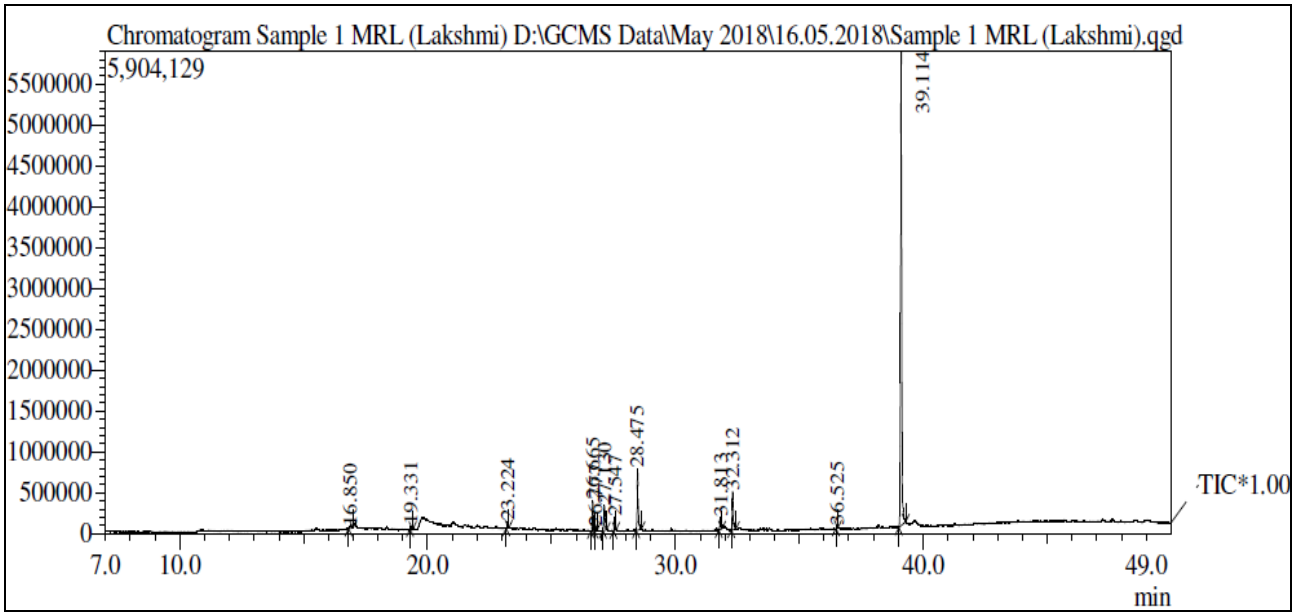

Fig 3: GC-MS Chromatogram of Methanolic leaf extract of *Memecylon randerianum*

The majority of the compounds identified from this plant were medicinally valuable and can be used to treat various human disorders. The bioactivity of some of the compounds detected from the plant is given in figure 4.

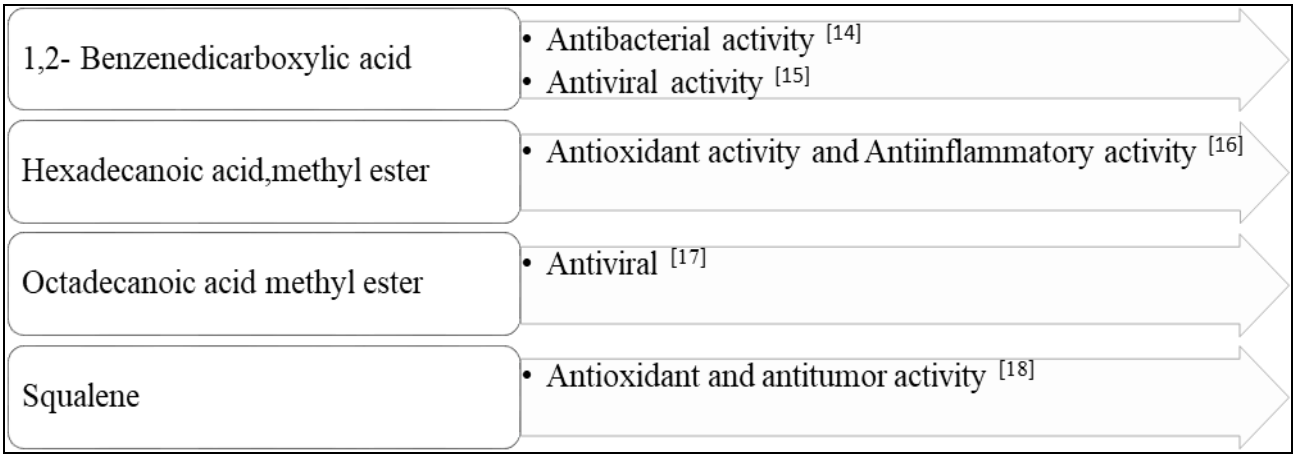

Fig 4

The HR-LCMS-QTOF analysis of the plant is carried out to find out the compounds responsible for the different medicinal properties of the plant. The majority of the identified compounds from the plant have antiviral properties, which are described in table 2, 3, and 4. The HR-LCMS analysis of methanol extract of *M.randerianum* leaves showed nine major different phytochemical constituents (Table.2).

Table 2: Bioactive Compounds in the methanolic leaf extract of *M.randerianum*

Sl No.	Name of the compound	RT	Abundance	Mass	DB Diff (ppm)
1.	Cosmosiin	6.485	6255.17	432.1056	0.12
2.	Apigenin	8.799	4744	270.0544	-5.69
3.	Cinnamic acid	6.678	1735	148.0485	26.65
4.	Ursolic acid	9.434	1131	456.3642	-8.4
5.	Rutin	14.241	851	610.1523	1.82
6.	Isorhamnetin	4.116	663	316.048	32.45
7.	Gallic acid	8.799	303	170.0322	-62.61
8.	Quercetin	20.136	265	302.0385	13.73
9.	Catechin	11.536	97	290.0752	13.31

The HR-LCMS analysis of methanol extract of *M. randerianum* stem detected six major different phytochemical constituents (Table.3).

Table 3: Bioactive Compounds in the methanolic stem extract of *M.randerianum*

Sl No.	Name of the compound	RT	Abundance	Mass	DB Diff (ppm)
1.	Ferulic acid	8.56	5023	194.06	2.31
2.	Rutin	12.925	4326	610.1516	2.93
3.	beta-Amyrin	23.266	784	426.3859	0.7
4.	Catechin	9.546	778	290.078	3.75
5.	Isorhamnetin	18.955	622	316.057	3.75
6.	Quercetin	18.859	103	302.036	19.07

Seven major compounds were identified in the HR-LCMS analysis of methanol extract of *M. randerianum* root (Table.4).

Table 4: Bioactive Compounds in the methanolic root extract of *M.randerianum*

Sl No.	Name of the compound	RT	Abundance	Mass	DB Diff (ppm)
1.	Alpha-Toxicarol	12.844	42741	410.140	-9.1
2.	Rutin	23.655	3157	610.153	0.57
3.	Kaempferol	6.203	1382	286.06	-45.55
4.	Quercetin	18.913	1253	302.039	11.03
5.	beta-Amyrin	15.161	1195	426.374	26.74
6.	Gallic acid	2.086	858	170.015	37.33
7.	Cinnamic acid	2.086	536	148.049	21.99

The reported biological activities of some compounds identified through HR-LCMS-QTOF analysis were given in Table 5.

Table 5

Compound	Biological activity
Cosmosiin	Antidiabetic activity (Rao *et al*, 2011)
	Antiviral actity (Cantera *et al*, 2011)
Apigenin	Antiviral, antibacterial, antioxidant, and strong antiinflammatory activities (Salimi and Pourahmad, 2018)
Ferulic acid	Anti-inflammatory, antimicrobial, anticancer (for instance lung, breast, colon and skin cancer), anti-arrhythmic, and antithrombotic activity, and it also demonstrated antidiabetic effects and immunostimulant properties (Zduńska *et al*, 2018)
	Antiviral actity (Wang *et al*, 2017)
AlphaToxicarol	Anticancer activity (Jang *et al*, 2004)
Rutin	Antimicrobial, antioxidant and anti-allergic agent (Al-Dhabi *et al*, 2015)

All these compounds show desirable pharmacological properties, and therefore the plant is rich in many bioactive compounds which can be used for the treatment of a number of health issues.

Conclusion

The phytochemical screening showed positive results for the majority of the tests. In the quantitative phytochemical analysis, saponins are found to be dominant over others. The presence of phytochemicals such as Flavonoids, Phenols, and Tannins, etc. justify using leaf extract to treat various diseases. The GCMS and LCMS-QTOF analysis of plant parts could find out numerous bioactive compounds responsible for different medicinal properties of the plant. Further research studies will certainly help to derive an

effective pharmaceutical drug against various health disorders.

Acknowledgement
We are greatly thankful to CSIR for providing the financial support and to IIT Mumbai for providing HR-LCMS-QTOF analysis and KFRI, Peechi, Kerala for the GCMS analysis.

References

1. Dhanabal SP, Muruganantham N, Basavaraj KH, Wadhwani A, Shamasundar NM. Antipsoriatic activity of extracts and fractions obtained from *Memecylon malabaricum* leaves. Journal of Pharmacy and Pharmacology,2012:64(10):1501-9.
2. Hullatti Kiran Kumar Antimicrobial activity of *Memecylon malabaricum* leaves. Fitoterapia,2004:75:409.
3. Ambasta SP. The Useful Plants of India, (National Institute of Science Communication, New Delhi),2000:365-366.
4. Harborne AJ. Phytochemical methods a guide to modern techniques of plant analysis. springer science & business media,1998:30.
5. Tiwari P, Kumar B, Kaur M, Kaur G, Kaur H. Phytochemical screening and extraction: a review. Internationale pharmaceutica sciencia,2011:1(1):98-106.
6. Fazel S, Hamidreza M, Rouhollah G, Verdian-rizi M. Spectrophotometric determination of total alkaloids in some Iranian medicinal plants. THE SOCIETY FOR Advancement of horticulture,2010:12(1):69-70.
7. Sivu AR, Pradeep NS, Rameshkumar KB, Pandurangan AG. Evaluation of phytochemical, antioxidant and antimicrobial activities of *Memecylon* L. species from Western Ghats,2013.
8. Chang ST, Wu JH, Wang SY, Kang PL, Yang NS, Shyur LF. *et al*. Antioxidant activity of extracts from *Acacia confusa* bark and heartwood. Journal of Agricultural and Food Chemistry,2001:49(7):3420-3424.
9. V Le A, E Parks S, H Nguyen M, D Roach P. Improving the vanillin-sulphuric acid method for quantifying total saponins. Technologies,2018:6(3):84.
10. Padma R, Parvathy NG, Renjith V, Rahate KP. Quantitative estimation of tannins, phenols and antioxidant activity of methanolic extract of Imperata cylindrica. International Journal of Research in Pharmaceutical Sciences,2013:4(1):73-77.
11. Fan JP, He CH. Simultaneous quantification of three major bioactive triterpene acids in the leaves of Diospyros kaki by high-performance liquid chromatography method. Journal of Pharmaceutical and Biomedical Analysis,2006:41(3):950-956.
12. Madhu M, Sailaja V, Satyadev TNVSS, Satyanarayana MV. Quantitative phytochemical analysis of selected medicinal plant species by using various organic solvents. Journal of Pharmacognosy and Phytochemistry,2016:5(2):25-29.
13. Tofighi Z, Hadjiakhoondi A, Yassa N. Determination of cardiac glycosides and total phenols in different generations of *Securigera securidaca* suspension culture. Research Journal of Pharmacognosy,2016:3(2):23-31.
14. Uddin SJ, Bettadapura J, Guillon P, Darren Grice I, Mahalingam S, Tiralongo E. *et al*. *In-vitro* antiviral activity of a novel phthalic acid ester derivative isolated from the Bangladeshi mangrove fern *Acrostichum aureum*. J Antivir Antiretrovir,2013:5(06):139-44.
15. Fadipe LA, Haruna K, Mohammed I. Antibacterial Activity of 1, 2-Benzenediccarboxylic acid, dioctyl ester isolated from the ethyl acetate soluble sub-portion of the unripe fruits of *Nauclea latifolia*. Int. J. Pure App. Biosci,2014:2:223-230.
16. Belakhdar G, Benjouad A, Abdennebi EH. Determination of some bioactive chemical constituents from *Thesium humile* Vahl. J Mater Environ Sci,2015:6(10):2778-2783.
17. Linton RE, Jerah SL, Bin Ahmad I. The effect of combination of octadecanoic acid, methyl ester and ribavirin against measles virus. Int J Sci Tech Res,2013:2(10):181-4.
18. Huang ZR, Lin YK, amp Fang JY. Biological and pharmacological activities of squalene and related compounds: potential uses in cosmetic dermatology. Molecules,2009:14(1):540-554.
19. Rao YK, Lee MJ, Chen K, Lee YC, Wu WS, Tzeng YM. *et al*. Insulin-mimetic action of rhoifolin and cosmosiin isolated from *Citrus grandis* (L.) Osbeck leaves: enhanced adiponectin secretion and insulin receptor phosphorylation in 3T3-L1 cells. Evidence-Based Complementary and Alternative Medicine,2011.
20. Cantera JL, Chen W, Yates MV. A fluorescence resonance energy transfer-based fluorometer assay for screening anti-coxsackievirus B3 compounds. Journal of virological methods,2011:171(1):176-182.
21. Salimi A, Pourahmad J. Role of natural compounds in prevention and treatment of chronic lymphocytic leukemia. Polyphenols: prevention and treatment of human disease,2018:195-203.
22. Zduńska K, Dana A, Kolodziejczak A, Rotsztejn H. Antioxidant properties of ferulic acid and its possible application. Skin pharmacology and physiology,2018:31(6):332-336.
23. Wang Z, Xie D, Gan X, Zeng S, Zhang A, Yin L. *et al*. Synthesis, antiviral activity, and molecular docking study of trans-ferulic acid derivatives containing acylhydrazone moiety. Bioorganic & medicinal chemistry letters,2017:27(17):4096-100.
24. Jang DS, Cuendet M, Pawlus AD, Kardono LB, Kawanishi K, Farnsworth NR. *et al*. Potential cancer chemopreventive constituents of the leaves of Macaranga triloba. Phytochemistry,2004:65(3):345-350.
25. Al-Dhabi NA, Arasu MV, Park CH, amp Park SU. An up-to-date review of rutin and its biological and pharmacological activities. EXCLI journal,2015:14:59.