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Mini-review of Phytochemistry for Polyalithia Longiflia

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Abstract: The review was aimed to review the phytochemical of the Polyalithia longiflia. Phytochemical screening for all parts of Polyalithia longiflia have been done and shown most of the chemical group compounds such as glycosides, Sterol, Carbohydrates, terpenoids, flavonoids. 174compounds have been isolated from five parts (leaves, steam bark, seeds, fruits, root) of Polyalithia longiflia, these compounds have been drown their structure. Leaves of Polyalithia longiflia were extracted and isolated 99 compounds most of these compounds were terpenoids, 59 compounds were isolated from the stem bark belong to different chemical groups such as Terpenoids, Alkaloids, Phenol, Fatty acids, and Steroids, 16 compounds were isolated from the fruit from several chemicals groups, 11 compounds were isolated from the root,7 compounds were isolated from the seeds which belong to different chemical groups which are Terpenoids, Fatty Acids, and Carbohydrate. Many of these compound have been used in medical filed in many applications due to their activities which make this plant very important in medicine filed. Root of Polyalithia longiflia only three articles about it. Also seeds of Polyalithia longiflia have not been studied yet its phytochemical screening. The compounds have been drown with chemdrow application, and with PubChem.

INTRODUCTION

Polyalithia longiflia also know Asoka in Hindi [1], is one of the most common species in the genus *polyalithia* [2,3,74], it has been found in subtropical andtropical grounds. It is commonly found in Sri Lanka, Malaysia, India [4,5], Pakistan [6], Bangladesh [7], Taiwan [8, and Ghana [9]. *Polyalthia longifolia* is about 12 matter tall, It has a base that grows symmetrically [9], with short branches that having distinct marks [10].

Trees of *Polyalthia longifolia* are aesthetically pleasing structures [11], and due to their shape, they are often used as ornamentation in households [9]. It's a flowering plant [12], evergreen plant, whose leaves are about 1-1.5 cm in length [13, 5].

It has been used as a most important popular medical treatment [5], to treat a lot of diseases such as skin diseases, gonorrhea, fever [14], malaria [3], uterine disorders [6], hypertension, helminthiasis, febrifuge [15], duodenal ulcers, diabetics, [16], rheumatism, gastric ulcer etc [17].

Many chemical compounds isolatedifrom different parts of *Polyalthia longifolia*. leaves have been extracted and isolated methyl-16-oxo-cleroda-3,13(14)*E*-dien-15-oate, 2-oxokolavenicacid [10], 16a-hydroxylcleroda-3, 13 (14) Zdien-15,16-olide [18], Longitriol, Longimide A [19]**.**

16- oxocleroda-3,13E-dien-15-oic acid, darienine[9], cleroda-3-enepyrrole-15,16-dione,cleroda-3-ene-15, 16-diamide, and cleroda-3,13(14)E-diene-15,16-diamide, [3] isolated from stem bark of *Polyalthia longifolia.*

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A lot of these compounds which were isolated from different parts of *Polyalthialongifolia*, were determined against different pathogens and they have been shown interested results, 16- oxo-.cleroda-3,13-dien.-15-oic acid was showed good results against A549and MCF-7 cancer cells, as a antiproliferative [8], 16-oxocleroda-3,13(14)-E-diene-15-oicacid(a), 16a-hydroxycleroda- 3,13 (14)-Z-diene-15,16-olide(b) have been shown high efficiency as an antibacterial and antifungal activities [15], 16α-hydroxycleroda-3,13(14), Z-dien-15,16-olide has been shown exhibit against *Neurospora crassa, Cryptococcus neoformans* (antifungal) MIC were 201.2 and 100.6 μM respectively [20].

PHTYTOCHEMICAL OF POLYALTHIA LONGIFOLIA

2.1. Leaf of Polyalthia Longifolia

The leaves of Polyalthia longifolia grow alternately on the stem (spirally arranged).The leaf is simple, glossy, bright green-coloured above and paler beneath. The leaf is coriaceous and glabrous on both sides. The leaves have a 7-8 mm long petiole. The leaf of *Polyalthia longifolia* is 3-4 cm wide and15-25 cm long. The shape of the blade is lanceolate with wavy edges, the apex is acute, the base is cuneate and the margins are entire.

The venation of the leaf is reticulate with a prominent midrib. Phytochemical screening of leaves of *Polyalthia longifolia* has been studied and shown different chemical group compounds, steroids, phenolic compounds, tannins, saponins[21], Cardio glycosides, Sterols, Oils, Carbohydrates [16, 22], diterpenoids, triterpene [19], flavonoids, alkaloids, sugar [23].

Many studies were done on the leaves to isolated chemical compounds and they were mentioned 99 compounds from different chemical groups such asFlavonoids [12], Alkaloids [23], Phenols [16], and Steroids [32].

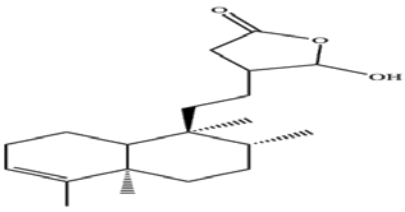
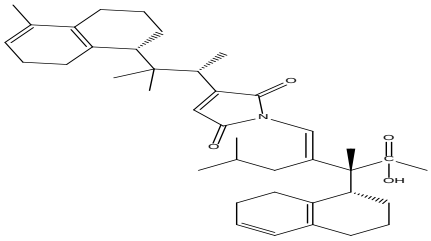
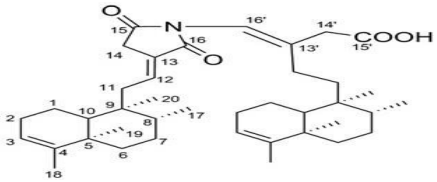
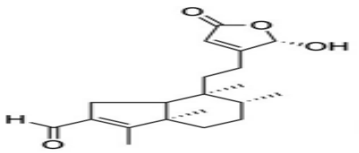
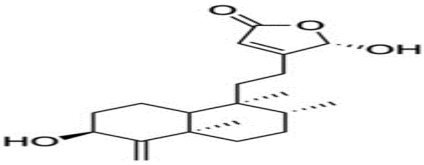
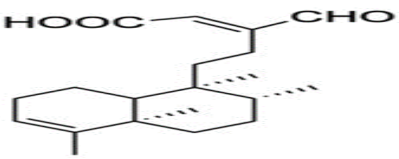
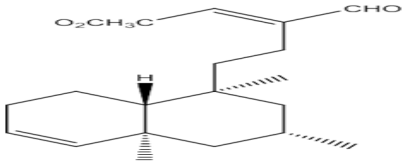
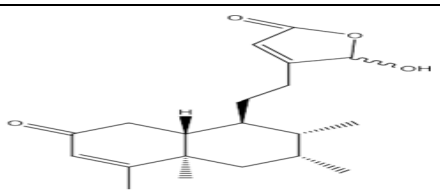
Many of these compounds were studies their antifungal and antibacterial agent [31],anti-ulcer activity [54], Antioxidant activity [13], Antihypergycemi [34], Hepatoprotective activity [27], Anticancer activity [55], Radioprotective activity [5], Protective effect [56], and antityrosinase [33].

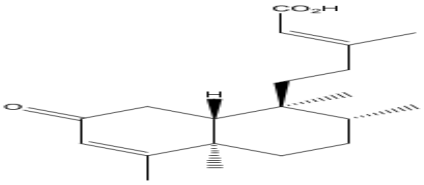
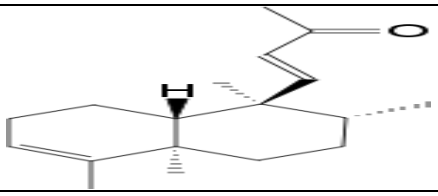
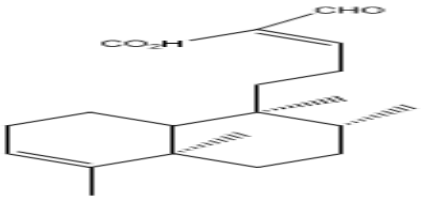
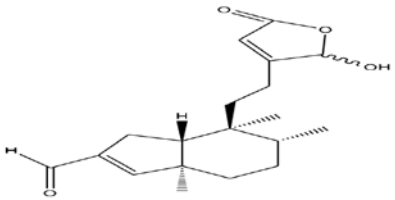
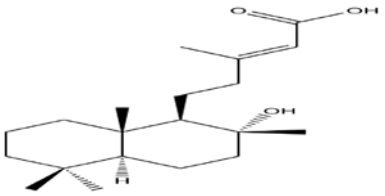
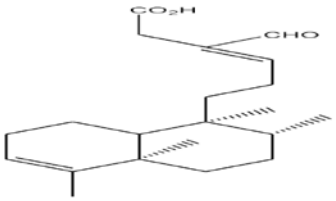
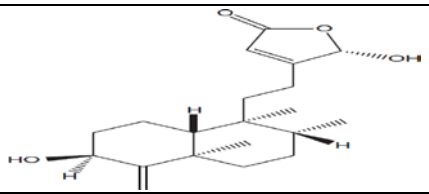
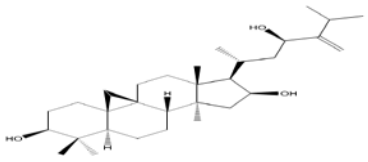
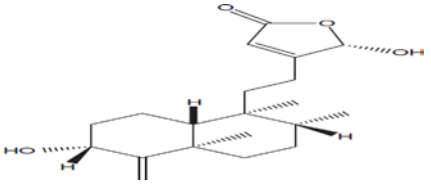
Leaves extract of *Polyalthia longifolia* were used as a green synthesized for nano-particles, where it was used to synthesized nano-silver along with D-sorbitol [57].Table 1 is shown the compounds which have been isolated from leaves.

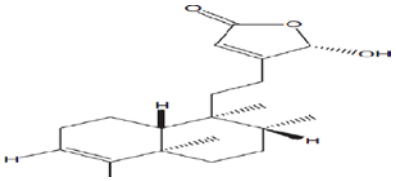
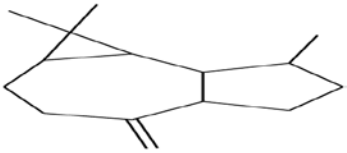
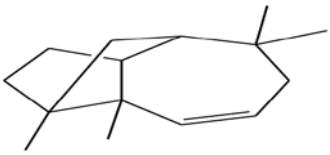
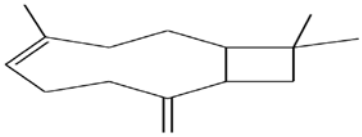
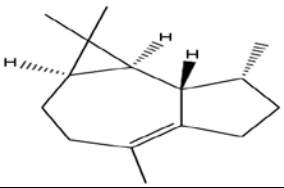
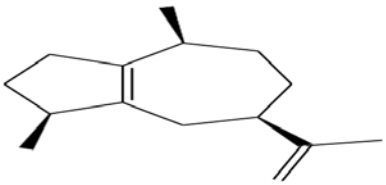
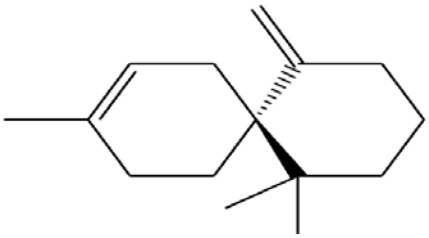
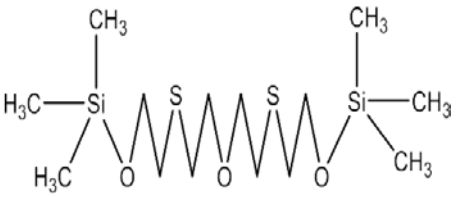
Figure 1: Leaves of polyalthia longifolia

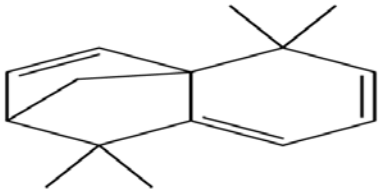
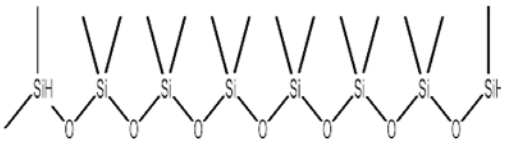
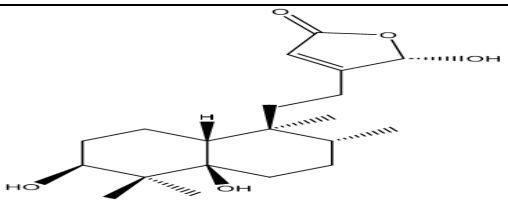
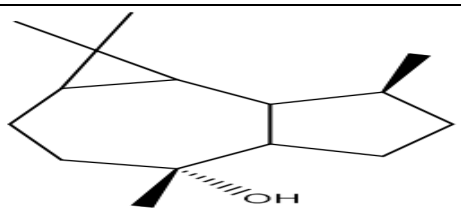
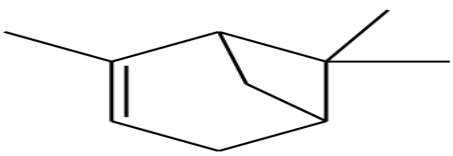
99 compounds were isolated from leaves belong to different chemical groups Terpenoids, Alkaloids, Flavonoids, Phenols, and Steroids.

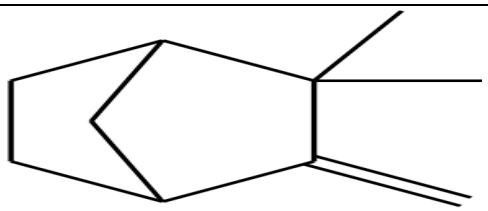
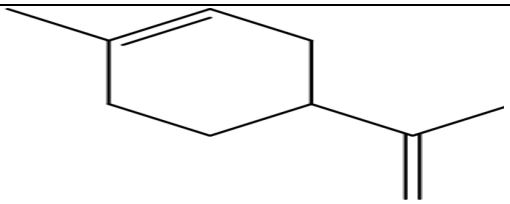
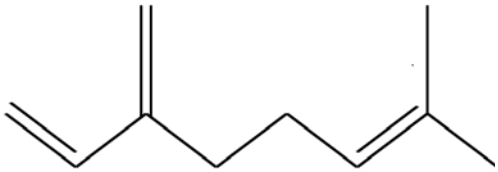
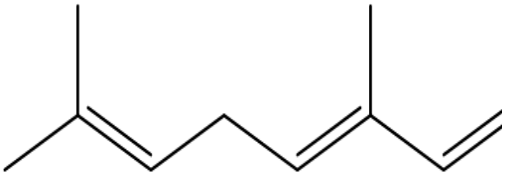
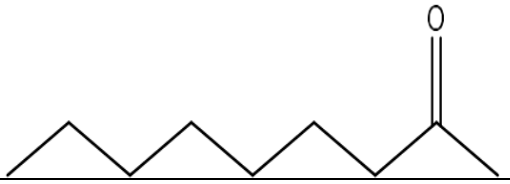
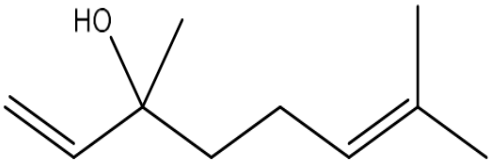
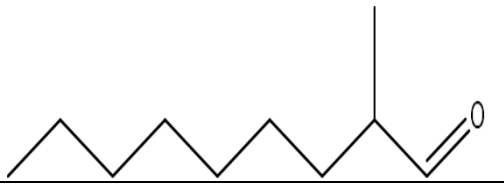
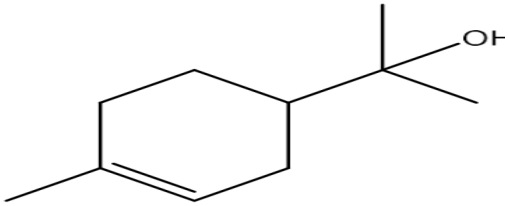
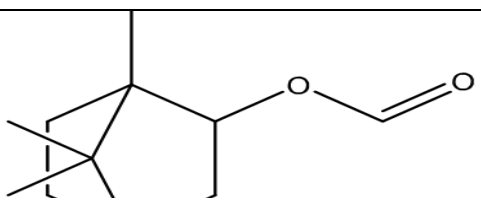
Table 1: Compounds were isolated from the leaves of *Polyalthia longifolia*

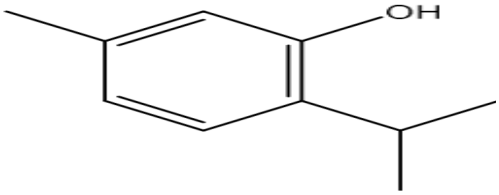
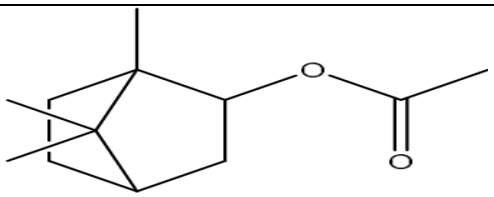
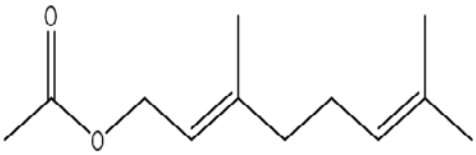
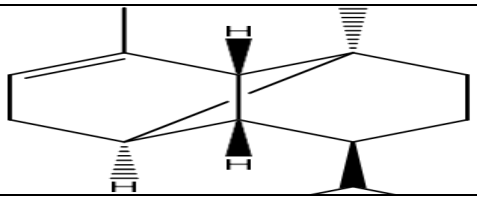
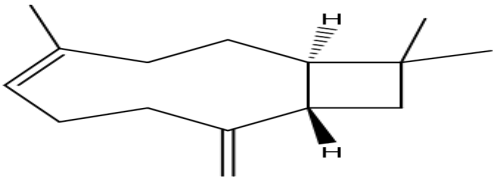
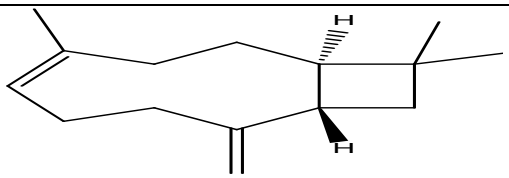
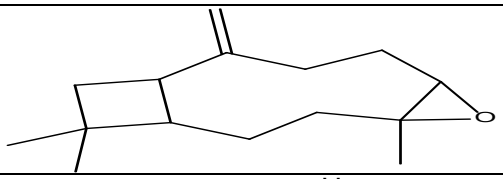
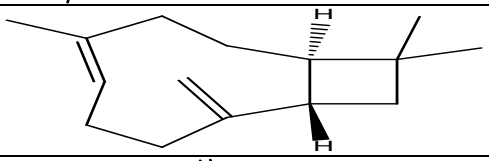
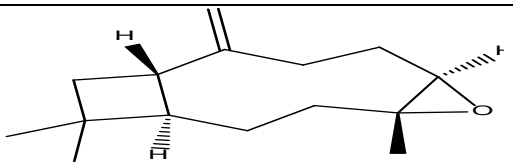
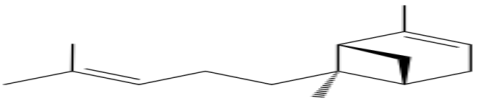
Group of compounds	Compounds		
	Name	Structures	References
Terpenoids	16α-hydrox,y -cleroda -3,13(14), Z- dien-15,16-olide **(1)**		[20, 24]
	Longimide A (**2**)		[19]
	Longimide(**3**)		
	(4-2)-abeo, 16(R/S)-2,13Z-k.olavadien -15,16- olide-3-al. (**4**)		[18]
	3β, 16 α-.di hydroxyl cleroda- 4(18), 13(14), Z-dien -15,16-olide . (**5**)		
	16-oxo cleroda, 3,13(14), E-diene.-15-oic acid. (**6**)		
	Methyl -16-oxo-cleroda -3,13(14),E-dien 15-oate.(**7**)		[10]
	2-oxo kolavenic acid (**8**)		

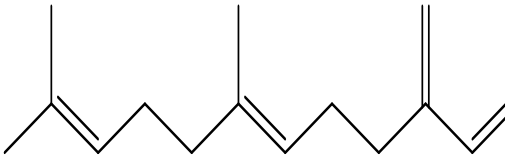
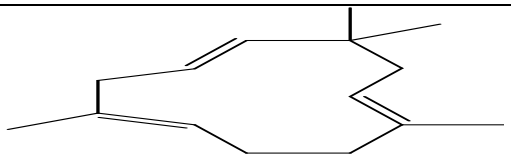
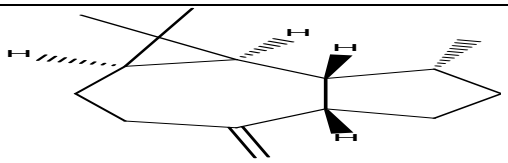
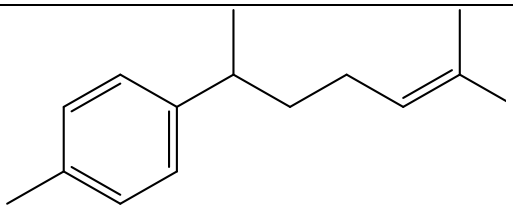
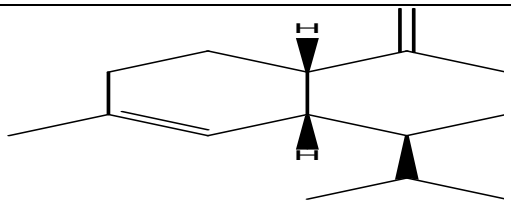
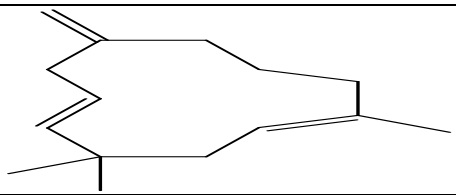
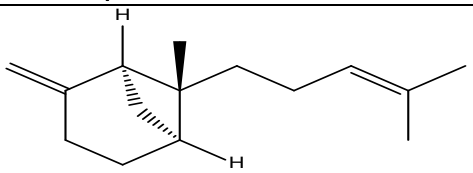
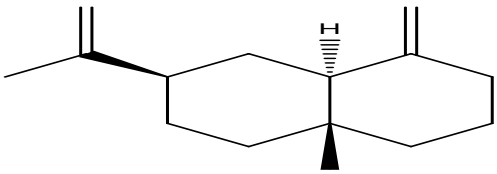
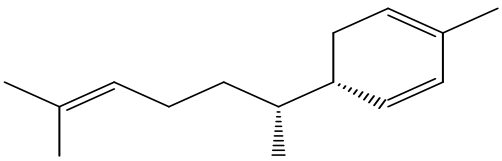
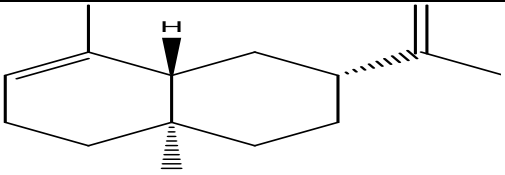
16 (R and n S)- hdroxy,-cleoda -3,13. (14)Z-dien -15,16- olide.-2-one (**9**),		
(4→2)-abeo 16(R and S)- hydroxyl cler oda,3,13(14)Z-dien -15,16-olide-3-al. (**10**)		
(-)-16 -oxo cleroda-3,13(14)		[26]
(-)-14,15-bisnor.-3,11E-kolavadien.13-one (**12**)		
(-)-3,12E-kolavadien 15-oic acid-16-al (**13**)		
(-)- labd-13Een,8ol -15-oic acid. (**14**)		
(-)-3β,16α- di-hydroxy- cleroda. 4(18), 13(14)Z-dien-15,16-olide (**15**)		[25]
(-)-3α,16α- di-hydroxycleroda-4(18),13(14)Z-dien-15,16-olide. (**16**)		
(-)-16-oxo cleroda-3,13(14) E-dien 15-oic acid (**17**)		

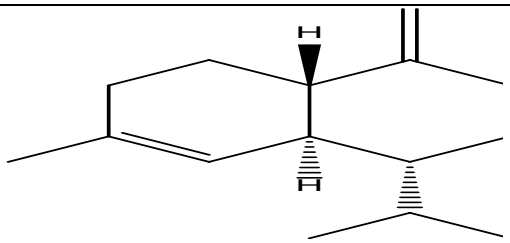
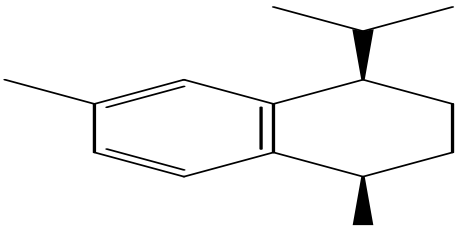
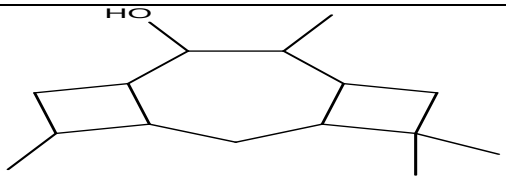
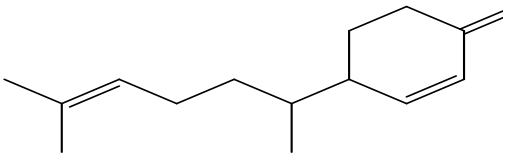
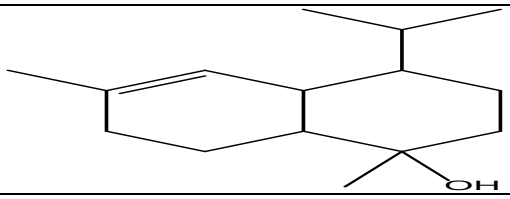
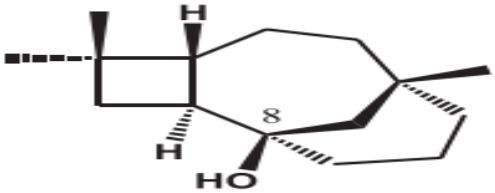
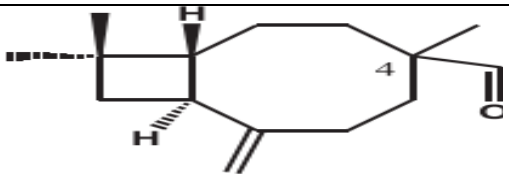
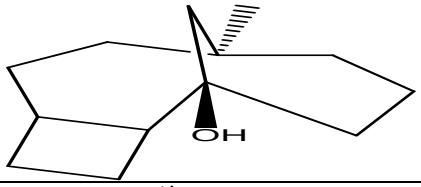
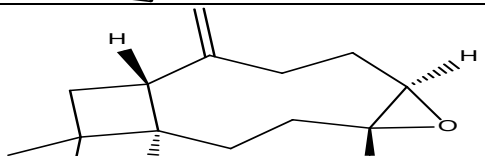
longitriol**(18)**		
Caryophyllene (**19**)		[27]
longifolene-(V4) (**20**		
aromadendrene (**21**)		
viridiflorene (**22**)		
α- guaiene (**23**)		
β-chamigrene (**24**)		
3,9,15-Tri-oxa-6,12-di-thia-2,16-di-silaheptadecane, 2,2,16,16-tetr-amethyl. (**25**)		[2]
2- propenoic acid-tridecyl ester (**26**)		

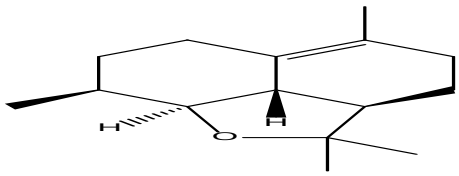
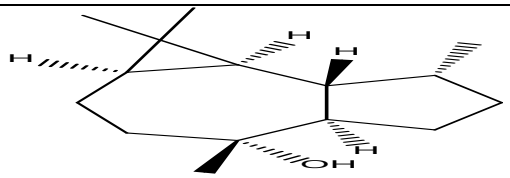
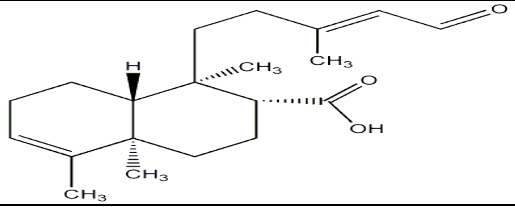
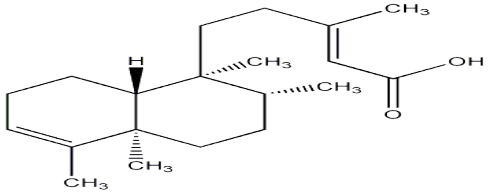
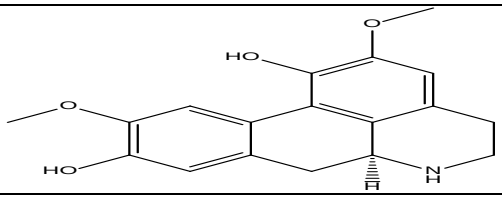
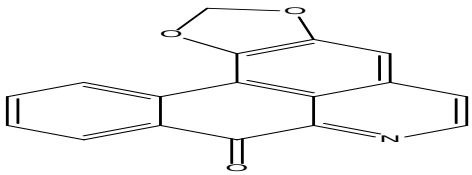
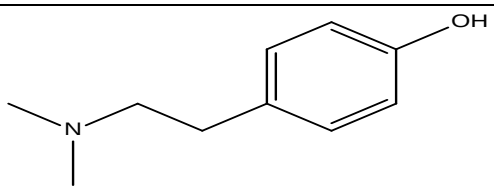
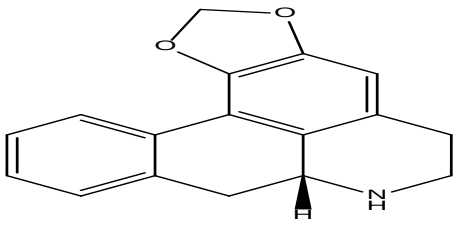
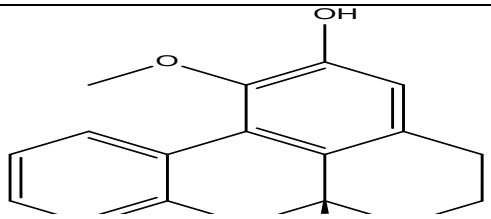
Pentadecanoic acid, 14-methyl, mthyl ester (**27)**		
Isolongifolene, 4,5,9,10-dehydro (**28**)		
9-Octadecenoic ,acid methyl ester (**29**)		
Octadecanoicacid - methylester.(**30**)		
9,15-Octadecadienoicacid,methy ester (Z,Z) (**31**)		
Octa-siloxane, .1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyl (**32**)		
3*β*, 5*β*, 16α-tri-hydroxyhalima-13(14)- en-15,16-oli de (**33**)		[28]
viridiflorol (**34**)		[29]
α-pinene (**35**)		

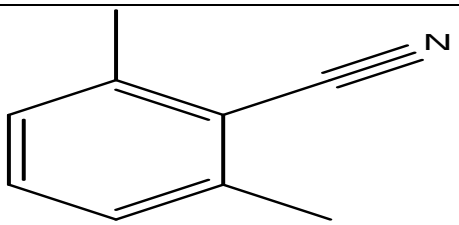
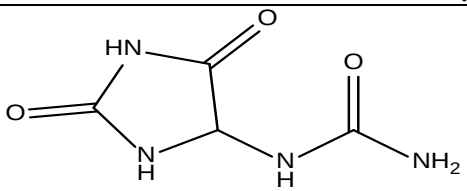
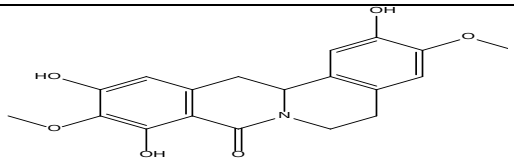
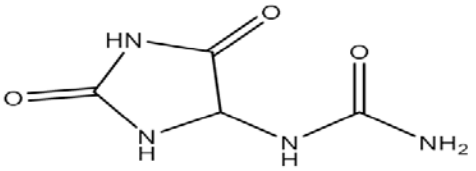
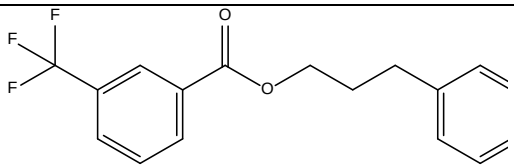
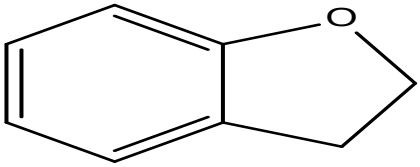
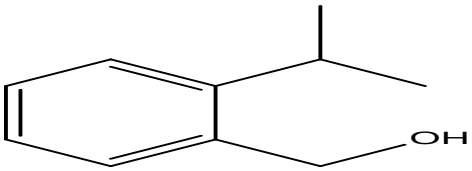
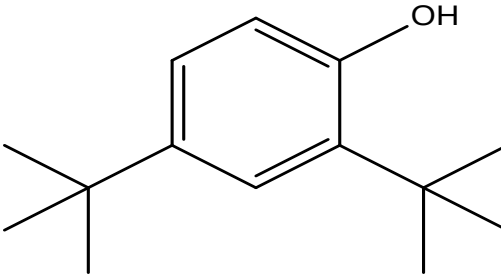
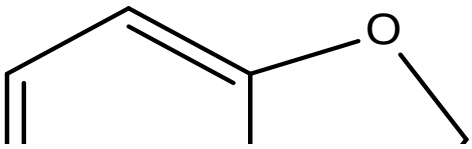
camphene (**36**)	
myrcene (**37**)	
limonene (**38**)	
(E)-β- ocimene (**39**)	
2-nonanone (**40**)	
linalool (**41**)	
2-methylnonanal(**42**)	
α-terpineol (**43**)	
Bornylformate (**44**)	

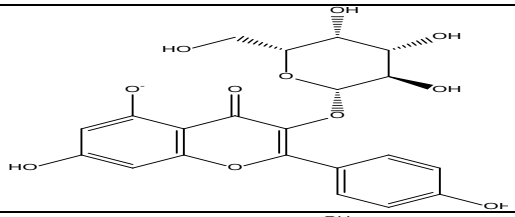
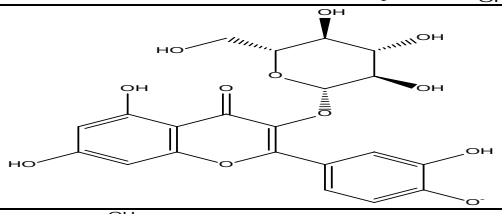
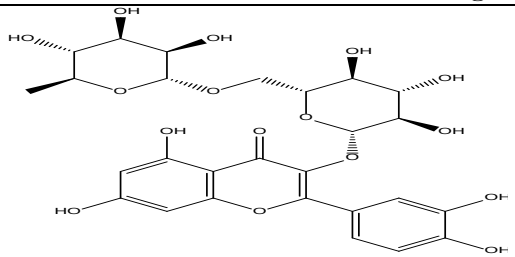
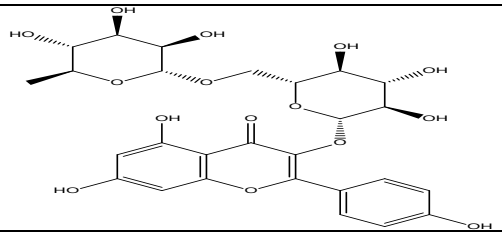
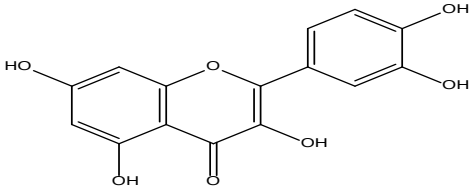
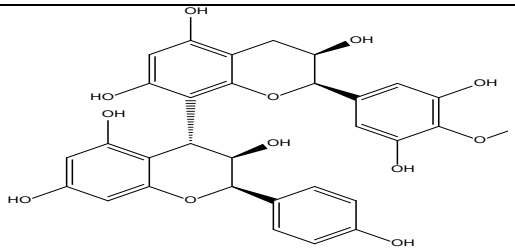
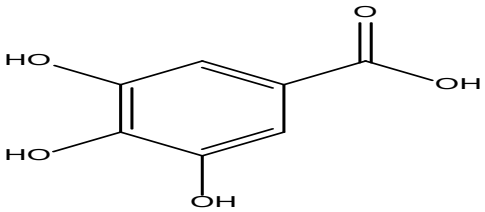
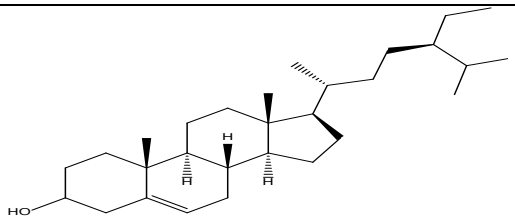
thymol (**45**)	
bornyl acetate (**46**)	
geranyl acetate (**47)**	
α-ylangene (**48**)	
α-copaene (**49**)	
isocaryophyllene (**50**)	
4,8-α-epoxycaryophyllane(**51**)	
(E)-β-caryophyllene (**52**)	
4,8-β-epoxycaryophyllane (**53**)	
trans-α-bergamotene (**54**)	

(E)-β-farnesene(**55**)	
α-humulene(**56**)	
Allo-aromadendrene(**57**)	
Arcurcumene(**58**)	
γ-muurolene (**59**)	
β-humulene (**60**)	
trans-β-bergamotene (**61**)	
β-selinene (**62**)	
α-zingiberene (**63**)	
α-selinene (**64**)	

γ-cadinene (**65**)	
calamenene (**66**)	
5,8-cyclocaryophyllan-4-ol (**67**)	
β-sesquiphellandrene (**68**)	
torreyol (**69**)	
caryolan-8-ola, palustrola (**70**)	
4-formyl-5-nor-β-caryophyllene.**(71)**	
4- Caryolanola. (**72**)	
Caryophyllene oxide (**73**)	

	5,11-epoxycadin-1(10)-enea (**74**)		
	Globulola (**75**)		
	kolavenic acid (**76**)		[30]
	Polyalthialdoic acid (**77**)		
Alkaloids	(+)-isoboldine (**78**)		[26]
	liriodenine (**79**)		
	hordenine (**80**)		
	(-)-anonaine (**81**)		
	(-)-asimilobine (**82**)		

	2,6-dimethylbenzonitrile (**83**)		[2]
	allantoin (**84**)		[18]
	(-)-8-oxopolyalthiaine (**85**)		[28]
	5-hydroxy-6-methoxyonychine (**86**)		[2]
Flavonoids	3-Trifluoromethylbenzoic acid, 3-phenylpropyl ester (**87**)		
	2,3-dihydrobenzofuran (**88**)		
	4-(1-methylethyl)benzenemethanol (**89**)		
	Phenol, 2,4-bis-(1,1-dimethylethyl) (**90**)		
	2,3-dihydrobenzofuran (**91**)		

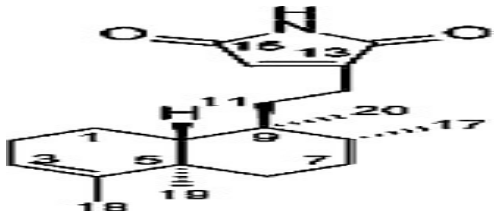
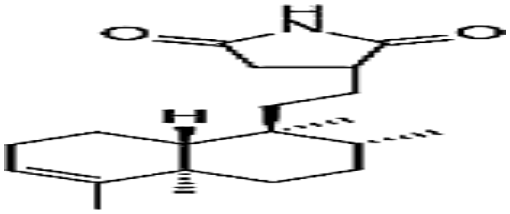
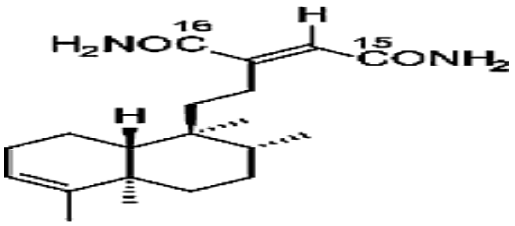
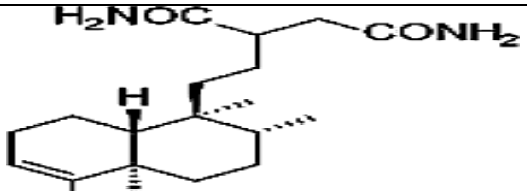
	Kaempfero.ln-3-O-β- rhamnopyranosyl.- (1-6)-β-galactopyranoside . (**92**)		[18]
	Quercetin-3-O -β-glucopyranoside (**93**)		
	Rutin (**94**)		
	Kaempfero l. -3-O-α- rhamnopyranosy . (1-6)-β – gluco-pyranoside. (**95**)		
	Quercetin (**96**)		[31,32]
Phenols	Proanthocyanidins (**97**)		[33]
	Gallic acid (**98**)		[14]
Steroids	β-sitosterol (**99**)		[32]

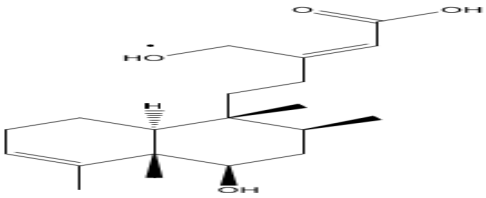
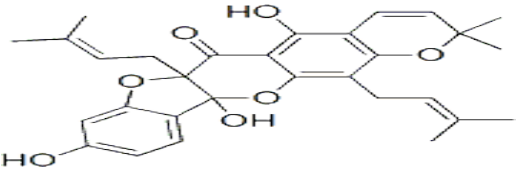
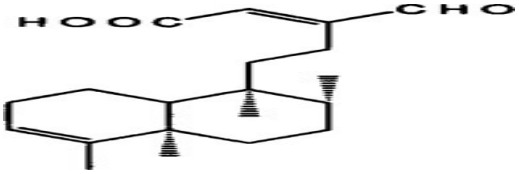
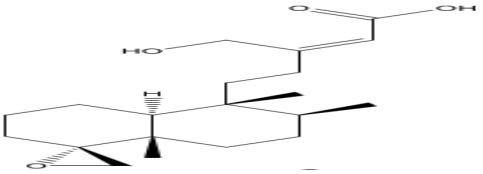
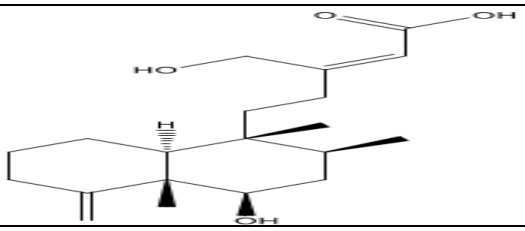
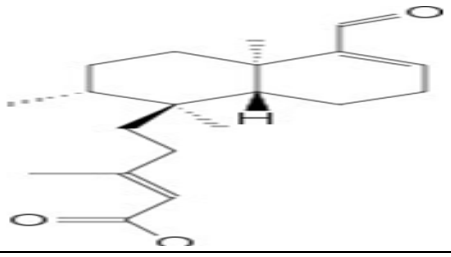
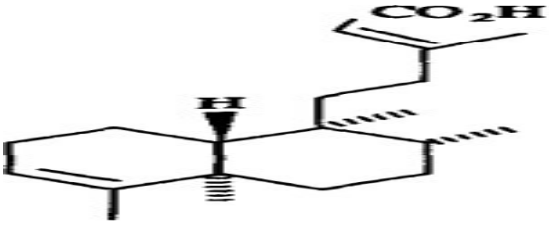
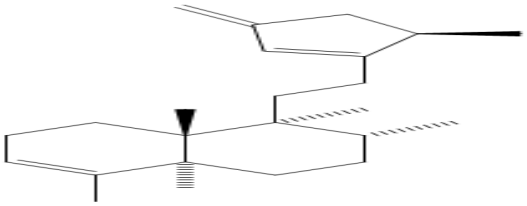
2.2. Stem bark of Polyalthia longifolia

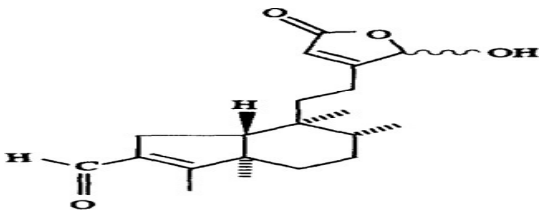
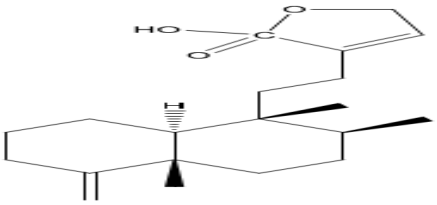
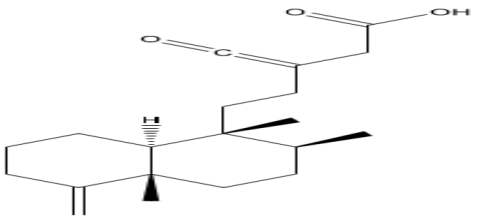
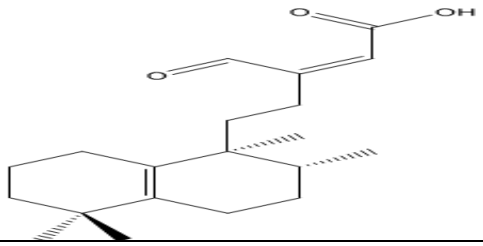
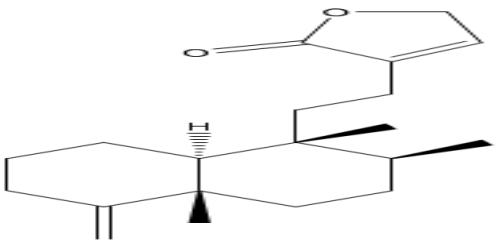
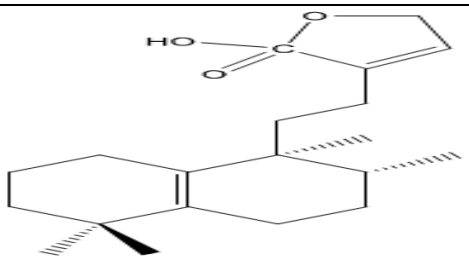
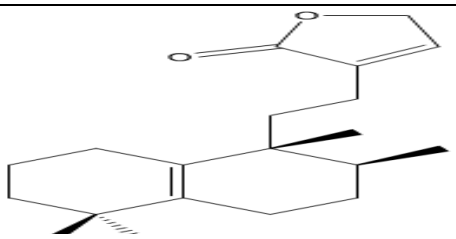
The tree characterized as An evergreen with a straight trunk, conical crown and slender drooping brenches, about 10-25 m tall. The bark of *Polyalthia longifolia* is pale brown greyish-coloured, longitudinally fissured and transversally cracked with age. grayish brown, branches sparsely puberulous when young, glabrous when mature. The Stems barkbof *Polyalthia longifoliab* studied its phytochemical screening and have been indicated terpenoids, tannins, flavonoids, steroids, phenoliccompounds[34], Reducing sugar, Glycoside, Alkaloids [35]. 59 compounds were isolated from stem bark. Many of these compounds were investigated their properties in medical and biological felids for many activities such as Antihyperglycemic and antioxidant activity [58], anticancer activity [59], Hypotensive activity [60], anti-ulcer activity [61], Antimicrobial activity [51], antinociceptive activity[62], and Antiplasmodial [63]. Table 2 is shown the compounds which have been isolated from stem bark.

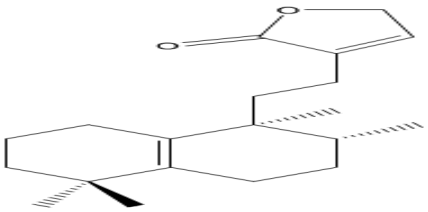
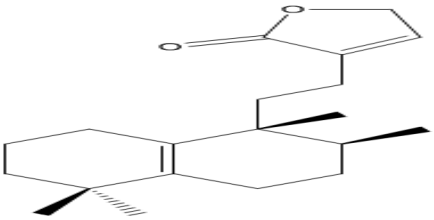
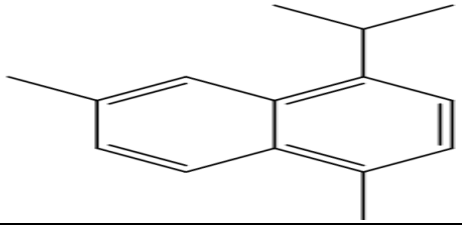
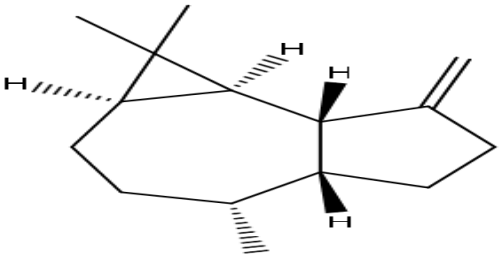
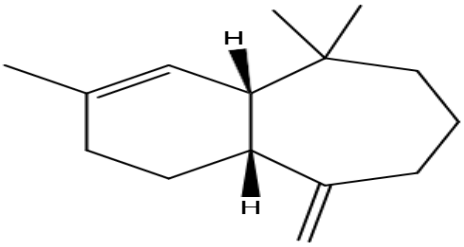
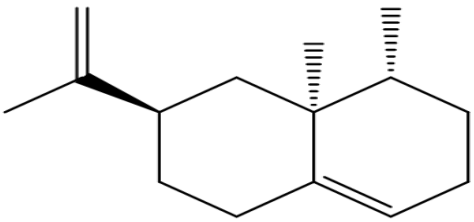
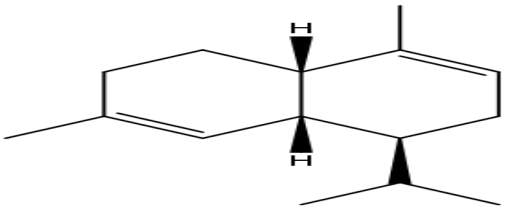
Figure 2: Stem bark of polyalthia longifolia

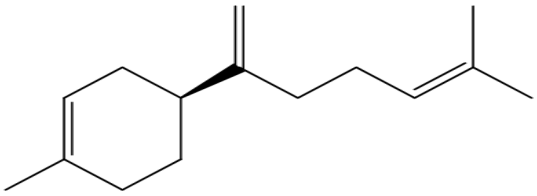
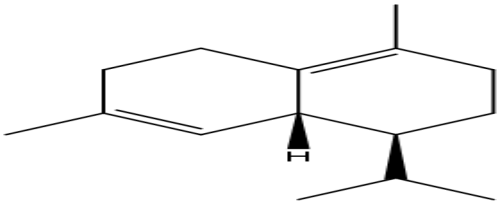
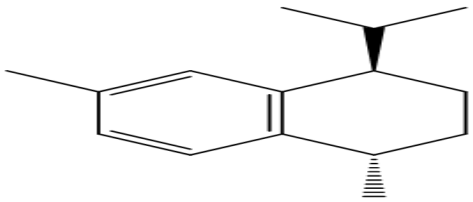
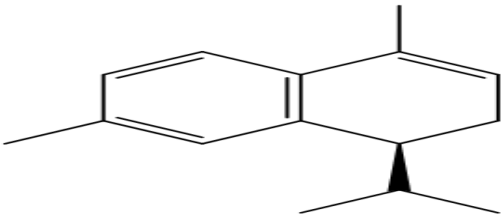
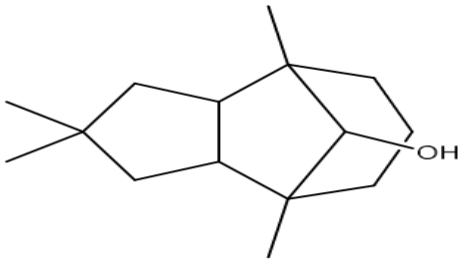
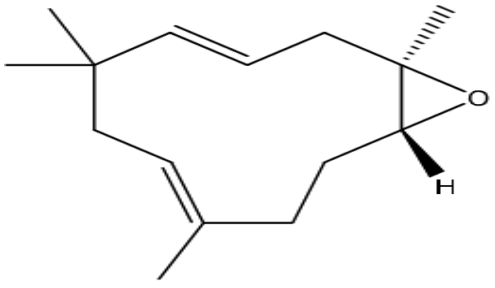
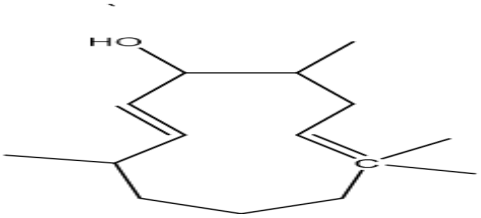
Table 2: Compounds which have been isolated from the stem bark

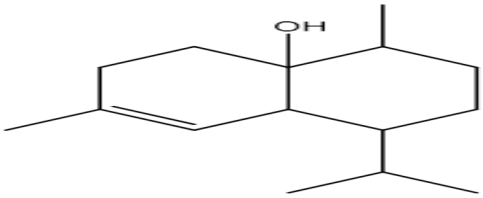
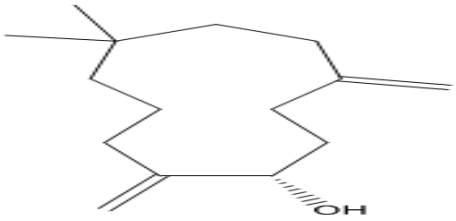
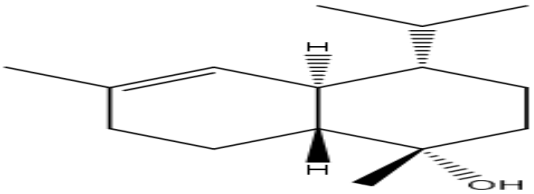
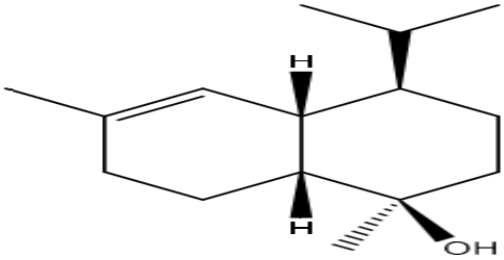
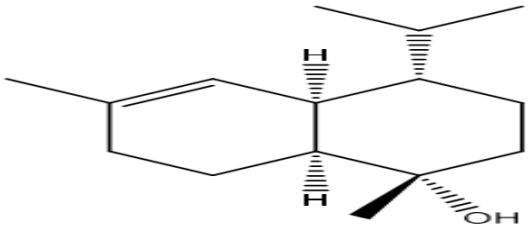
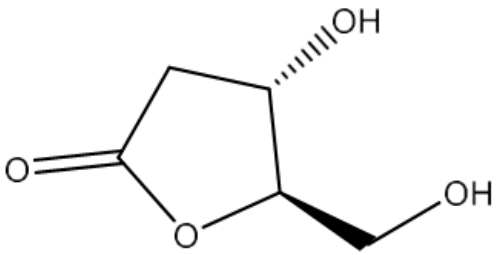
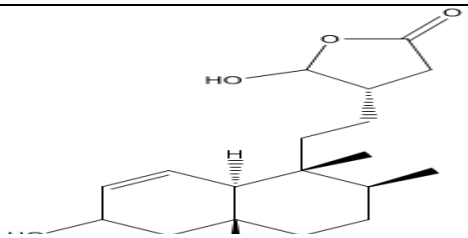
Group compounds	Compounds		
	Name of compounds	Structure	Referen
Terpenoids	Cleroda. -3-ene pyrrole. -15,16-dione. (**100**)		[3]
	Cleroda-3-ene., pyrrolidine. -15,16-dione. **(101)**		
	Cleroda. -3,13(14)E-diene. -15,16- di-amide (**102**)		
	Cleroda. -3-ene. -15, 16-di-amide. (**103**)		

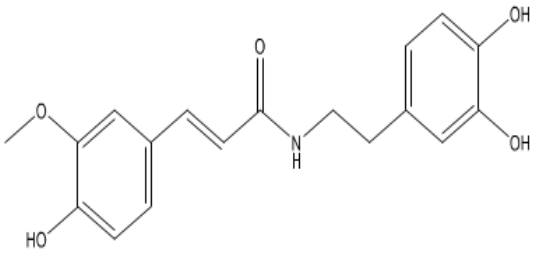
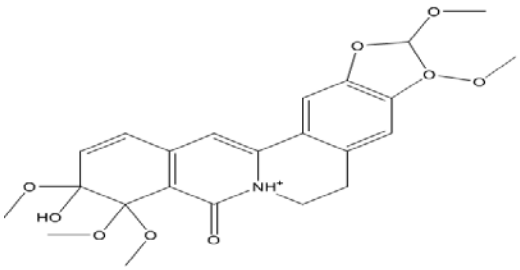
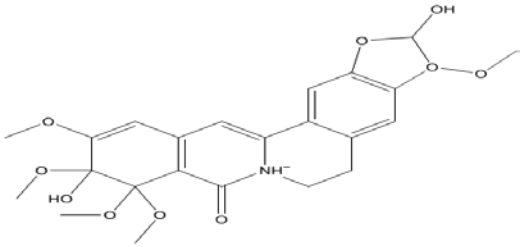
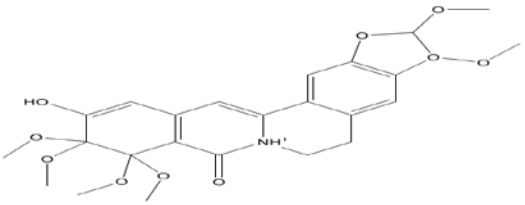
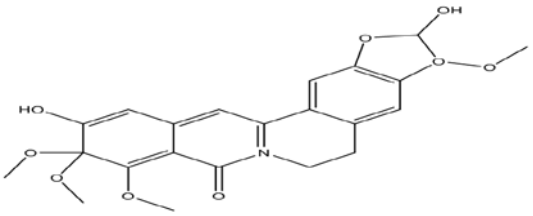
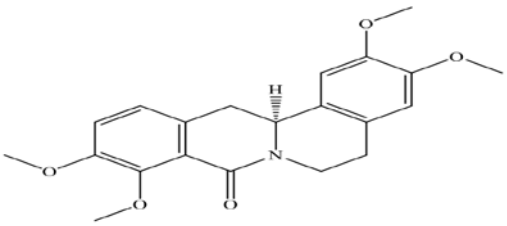
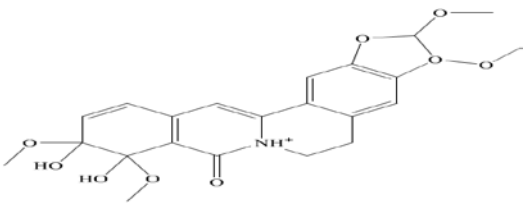
Group compounds	Compounds		
	Name of compounds	Structure	Referen
	(*Z*)-n4-hydroxy-3-(2″6″-hdroxy-5″-(hydroxylmethyl)- 5″,8″α-dinmethyloctahydro-1*H*-spiro[naphthalene-2″,2‴-oxiran]-1″-yl) ethydene.dihydrofuran-2(3*H*)-One.**(104)**		[34]
	16β-hydroxyncleroda. -3,13-dien-15,16-oliden.k**(105)**		[36]
	6R,16-diohydroxyncleroda. -3,13-dien-15-oickacid.**(106)**		[8]
	4R,18_- epoxym16-hydroxykclerod-13-en-15-oic acidn.n (**107**)		
	6R,16- di-hydroxmycleroda -4(18),13-dienm-15-oic acidm. (**108**),		
	2-oxo-3,13*En*clero-dienm15-oiciacid. (**109**)		
	3,13 E kolavadienj15 oiciacid. (**110**)		[37]
	16i(R and S)-3,13ZiKolavadien-16,15-olide-2ione. (**111**)		

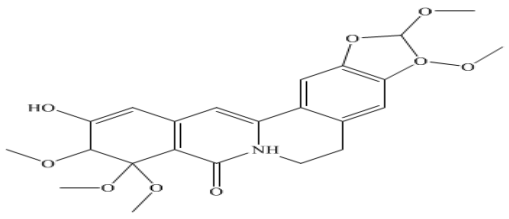
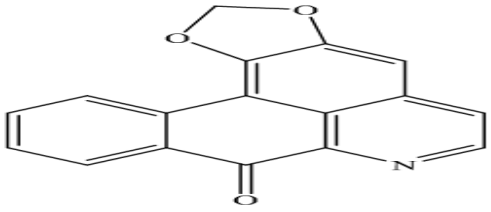
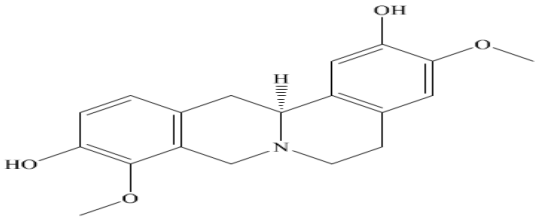
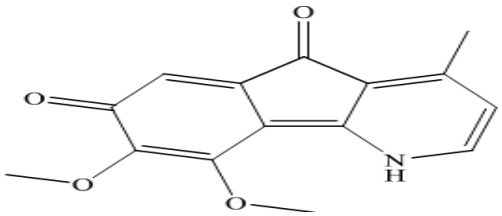
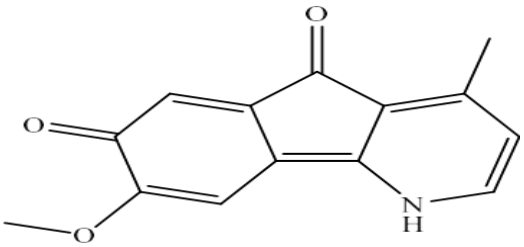
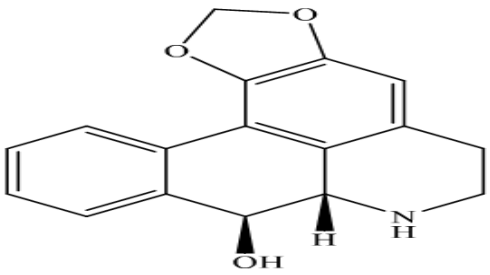
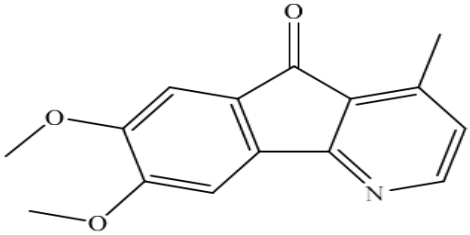
Group compounds	Compounds		
	Name of compounds	Structure	Referen
	(4~2)-abeo-16 (R and S)i2,13ZkKolavadien- 16,15-olide-3-al.i (**112**)		
	16- hydroxoycleroda-4 (18),13-dien-16,15-olideo.o (**113**)		[1]
	16- oxo -cleroda- 4(18),13E-dien.-oicacid.oioi, (**114**)		
	16-oxo-ent-halima, - 5(10),13 E-dien-15-oic acid. (**115**)		
	Cleroda. -4(18),-13- dien-16,15-olide. (**116**)		
	16-hydroxyentHalimaooo- 5(10), 13-dien-16,15-olidejkj. (**117**)		
	Ent-halima.-l(10),13 E-dien-16,15-olide. (**118**)		

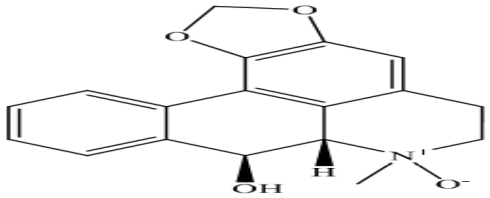
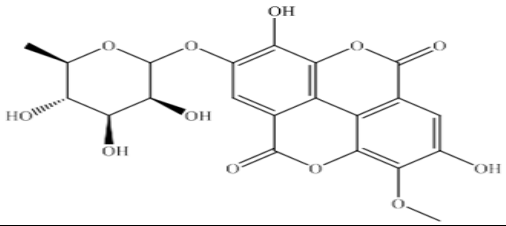
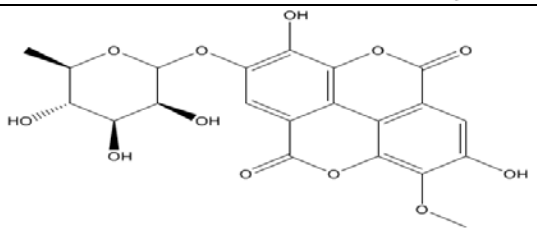
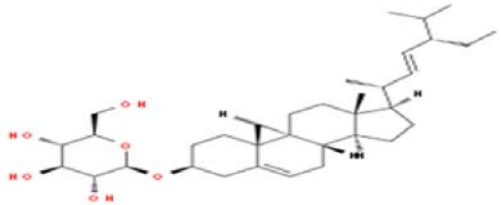
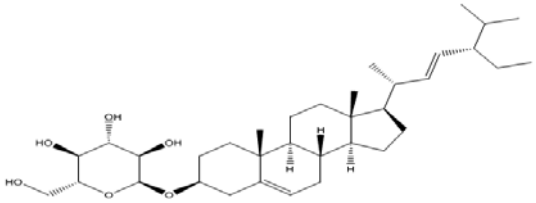
Group compounds	Compounds		
	Name of compounds	Structure	Referen
	Enthalima,u5(10),13-iidien-16,15-olide.pop (**119**)		
	Ent-halima,oo-5(10),13E-dien.-16,15-olidej.iuy (**120**)		
	Cadalene**(121)**		[38]
	β-gurjunene (**122**)		
	α- himachalene (**123**)		
	valencene**(124)**		
	α-muurolene (**125**)		

Group compounds	Compounds		
	Name of compounds	Structure	Referen
	β- bisabolene (**126**)		
	δ-cadinene**(127)**		
	Trans-calamenene**(128)**		
	α- calacorene**(129)**		
	Caryophyllene alcohol **(130)**		
	humulene oxide II **(131)**		
	Humul-m1,6-dienj 3-olm**(132)**		

Group compounds	Compounds		
	Name of compounds	Structure	Referen
	1-epi-cubenol **(133)**		
	nnCaryophyllan-4(14), 8 (15)-dien-o5β-olio**(134)**		
	τ-cadinoln**(135)**		
	τ-muurolol**(136)**		
	α –muurolol**(137)**		
	(3S,4R)-3,4,5-tri-hydroxy-pentanoic acid-1,4-lactone **(138)**		[11]
	3,16-di-hydroxylocleroda.m4(18),13 (14) Z-dienm15,16-olidem.**(139)**		[39]

Group compounds	Compounds		
	Name of compounds	Structure	Referen
Alkaloids	*N-trans*-feru.loyldopamine (**140**)		[8]
	(-)-8-noxo-10-mhydroxy-2,3,9-trimethoxyberberine (**141**)		
	(-)-8-oxom-2,10-diohydroxy-m3,9,11-trimethoxyberberine (**142**)		
	(-)-8- oxo-11-hydroxy-2,3,9,10- [8] tetramethoxyberberine (**143**)		
	(-)-8m-moxo-2,11-dimhydroxy-3,10-dimethoxyberberine(**144**)		
	8-oxomtetra- hydroplamatine. (**145**)		
	(-)-8-oxo-9,10-di-hydroxy-2,3-di-methoxyberberine. (**146**)		

Group compounds	Compounds		
	Name of compounds	Structure	Referen
	(-)-8-oxo- 11-hydroxy-2,3,9- tri-methoxy- berberine. (**147**)		
	Liriodenine**(148)**		[11]
	L-stepholidine**(149)**		[38]
	Darienine**(150)**		
	Isooncodine**(151)**		
	Noroliveroline**(152)**		
	Polyfothine**(153)**		

Group compounds	Compounds		
	Name of compounds	Structure	Referen
	Oliveroline-β-N-oxide **(154)**		
Phenol	3-O-methyl ellagic acid 4'-rhamnoside **(155)**		[41
Fatty acids	1-*O*- (9*Z*,12*Z*octadecadienoyl) glycerol **(156)**		[38]
	1-*O*-(9*Z*octadecadienoyl) glycerol **(157)**		
Steroids	stigmasterol 3*β*-Dglucopyranoside(**158**)		[8]
	β-sitosterol 3*β*-Dglucopyranoside**(159)**		

59 compounds were isolated from the stem bark belong to different chemical groups such as Terpenoids, Alkaloids, Phenol, Fatty acids, and Steroids. Many of these compound have been used in medical filed in many applications due to their activities which make this plant very important in medicine filed.

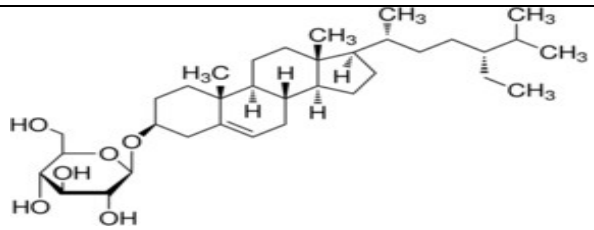
Seeds of Polyalthia longifolia

The seeds of *Polyalthia longifolia* are pale brown, ellipsoid 0.8-1 cm wide and, 1-1.2 cm long, usually with a longitudinal groove. There is only one seed per fruit.Seeds of *Polyalthia longifolia* have been extraction [42], and detected fatty acids[43, 44], terpenoids [15], carbohydrate [45], Terpenoids compound were isolated from seeds of *Polyalthia longifolia* compound **(6)**, **(76)** [46], compound **(1)** [15], fatty acids compound have been indicated cis-9- octadecenoic acid **(160)**, cis-9,12- octadecenoic acid

(161), octadecanoic acid **(162),** linolenic acid**(163)** [43]. Seeds have been studies to check their properties in biological and medical felids and have been investigated many activities such as Antimicrobial activity [15], Anti-inflammatory and cytotoxic[64], Adsorbent for the Removal of Cd(II) [65], Antifungal activity [66], Anti-proliferative [67], and Antioxidan [68]. Table 3 is shown the chemical compounds which were isolated from seeds.

Figure 3: Seeds of polyalthia longifolia

Table 3: Chemical compounds were isolated from seeds

Chemical groups	Compounds structure	Compounds structure	Ref
fatty acids	 **(161)**	 **(162)**	[43]
	 **(163)**	 **(160)**	

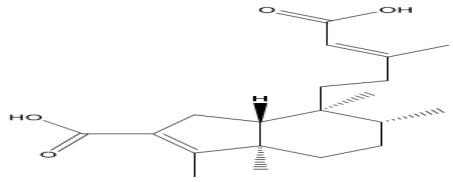
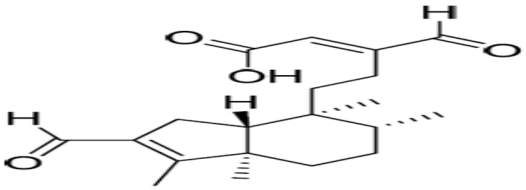
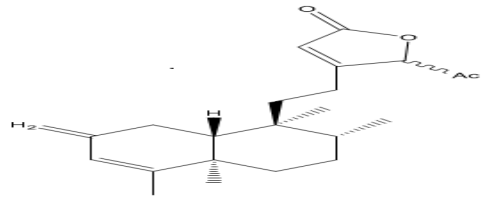
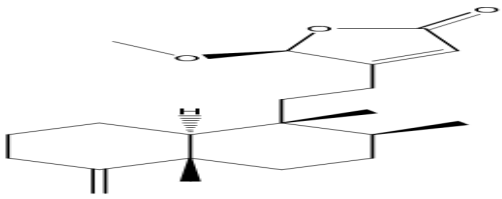
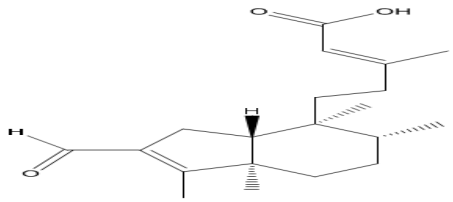
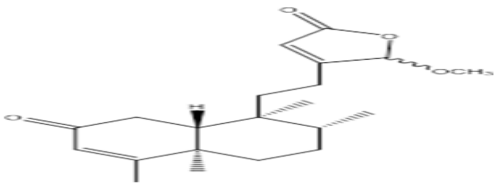
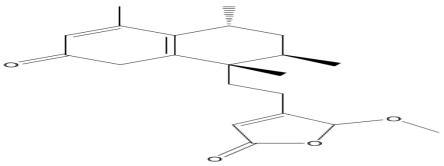
7 compounds were isolated from the seeds which belong to different chemical groups which are Terpenoids,Fatty Acids, and Carbohydrate.

Fruits Polyalthia longifolia

The fruit of *Polyalthia longifolia* is a berry. They grow in cluster of 10-20. The berry is about 1.2 cm wide and 2 cm long with a 1.2 cm long peduncle. The fruit is dark brown-purple-coloured when ripe and it contains 1 seed. Phytochemical screening has been done on fruits (Unripe Pericarp Ripe and) of Polyalthia longifolia [47], and have been indicated Alkaloids, flavonoids, glycosides, sterols, tannins [49], saponins, terpenoids [48], and phenolics [50]. Terpenoids were investigated from the fruits of Polyalthia longifolia and characterized compound (5, 6, 7, 8, 9 , 10) 16(R and S)-mAcetoxy-cleroda.m-3,13(14)Z-dien-15,16-olide (164) [51], (4→2)-mabeo-2,13-di-formyl-cleroda-2,13E-dien-14-oic.Acid. (165), (4→2)-abeo-cleroda-2,13E-mdien, -2,14dioic.n (166), 16(R&S)-methoxy-clerodajm.4(18),13-dien-15,16-olide. (167), solidagonal acid (168), compounds (33),(1), polylongifoliaonsA (169), polylongifoliaons b (170),polylongifoliaic A (171), [40]. Some studies were done for fruit in many medical and biological applications such as Antifungal activity [4], antioxidant activity [69], Pharmaceutical activities [69], and Hepatoprotective [70].

Figure 4: Fruits ofPolyalthia longifolia

Table 4: Compounds Which Were Isolated From The Fruit

Chemical groups	Compounds structure	Compounds structure	Reference
Phenols	 **(164)**	 **(165)**	[40]
	 **(166)**	 **(167)**	
	 **(168)**	 **(170)**	
	 **(171)**		

16 compounds were isolated from the fruit from several chemicals groups. Many of these compounds were investigated for many medical application due to their biological activates. However there are only a few studies about fruit which can be considered as a gup to future work.

Root of Polyalthia longifolia

Root of *Polyalthia longifolia* has been studied its phytochemical constituents and indicated alkaloids, terpenoids, saponin glycosides, reducing sugars [52], 3, 4(18),12-E-kolavadien-15- oic acid-16-al (172), compounds (13), (76) as terpenoids have been isolated and identified from root of *Polyalthia longifolia*. Alkaloids compounds from the root of *Polyalthia longifolia* have been isolated lysicamine (173),

bisclerodane imide (174), and compound (78)[53]. *Polyalthia longifolia* has been studied its phytochemical constituents and indicated alkaloids, terpenoids, saponin glycosides, reducing sugars [52], 3, 4(18),12-E-kolavadien-15- oic acid-16-al (172), compounds (13), (76) as terpenoids have been isolated and identified from root of *Polyalthia longifolia*. Alkaloids compounds form the root of Polyalthia longifolia have been isolated lysicamine (173), bisclerodane imide (174), and compound (78)[53].

Figure 5: Root of Polyalthia longifolia

11 compounds were isolated from the root. Many of these compounds have been used in many medical applications due to their biological ability such as Hypotensive activity and toxicology [71], Antimicrobial [11], Antipyretic activity[52], and Potential Nutraceutical [72]. There are not many studied about the root and due to the biological activates for it, it may be a god target to the future studies such as Nano-filed in green synthesized.

CONCLUSIONS

The phytochemical and biological activities of *Polyalthia longifolia* is very effective and useful in medicinal study. The plantscomes underthe *Polyalthia* longifolia has demonstrated the medicinal values in the research studies. Before the research begun the ancient people have identified the medicinal valuesand nutrition strength of the plants in the Asian Countrieslike India, Malaysia, China and Pakistan etc.. The different partsof the plants are useful to cure different diseases. The dreadful diseases like cardio vascular arrests, hyperglycemia, high blood pressure, diabetes are curable with theparts of the plants comes under the category of *Polyalthia longifolia*. The above review has revealed the significance of phytochemicals of *Polyalthia longifolia* in detail. The plants and shebs belongs to polyalthia genus are widely seen in Asian Countries and have been used by the villagers for their health protection. Some of the leaves of *Polyalthia longifolia* have been used widely as anti- inflammatory paste for their skin problems. The research studies conducted on these plants have revealed unbelievable facts that the plants are rich with high medicinal values. The parts of the plants have demonstrated the antifungal activities, anti-microbial activities and high nutritional values. The biological activities of *Polyalthia longifolia* are provided be medicinal and nutritional.

REFERENCES

[1] Hara, Noriyuki, Hitomi Asaki, Yoshinori Fujimoto, YogeshKumar Gupta, Ashish Kumar Singh, and Mahendra Sahai. and ent-halimane diterpenes from Polyalthia longifolia." Phytochemistry 38, no. 1 (1995): 189-194.

[2] Vijayarathna, Soundararajan, Chern Ein Oon, Yeng Chen, Jagat R. Kanwar, and Sreenivasan Sasidharan. "Polyalthia longifolia Methanolic Leaf Extracts (PLME) induce apoptosis, cell cycle arrest and mitochondrial potential depolarization by possibly modulating the redox status in hela cells."Biomedicine & Pharmacotherapy89(2017):499- 514.

[3] Annan, Kofi, Edmund Ekuadzi, Cindy Asare, Kwame Sarpong, Dominik Pistorius, Lukas Oberer, Ben A. Gyan, and Michael Ofori. "Antiplasmodial constituents from the stem bark of Polyalthia longifolia var pendula." Phytochemistry Letters 11 (2015): 28-31.

[4] Dileep, N., Syed Junaid, K. N. Rakesh, K. T. R. Prashith, and N. A. S. Noor. "Antifungal activity of leaf and pericarp of Polyalthia longifolia against pathogens causing rhizome rot of ginger." Science, technology and arts Research Journal 2, no. 1 (2013): 56-59.

[5] Jothy, Subramanion L., Yeng Chen, Jagat R. Kanwar, and Sreenivasan Sasidharan. "Evaluation of the Genotoxic Potential against-Radical-Mediated DNA Damage andAcute Oral Toxicity of

Standardized Extract of Polyalthia longifolia Leaf." Evidence-Based Complementary and Alternative Medicine 2013(2013).

[6] Katkar, K. V., Suthar, A. C., & Chauhan, V. S. (2010). The chemistry, pharmacologic, and therapeutic applications of Polyalthialongifolia. Pharmacognosy reviews, 4(7),62.

[7] Moniruzzaman, Md, Afia Ferdous, and Fatama Wahid Bokul. "Evaluation of antinociceptive activity of ethanol extract of bark of Polyalthia longifolia." Journal of ethnopharmacology172 (2015):364-367.

[8] Lee, Tzong-Huei, Mei-Jhen Wang, Pi-Yu Chen, Tung-Ying Wu, Wu-Che Wen, Fu-Yu Tsai, and Ching-Kuo Lee. "Constituents ofPolyalthia longifolia var. pendula."Journal of natural products 72, no. 11 (2009): 1960-1963.

[9] Gbedema, S. Y. (2014). Antiplasmodial evaluation of extracts of selected Ghanaian medicinal plants and other bioactivities of isolates of polyalthia longifolia var. pendula (annonaceae)(Doctoral dissertation).

[10] Gbedema, Shaheen, Rashid Ali - Khan,- Najma Rasool Mughal, Mariam Shafique Malik, Kaneez e Sayyeda Sajjadi, and Aqeel Ahmad. "Antimicrobial activity of various parts of Polyalthia longifolia var. pendula: isolation of active principles from the leaves and the berries." Phytotherapy Research 22, no. 7 (2008): 907-912.

[11] Faizi, Shaheen, Rashid Ali Khan, Soobia Azher, Shakeel Ahmed Khan, Saima Tauseef, and Aqeel Ahmad. "New antimicrobial alkaloids from the roots of Polyalthia longifolia var. pendula." Planta medica 69, no. 04 (2003): 350-355.

[12] Doshi, Gaurav M., and H. D. Une. "Screening of Polyalthia Iongifolia Leaves as Potential Immunomodulatory." Int J. Pharmacol 11, no. 2(2015):106-113.

[13] Jothy, S. L., Aziz, A., Chen, Y., & Sasidharan, S. (2012). Antioxidant activity and hepatoprotective potential of Polyalthia longifolia and Cassia spectabilis leaves against paracetamol-induced liver injury. Evidence-Based Complementary and Alternative Medicine, 2012.

[14] Sampath, M. "Isolation and identification of gallic acid from Polyalthia longifolia (Sonn.) Thawaites." Int. J. Pharm. Biol. Sci 4 (2013): 966-972.

[15] Murthy, M. Marthanda, M. Subramanyam, M. Hima Bindu, and J. Annapurna. "Antimicrobial activity of clerodane diterpenoids from Polyalthia longifolia seeds." Fitoterapia 76, no. 3-4 (2005): 336-339.

[16] Thenmozhi, M., and Sivaraj Rajeshwari. "Phytochemical analysis and antimicrobial activity of Polyalthia longifolia."International Journal of Pharma and Bio Sciences 1, no. 3 (2010): 1-7.

[17] Moniruzzaman, Md, Afia Ferdous, and Fatama Wahid Bokul. "Evaluation of antinociceptive activity of ethanol extract of bark of Polyalthia longifolia." Journal of ethnopharmacology172 (2015):364-367.

[18] Sashidhara, Koneni V., Suriya P. Singh, Anuj Srivastava, and Anju Puri. "Identification of the antioxidant principles of Polyalthia longifolia var. pendula using TEAC assay." Natural product research 25, no. 9 (2011): 918-926.

[19] Sashidhara, Koneni V., Suriya P. Singh, Jayanta Sarkar, and Sudhir Sinha. "Cytotoxic clerodane diterpenoids from the leaves of Polyalthia longifolia." Natural product research 24, no. 18 (2010): 1687-1694.

[20] Bhattacharya, Asish K., Hemender R. Chand, Jyothis John, and Mukund V. Deshpande. "Clerodane type diterpene as a novel antifungal agent from Polyalthia longifolia var. pendula."European journal of medicinal chemistry 94 (2015): 1-7.

[21] Doshi, G. M., Zine, S. P., Chaskar, P. K., & Une, H. D. (2014). Solicitation of HPLC and HPTLC Techniques for Determination of Rutin from Polyalthia longifolia Thwaites.Pharmacognosy research, 6(3), 234.

[22] Danlami, Uzama, Ahmadu Rebecca, David Bwai Machan, and Thomas Sunday Asuquo. "Comparative study on the antimicrobial activities of the ethanolic extracts of lemon grass and Polyalthia longifolia." Journal of Applied Pharmaceutical Science 1,no.9(2011):174.

[23] Pal, Rashmi Saxena, Yogendra Pal, A. K. Rai, Pranay Wal, Ankita Wal, Ashish Srivastava, Suresh Chandra, and Nikita Saraswat. "Physico-chemical and phytochemical evaluation of crude drug powder (leaves) of Polyalthia longifolia." Journal of Pharmacognosy and Phytochemistry 5, no. 3 (2016): 212.

[24] Gupta, Vivek Kumar, Nimisha Tiwari, Priyanka Gupta, Surjeet Verma, Anirban Pal, Santosh Kumar Srivastava, and Mahendra Pandurang Darokar. "A clerodane diterpene from Polyalthia longifolia as a modifying agent of the resistance of methicillin resistant Staphylococcus aureus." Phytomedicine23, no. 6 (2016): 654-661.

[25] Sashidhara, Koneni V., Suriya P. Singh, Ruchir Kant, Prakas R. Maulik, Jayanta Sarkar, Sanjeev Kanojiya, and K. Ravi Kumar. "Cytotoxic cycloartane triterpene and rare isomeric bisclerodane diterpenes from the leaves of Polyalthia longifolia var. pendula." Bioorganic & medicinal chemistry letters 20, no. 19 (2010): 5767-5771.

[26] Sashidhara, Koneni V. "Antimicrobial evaluation of clerodane diterpenesfromPolyalthia longifolia var. pendula." (2009).

[27] Jain, Tripta, and Kanika Sharma. "Bioassay-Guided Isolation and Identification of Antifungal Compounds from Polyalthia longifolia Benth. & Hook." Journal of Biologically Active Products from Nature 3, no. 2 (2013): 106-114.

[28] Chen, Chung-Yi, Fang-Rong Chang, Yao-Ching Shih, Tian-Jye Hsieh, Yi-Chen Chia, Huang- Yi Tseng, Hua-Chien Chen, Shu-Jen Chen, Ming-Chu Hsu, and Yang-Chang Wu. "Cytotoxic Constituents of Polyalthia l ongifolia var. p endula." Journal of Natural Products 63, no. 11 (2000): 1475-1478.

[29] Ouattara, Zana A., Jean Brice Boti, Antoine Coffy Ahibo, Sylvain Sutour, Joseph Casanova, Félix Tomi, and Ange Bighelli. "The key role of 13C NMR analysis in the identification of individual components of Polyalthia longifolia leaf oil." Flavour and fragrance journal 29, no. 6 (2014): 371-379.

[30] Sari, Dina Permata, Masayuki Ninomiya, Mai Efdi, Adlis Santoni, Sanusi Ibrahim, Kaori Tanaka, and Mamoru Koketsu. "Clerodane diterpenes isolated from Polyalthia longifolia induce apoptosis in human leukemia HL-60 Cells." Journal of oleo science 62, no. 10 (2013): 843-848.

[31] Doshi, Gaurav M., and H. D. Une. "Screening of Polyalthia Iongifolia Leaves as Potential Immunomodulatory." Int J. Pharmacol 11, no. 2(2015):106-113.

[32] Doshi, Gaurav M., Vivek V. Nalawade, Aaditi S. Mukadam, Pratip K. Chaskar, Sandeep P. Zine, Rakesh R. Somani, and Hemant D. Une. "Elucidation of flavonoids from Carissa congesta, Polyalthia longifolia, and Benincasa hispida plant extracts by hyphenated technique of liquid chromatography-mass spectroscopy." Pharmacognosy research 8, no. 4 (2016): 281.

[33] Chen, Xiao-Xin, Ge Liang, Wei-Ming Chai, Hui-Ling Feng, Han-Tao Zhou, Yan Shi, and Qing-Xi Chen. "Antioxidant and antityrosinase proanthocyanidins from Polyalthia longifolia leaves." Journal of bioscience and bioengineering 118, no. 5 (2014): 583-587.

[34] Ghosh, G., B. B. Subudhi, M. Banerjee, and S. K. Mishra. "A new clerodane-type γ-hydroxybutenolide diterpene from the bark of Polyalthia longifolia var. angustifolia." Indian Journal of Chemistry-Part B OrganicIncluding Medicinal 50, no. 10 (2011):1510.

[35] Sharker, Shazid MD, and Israt Jahan Shahid. "Assessment of antibacterialandcytotoxic activityof somelocallyused medicinal plants in Sundarban mangrove forest region."African Journal of Pharmacy and Pharmacology 4, no. 2 (2010): 066-069.

[36] Rashid, M. A., M. A. Hossain, C. M. Hasan, and M. S. Reza. "Antimicrobial diterpenes from Polyalthia longifolia var. pendulla (Annonaceae)." Phytotherapy Research 10, no. 1 (1996): 79-81.

[37] Kijjoa, Anake, Madalena MM Pinto, Paulo MM Pinho, Bumrung Tantisewie, and Werner Herz. "Clerodane derivatives from Polyalthia viridis." Phytochemistry 29, no. 2 (1990): 653- 655.

[38] Ogunbinu, Akinola O., Isiaka A. Ogunwande, Emmanuel Essien, Pier L. Cioni, and Guido Flamini. "Sesquiterpenes-rich essential oils of Polyalthia longifolia Thw.(Annonaceae) from Nigeria." Journal of Essential Oil Research 19, no. 5 (2007): 419-421.

[39] Gbedema, Stephen Y., Marcel T. Bayor, Kofi Annan, and Colin W. Wright. "Clerodane diterpenes from Polyalthia longifolia (Sonn) Thw. var. pendula: Potential antimalarial agents for drug resistant Plasmodium falciparum infection."Journal of ethnopharmacology 169 (2015): 176-182.

[40] Wu, Yang-Chang, Chang-Yih Duh, Shang-Kwei Wang, Keh-Shaw Chen, and Tsang-Hsiung Yang. "Two new natural azafluorene alkaloids and a cytotoxic aporphine alkaloid from Polyalthia longifolia." Journal of natural products 53, no. 5 (1990): 1327-1331.

[41] KumarJain, Pankaj, Arjun Patra, Sonika Jain, Khan Saleemulla, and Swaha Satpathy. "Antibacterial and Antioxidant Activities of 3-O-methyl Ellagic Acid 4'-rhamnoside from Stem Bark of Polyalthia longifolia Thw." (2014).

[42] Islam, M. N., A. Sabur, R. Ahmmed, and M. E. Hoque. "Oil extraction from pine seed (Polyalthia longifolia) by solvent extraction method and its property analysis." Procedia Engineering 105 (2015):613-618.

[43] Oyedeji, F. O., B. B. Adeleke, and C. B. Akintola. "Physicochemical and fatty acid profile analysis of Polyalthia longifoliaseedoil." Trends Appl. Sci. Res 6(2011):614-621.

[44] Farshori, Nida N., Mai M. Al-Oqail, Ebtesam S. Al-Sheddi, Maqsood A. Siddiqui, and Abdul Rauf. "Antimicrobial potentiality of Polyalthia longifolia seed oil against multi drug resistant (MDR) strains of bacteria and fungus of clinical origin." African Journal of Microbiology Research 7, no. 19 (2013): 1977-1982.

[45] Ajayi, Ibironke Adetolu, and Emmanuel Nnamdi Ifedi. "Proximate Analysis and Toxicological Studies of Polyalthia longifolia Seed Flourin Dietary Formulation of AlbinoRats.

[46] Sadik, Golam. "Antimicrobial activity and Cytotoxicity of Clerodane Diterpines from Polyalthia¡ ongifolia seed." The Sciences 1, no. 5 (2001): 320-323.

[47] Kekuda, P. T. R., N. Mallikarjun, S. P. Swarnalatha, K. S. Surabhi, H. R. Preethi, and K. S. Vinayaka. "Studies on effect of methanol extract of Polyalthia longifolia Thw and Abrus pulchellus Wall on germination and mycotic infection of sorghum seeds." International Journal of Applied Agricultural Research 5, no. 4 (2010): 503-509.

[48] Kekuda, TR Prashith, N. Dileep, K. N. Rakesh, J. Syed, and H. L. Raghavendra. "Elemental analysis and bioactivities of ripe and unripe pericarp of Polyalthia longifolia (Annonaceae)." Science, Technology and Arts Research Journal3,no. 2(2014):68-75.

[49] Poornima, G., V. Abhipsa, C. Rekha, M. Manasa, and Prashith TR Kekuda. "Antibacterial activity of combination of Polyalthia longifolia thw. extract, cow urine distillate and Streptomycin." Research Journal of Pharmacy and Technology 5, no. 7 (2012): 7.

[50] Jayaraman, R., and A. J. M. Christina. "Effects of Polyalthiya longifolia fruits extract on lipid profile and antioxidant status during DEN/PBinducedhepatocellularcarcinomainrats."

[51] Faizi, Shaheen, Rashid Ali- Khan,- Najma Rasool Mughal, Mariam Shafique Malik, Kaneez e Sayyeda Sajjadi, and Aqeel Ahmad. "Antimicrobial activity of various parts of Polyalthia longifolia var. pendula: isolation of active principles from the leaves and the berries." Phytotherapy Research 22, no. 7 (2008): 907-912.

[52] Annan,K.,R. A. Dickson,K. Sarpong, C. Asare, K. Amponsah,and E. Woode. "Antipyretic activity of Polyalthia longifolia Benth. & Hook. F. var. pendula (Annonaceae), on lipopolysaccharide-induced fever in rats." Journal of Medical andBiomedicalSciences2,no. 1 (2013).

[53] Saleem, Rubeena, Muhammad Ahmed, Syed Iqbal Ahmed, Mohammad Azeem, Rashid AliKhan,NajmaRasool,HinaSaleem, Fatima Noor, and Shaheen Faizi. "Hypotensive activity and toxicology of constituents from root bark of Polyalthia longifolia var. pendula." Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives19,no.10(2005):881-884.

[54] Malairajan, P., Geetha Gopalakrishnan, S. Narasimhan, and K. Jessi Kala Veni. "Evalution of anti-ulcer activity of Polyalthia longifolia (Sonn.) Thwaites in experimental animals." Indian journal of pharmacology 40, no. 3 (2008): 126.

[55] Verma, Monika, Shashank K. Singh, Shashi Bhushan, V. K. Sharma, Prabhu Datt, B. K. Kapahi, and A. K. Saxena. "In vitro cytotoxic potential of Polyalthia longifolia on human cancer cell lines and induction of apoptosis through mitochondrial-dependent pathway in HL-60 cells." Chemico-biological interactions 171, no. 1 (2008): 45-56

[56] Chanda, Sumitra, Yogesh Baravalia, and Mital Kaneria. "Protective effect of Polyalthia longifolia var. pendula leaves on ethanol and ethanol/HCl induced ulcer in rats and its antimicrobial potency." Asian Pacific journal of tropical medicine 4, no. 9 (2011): 673-679.

[57] Kaviya, S., J. Santhanalakshmi, and B. Viswanathan. "Green synthesis of silver nanoparticles using Polyalthia longifolia leaf extract along with D-sorbitol: study of antibacterial activity." Journal of nanotechnology 2011 (2011).

[58] Ghosh, Goutam, Durga M. Kar, Bharata B. Subudhi, and Sagar K. Mishra. "Antihyperglycemic and antioxidant activity of stem bark of Polyalthia longifolia var. angustifolia." Der Pharmacia Lettre 2, no. 2 (2010): 206-216.

[59] Verma, Monika, Shashank K. Singh, Shashi Bhushan, V. K. Sharma, Prabhu Datt, B. K. Kapahi, and A. K. Saxena. "In vitro cytotoxic potential of Polyalthia longifolia on human cancer cell lines and

induction of apoptosis through mitochondrial-dependent pathway in HL-60 cells." Chemico-biological interactions 171, no. 1 (2008): 45-56.

[60] Saleem, Rubeena, Muhammad Ahmed, Syed Iqbal Ahmed, Mohammad Azeem, Rashid Ali Khan, Najma Rasool, Hina Saleem, Fatima Noor, and Shaheen Faizi. "Hypotensive activity and toxicology of constituents from root bark of Polyalthia longifolia var. pendula." Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives 19, no. 10 (2005): 881-884.

[61] Malairajan, P., Geetha Gopalakrishnan, S. Narasimhan, and K. Jessi Kala Veni. "Evalution of anti-ulcer activity of Polyalthia longifolia (Sonn.) Thwaites in experimental animals." Indian journal of pharmacology 40, no. 3 (2008): 126.

[62] Moniruzzaman, Md, Afia Ferdous, and Fatama Wahid Bokul. "Evaluation of antinociceptive activity of ethanol extract of bark of Polyalthia longifolia." Journal of ethnopharmacology172 (2015): 364-367.

[63] Annan, Kofi, Edmund Ekuadzi, Cindy Asare, Kwame Sarpong, Dominik Pistorius, Lukas Oberer, Ben A. Gyan, and Michael Ofori. "Antiplasmodial constituents from the stem bark of Polyalthia longifolia var pendula." Phytochemistry Letters 11 (2015): 28-31.

[64] Chang, Fang-Rong, Tsong-Long Hwang, Yu-Liang Yang, Chia-En Li, Chin-Chung Wu, Hamad H. Issa, Wen-Bin Hsieh, and Yang-Chang Wu. "Anti-inflammatory and cytotoxic diterpenes from formosan Polyalthia longifolia var. pendula." Planta medica 72, no. 14 (2006): 1344-1347.

[65] Rao, Rifaqat Ali Khan, and Fouzia Rehman. "Use of Polyalthia longifolia seeds (seeds of Indian Mast Tree) as adsorbent for the removal of Cd (II) from aqueous solution."Journal of Dispersion Science and Technology 33, no. 4 (2012): 472-481.

[66] Lalitha, V., B. Kiran, and K. A. Raveesha. "Antifungal activity of Polyalthia longifolia (Sonn.) Thw. against seed borne fungi of paddy (Oryza sativa L)." Journal of Phytology 3, no. 5 (2011): 4-8.

[67] Rupachandra, S., and D. V. L. Sarada. "Anti-proliferative and apoptotic properties of a peptide from the seeds of Polyalthia longifolia against human cancer cell lines." (2014).

[68] Njoku, Ugochi O., Parker Elijah Joshua, and Obiageli V. Omeh. "Antioxidant properties of Polyalthia longifolia." New York Science Journal 4, no. 6 (2011): 83-87.

[69] Dileep, N., K. N. Rakesh, Syed Junaid, G. Poornima, S. P. Swarnalatha, and Prashith TR Kekuda. "In vitro antioxidant activity of ripe pericarp of Polyalthia longifolia Thw." Research Journal of Pharmacy and Technology 5, no. 10 (2012): 7.

[70] Dixit, Prateek, Tripti Mishra, M. A. H. E. S. H. PALa, T. S. Rana, and D. K. Upreti. "POLYALTHIA LONGIFOLIA AND ITS PHARMACOLOGICAL ACTIVITIES." Int. J. Sci. Innov. Res. 2 (2014): 17-25.

[71] Rajangam, Jayaraman. "Evaluation of Hepatoprotective and antioxidant potential of methanolic extract of Polyalthiya longifolia fruits: An In-vitro and In-vivo approach." Journal of Applied Pharmaceutical Science 3, no. 2 (2013): 69.

[72] Saleem, Rubeena, Muhammad Ahmed, Syed Iqbal Ahmed, Mohammad Azeem, Rashid Ali Khan, Najma Rasool, Hina Saleem, Fatima Noor, and Shaheen Faizi. "Hypotensive activity and toxicology of constituents from root bark of Polyalthia longifolia var. pendula." Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives 19, no. 10 (2005): 881-884.

[73] Mahajan, N. "Polyalthia longifolia promises to be a potential nutraceutical." Med. Aromat. Plants (2015): 2167-0412.

[74] Mustafa Mudhafar &ISMAIL ZAINOL "Medical values, antimicrobial, and anti fungal activities of Polyalthia genus'' International Journal of Pharmaceutical Research |January- March 2019 | Vol 11 | Issue 1.