RESEARCH ARTICLE ISSN: 2349-2678

Contents lists available at www.ijpba.in
International Journal of Pharmaceutical and Biological Science Archive
PubMed (National Library of Medicine ID: 101738825)
Index Copernicus Value 2017: 71.80
Volume 7 Issue 5; September-October; 2019; Page No. 16-22

PHYSICOCHEMICAL CHARACTERIZATION OF SEED OIL OF Simarouba glauca DC. FROM SOUTH INDIA

Jayashanthini. S, K. S. Rathinam, R. Lakshmidevi, R. Sumathi, S. Murugesan, N. Senthilkumar*
Division of Chemistry and Bioprospecting, Institute of Forest Genetics sand Tree Breeding, Coimbatore 641002, Tamilnadu, India.
Conflicts of Interest: Nil
Corresponding author**:** N. Senthilkumar

ABSTRACT

The physicochemical characterization of oil extracts from Simarouba glauca DC. seeds collected in Southern states of India was performed. Among the organic solvents used for oil extraction n-hexane was found promising with high oil yield of 32%.Maximum oil yield was observed in the accession KD 23 with 34% collected from Nallampalli, Dharmapuri. Phytochemical screening of seed oil of S. glauca showed the presence of Steroids and Terpenoids. High saponification value indicated that the free fatty acids are low and saponifiable fats are more especially high triglycerol content hence, the seed oil has been converted into FAME for further characterization. The genetic source KD 23 yielded appreciably high oil and rich storehouse of bioactive constituents (secondary metabolites), with high saponifiable matters (252), and unsaponifiable matters (6%) which could be tapped for use as insecticide.

Keywords: *Simarouba glauca*, FAME, insecticide, bioactive, saponification

INTRODUCTION

Due to the problems associated with the use of chemical insecticides, the need for eco-friendly methods is increasingly felt. Biopesticides play a major role in IPM. Biopesticides are the promising options for ecofriendly management of insect pests in agriculture and forestry. Neem based commercial formulations are only available hence, evaluation of non edible oil from tree borne seeds as biopesticide is warranted. Biopesticide formulation from *Simarouba glauca* is not available as ready to use products for farmers. *Simarouba glauca* belongs to the family Simaroubaceae. It is known as paradise tree, a multipurpose tree that grows under a wide range of ecological conditions. It is native to North America, now found in different regions of India. Its seeds comprise of about 40 % kernel which yield around 55 -65% oil. The amount of oil would be 1000 – 2000 kg/ha/year for a tree. Seed oil of *S. glauca* contains 59-65% of Oleic acid, a multipurpose unsaturated fatty acid, used for industrial purposes in the manufacture of soaps, detergents and lubricants etc. It is reported that the chemicals present in leaf, fruit, pulp and seed of *S. glauca* are known to possess medicinal properties such as analgesic, antimicrobial, antiviral, astringent, stomachic, tonic, vermifuge. Plant-derived insecticides comprise an array of bioactive compounds that decrease the chance of pests to develop resistance against botanicals[1]. The presence of bioactive sterols and triterpene alcohols are responsible for the insecticidal properties of oil[2]. Hence, the study aimed at evaluation of physicochemical properties of seed oil of *S.glauca*.

Methodology

Seed source of S.glauca

Simarouba glauca trees were surveyed in seven different agroclimatic zones of Tamilnadu and Karnataka to identify the potential seed source. Identified 103 major resource in Western Zone (Sathyamangalam, Erode, Coimbatore district), and North Western Zone (Krishnagiri and Dharmapuri district) of Tamilnadu.

Collection and processing of seeds

The *S. glauca* ripe fruits were collected from Coimbatore, Erode, Krishnagiri and Dharmapuri districts. Fruits were depulped, processed and the seeds were air dried, packed and stored at -20 °C in deep freezer for further analysis.

Extraction of oil/determination of oil yield

S.glauca seed oil was extracted with methanol, chloroform, petroleum ether (40-60 °C) and n-

Hexane using soxhlet apparatus. The yield of oil was calculated and stored at room temperature until further analysis.

Phytochemical screening of *S.glauca* seed oil extracts

Phytochemicals such as alkaloids, flavonoids, tannins, saponins, quinones, sterols, phenols, anthocyanins and terpenoids present in the extracts of seed oil of *S. glauca* were screened using Harborne (1973) methods.

Physicochemical properties of *S.glauca* seed oil extracts

Physicochemical properties like pH, density, saponification value, unsaponifiable matter, Acid value, free fatty acid, iodine value, and peroxide value of seed oil *S.glauca* were determined following AOAC (1980) method to ascertain its quality. The physicochemical properties are amongst the most important properties of the oil which decide the quality and shelflife of oil.

Results and discussion

Simarouba glauca fruits collected from 103 accessions were processed and oil was extracted from seeds using organic solvents viz., n-Hexane (32 %), Petroleum Ether (28 %), Methanol (18 %), and chloroform (15%) among which n-hexane found promising with highest oil yield and chloroform was the least. Polar solvent has lower affinity for oil hence lesser oil yield [(3)]. Monson (1971) reported that n-hexane,the solvent with lowest dielectric constant provided highest oil yield[(4)]. Silva *et al*., (2016) reported the effect of n-hexane on the oil yield in *Salvia hispanica* L was statistically significant ($p<0.05$)[(5)] and has the highest extraction efficiency with oil yield of 33.55%. The oil yield of the seeds collected from 103 accessions of *S.glauca* ranged from 16.52 to 34% and maximum oil yield was observed in KD 23 seed source collected from Nallampalli, Dharmapuri (N 12º03'50.37"and E 78º06'31.78" with an elevation of 489. No significant correlation was observed between seed weight, number of seeds for 100g and oil yield. Seeds of average weight 0.90g, 0.82g and 0.81g with seed number of 122, 126 and 129 per 100 g of seed weight produced 30% seed oil. Laei *et al*., (2016) reported that seed weight of castor is negatively related to oil percentage ($r = –0.65^{**}$)[(6)] the findings of Koutroubas *et al*., (1999) were contrary to our results that the seed weight was positively related to oil percentage[(7)]. This result may be due to the account of free fatty acids and glycerides towards oil yield not related to the seed weight.

Table 1: Oil yield of *S.glauca* seeds collected at different locations of Tamilnadu and Karnataka

S. No	Lot name	Location	Latitude	Longitude	Elevation	Average number of seeds/100 g	Average seed wt (g)	Oil Yield %
1	ES1	Ganghinagar	11º19'53.20"	77º01'18.88"	299	126	0.79	25
2	ES2	Rayannagar	11º19'57.73"	77º01'27.06"	297	117	0.85	26
3	ES3	Rayannagar	11º20'20.44"	77º01'27.06"	294	120	0.83	24
4	ES4	Rayannagar	11º20'31.42"	77º01'32.14"	308	108	0.93	25
5	ES5	Sambaravallipudur	11º21'03.63"	77º02'39.39"	333	109	0.92	27
6	ES6	Palkaransalaipudur	11º21'15.83"	77º03'00.54"	337	119	0.84	26
7	ES7	Palkaransalaipudur	11º23'55.94"	77º06'42.86"	362	106	0.94	25
8	ES8	Palkaransalaipudur	11º23'57.50"	77º06'44.46"	357	126	0.79	28
9	ES9	Palkaransalaipudur	11º23'53.95"	77º06'39.19"	360	109	0.92	25
10	ES10	Palkaransalaipudur	11º23'36.91"	77º06'32.32”	353	134	0.75	24
11	ES11	Vallikalyanamandabamopp	11º23'36.91"	77º06'19.83"	360	143	0.70	24
12	ES12	Vallikalyanamadabamopp	11º23'35.33"	77º06'35.33"	359	129	0.78	25
13	ES13	Vallikalyanamadabamopp	11º23'33.61"	77º06'15.93"	340	100	1.00	26
14	ES14	Sethankuttaimani road	11º23'19.95"	77º06'02.97"	366	162	0.62	27
15	ES15	Chettipalayam	11º21'49.99"	77º03'50.52"	332	115	0.87	31
16	C1	Ajanur	11º00'48.84"	76º53'11.25"	198	122	0.82	23
17	C2	Ajanur	11º00'49.66"	76º53'11.04"	196	143	0.70	24
18	C3	Ajanur	11º00'49.93"	76º53'10.97"	197	135	0.74	25
19	C4	Ajanur	11º00'51.38"	76º53'10.50"	198	158	0.63	26
20	C5	Ajanur	11º00'53.46"	76º53'10.54"	198	147	0.68	28
21	C6	Bharathiar university	11º02'24.99"	76º51'46.31"	207	99	1.01	25
22	C7	Bharathiar university	11º02'43.32"	76º51'39.21“	210	138	0.72	27
23	C8	Karunya	10º56'22.18"	76º44'47.64"	132	127	0.79	28
24	C9	Karunya	10º56'17.25"	76º44'31.45"	132	107	0.93	32

25	C10	Karunya	10º56'22.18"	76º44'47.64"	136	114	0.88	27
26	C11	Ramakrishna dental Hospital	11º01'19.27"	76º59'18.92"	360	125	0.80	25
27	C12	Ramakrishna dental Hospital	11º01'17.60"	76º59'16.53"	365	109	0.92	26
28	C13	Ramakrishna dental Hospital	11º01'17.00"	76º59'17.46"	364	147	0.68	27
29	C14	Pollachi	10º44'58.89"	77º00'56.49"	269	163	0.61	29
30	C15	Pollachi	10º44'57.72"	77º00'56.44"	274	125	0.80	28
31	C16	Pollachi	10º44'57.71"	77º00'56.48"	274	116	0.86	32
32	KD1	Vellakal	11º00'45.73"	76º55'19.86"	533	129	0.78	26
33	KD2	Vellakal	11º00'45.75"	76º55'19.88"	533	121	0.83	21
34	KD3	Vellakal	11º00'45.75"	76º55'19.88"	533	131	0.76	23
35	KD4	Vellakal	11º00'45.75"	76º55'19.88"	533	117	0.85	22
36	KD5	Vellakal	11º00'45.75"	76º55'19.88"	533	121	0.83	27
37	KD6	Vellakal	11º00'45.75"	76º55'19.88"	533	143	0.70	25
38	KD7	Vellakal	11º00'45.75"	76º55'19.88"	534	137	0.73	28
39	KD8	Vellakal	11º00'45.75"	76º55'19.88"	534	151	0.66	29
40	KD9	Vellakal	12º01'43.06"	78º06'03.52"	518	107	0.93	30
41	KD10	Vellakal	12º01'43.28"	78º06'03.56"	519	111	0.90	33
42	KD11	Vellakal	12º01'43.40"	78º06'03.65"	518	129	0.78	34
43	KD12	Vellakal	12º01'43.74"	78º06'03.67"	519	117	0.85	23
44	KD13	Vellakal	12º01'44.45"	78º06'03.75"	518	105	0.95	27.43
45	KD14	Vellakal	12º01'42.93"	78º06'03.56"	517	108	0.93	23.15
46	KD15	Vellakal	12º02'39.42"	78º06'18.15"	509	124	0.81	16.52
47	KD16	Vellakal	12º02'39.17"	78º06'17.97"	507	127	0.79	26.61
48	KD17	Vellakal	12º02'38.93"	78º06'17.94"	507	121	0.83	28
49	KD18	Vellakal	12º02'38.87"	78º06'17.83"	507	132	0.76	29
50	KD19	Vellakal	12º02'38.55"	78º06'17.77"	506	102	0.98	25.17
51	KD20	Vellakal	12º02'38.35"	78º06'17.75"	507	113	0.88	23.5
52	KD21	Vellakal	12º02'38.18"	78º06'17.61"	506	100	1.00	30.3
53	KD22	ExtensionOffice Dharmapuri	12º03'50.37"	78º06'31.78"	489	138	0.72	31
54	KD23	ExtensionOffice Dharmapuri	12º03'50.37"	78º06'31.78"	489	122	0.82	33
55	KD24	ExtensionOffice Dharmapuri	12º03'50.37"	78º06'31.78"	489	136	0.74	22.66
56	KD25	ExtensionOffice Dharmapuri	12º03'50.37"	78º06'31.78"	489	125	0.80	24
57	KD26	ExtensionOffice Dharmapuri	12º03'50.37"	78º06'31.78"	490	139	0.72	25
58	KD27	Kariyamakalam Road	12º17'26.22"	78º11'56.86"	457	146	0.68	28
59	KD28	Kariyamakalam Road	12º17'26.16"	78º11'56.91"	456	124	0.81	20.5
60	KD29	Kariyamakalam Road	12º17'24.69"	78º11'56.47"	458	102	0.98	26
61	KD30	Kariyamakalam Road	12º17'22.19"	78º11'56.26"	458	153	0.65	27.43
62	KD31	Kariyamakalam Road	12º17'21.77"	78º11'56.26"	459	136	0.74	29
63	KD32	Kariyamakalam Road	12º17'21.32"	78º11'56.23"	458	102	0.98	30
64	KD33	Kariyamakalam Road	12º17'21.08"	78º11'56.31"	459	147	0.68	27
65	KD34	Kariyamakalam Road	12º17'20.64"	78º11'56.31"	461	119	0.84	20.91
66	KD35	Kariyamakalam Road	12º17'19.85"	78º11'56.11"	462	138	0.72	21.83
67	KD36	Kariyamakalam Road	12º17'19.38"	78º11'56.18"	461	141	0.71	23
68	KD37	Kariyamakalam Road	12º17'19.22"	78º11'56.01"	462	134	0.75	26.05
69	KD38	Kariyamakalam Road	12º17'18.50"	78º11'55.88"	464	139	0.72	28
70	KD39	Kariyamakalam Road	12º17'17.57"	78º11'55.74"	464	142	0.70	19
71	KD40	Kariyamakalam Road	12º16'53.03"	78º11'51.63"	469	117	0.85	27.7
72	KD41	Kariyamakalam Road	12º16'50.91"	78º11'51.39"	467	126	0.79	27
73	KD42	Kariyamakalam Road	12º17'06.64"	78º10'36.59"	454	124	0.81	33
74	KD43	Kariyamakalam Road	12º11'07.62"	78º10'37.04"	454	112	0.89	26
75	KD44	Kariyamakalam Road	12º11'07.73"	78º10'36.92"	454	123	0.81	32
76	KD45	Kariyamakalam Road	12º11'08.22"	78º10'37.10"	455	110	0.91	27
77	KD46	Kariyamakalam Road	12º11'08.01"	78º10'37.13"	455	124	0.81	20
78	KD47	Kariyamakalam Road	12º09'51.81"	78º09'40.41"	452	132	0.76	24
79	KD48	Kariyamakalam Road	12º09'51.09"	78º09'39.72"	452	106	0.94	24.72
80	KD49	Kariyamakalam Road	12º09'50.53"	78º09'38.95"	453	121	0.83	23.07
81	KD50	Kariyamakalam Road	12º07'41.56"	78º08'09.16"	471	137	0.73	20
82	KD51	Kariyamakalam Road	12º07'42.20"	78º08'09.36"	471	131	0.76	27
83	KD52	Kariyamakalam Road	12º07'42.66"	78º08'09.52"	470	119	0.84	26
84	KD53	Kariyamakalam Road	12º07'44.40"	78º08'10.07"	470	127	0.79	21
85	KD54	Kariyamakalam Road	12º07'44.69"	78º08'10.14"	470	121	0.83	26.82
86	KD55	Kariyamakalam Road	12º07'44.97"	78º08'10.18"	469	132	0.76	25
87	KD56	Kariyamakalam Road	12º03'22.22"	78º06'28.40"	495	111	0.90	23

88	KD57	Kariyamakalam Road	12º03'20.59"	78º06'28.12"	492	91	1.10	29
89	KD58	Kariyamakalam Road	12º03'20.41"	78º06'28.10"	492	132	0.76	30
90	KD59	Kariyamakalam Road	12º03'20.32"	78º06'28.05"	494	125	0.80	26.05
91	KD60	Kariyamakalam Road	12º03'20.32"	78º06'28.00"	493	132	0.76	31
92	KD61	Kariyamakalam Road	12º03'20.25"	78º06'28.05"	495	138	0.72	21.86
93	KD62	Kariyamakalam Road	12º03'11.31"	78º06'26.55"	499	137	0.73	32
94	KD63	Kariyamakalam Road	12º03'11.41"	78º06'26.55"	494	125	0.80	27
95	KD64	Kariyamakalam Road	12º03'11.41"	78º06'26.55"	494	117	0.85	25
96	KD65	Kariyamakalam Road	12º04'04.88"	78º06'34.18"	485	115	0.87	24.61
97	KD66	Kariyamakalam Road	12º04'04.88"	78º06'34.18"	485	140	0.71	24
98	KD67	Kariyamakalam Road	12º04'04.88"	78º06'34.18"	485	154	0.65	26
99	KD68	Kariyamakalam Road	12º04'07.89"	78º06'35.20"	487	132	0.76	27
100	KD69	Kariyamakalam Road	11º30'12.48"	77º15'10.22"	273	102	0.98	32.6
101	KA1	Karnataka	13º35'02.40"	76º05'44.11"	719	99	1.01	17.32
102	KA2	Karnataka	14º04'43.62"	75º31'39.93"	636	86	1.16	20.05
103	KA3	Karnataka	13º45'15.19"	75º33'44.33"	586	106	0.94	20.88

The search for botanical biopesticides requires the screening of naturally occurring bioactive compounds in plants[8]. In the present study, phytochemical screening of *S. glauca* seed oil showed the presence of Steroids and Terpenoids. Phenols, phenolics, flavonoids, terpenoids, and alkaloids are reported as most acutely toxic plant chemicals[9-10]. Several sterols, terpene alchohols and terpenoids are known to exhibit insecticidal activity against different insects [11].

Evaluation of physico-chemical properties such as Iodine, Peroxide, Acid and Free Fatty Acid value of the oil extracts of 103 seed sources quantified to be 26.47(C-10) to 29.19 (C-6) mg/g, 0.43 (C-2) to 2.14 mg/g (KD44), 1.6 (KD45) to 12.0 2 mg/g(KD3) and 0.8 (KD45) to 6.01% (KD3) respectively. Physico-chemical properties of the *Jatropha curcas* seed oil indicated that the acid value, freefatty acids, peroxide value and iodine value were high[12]. Saponifiable and unsaponifiable matters were also estimated and found to range between 140 (KD65) to 264 (KD68) and 1 (ES8) to 6% (KD39) respectively. Adebowale and Dedire (2006) reported that the potential of *J.curcas* for use as ecofriendly natural insecticide is due to the presence of unsaponifiable matter (3.8%)[12]. The insecticidal properties of the oils are due to the presence of sterols and triterpene alcohols in the unsaponifiable matter [2]. Density was observed to be 0.368 (C10) -0.493 g (C6) and refractive index of seed oil of *S.glauca* was found to be 1.44. High saponification value indicates more saponifiable fats *S. glauca* seed oil was subjected to trans-esterification using methylating agent (MeOH) to convert into fatty acid methyl ester [FAME].The genetic source KD 23 yielded appreciably high oil and rich storehouse of bioactive constituents (secondary metabolites), with high saponifiable matters (252), free fatty acids (2 %) and unsaponifiable matters(6%)which could be tapped for use as pesticide. The *S.glauca* represents a good source of active botanicals and significant physicochemical properties could be exploited for its insecticidal activity.

Table 2.Physico-chemical properties of *S.glauca* seed oil

Lot no	Density	Iodine value mg/g	Peroxide value mg/g	Acid value mg/g	Free Fatty Acid Value %	Saponification value	Unsaponifiable matter %
S1	0.474	27.92	1.71	6.41	3.21	224	4
ES2	0.453	29.19	0.57	3.21	1.60	196	2
ES3	0.434	28.82	1.00	3.21	1.60	252	4
ES4	0.429	29.19	1.14	4.01	2.00	184	6
ES5	0.414	28.82	1.71	2.40	1.20	208	1
ES6	0.444	28.46	1.57	3.21	1.60	192	2
ES7	0.437	29.01	1.14	2.40	1.20	184	3
ES8	0.467	28.82	0.43	2.40	1.20	144	1
ES9	0.456	28.46	1.00	4.01	2.00	204	1

ES10	0.403	27.56	1.14	3.21	1.60	220	4
ES11	0.429	28.28	0.86	5.61	2.81	228	5
ES12	0.424	28.46	0.71	3.21	1.60	192	3
ES13	0.434	27.37	1.00	4.01	2.00	232	5
ES14	0.447	27.01	1.00	1.60	0.80	204	2
ES15	0.452	28.82	1.43	3.21	1.60	244	1
C1	0.459	28.46	1.14	4.81	2.40	184	3
C2	0.442	27.37	0.43	5.61	2.81	184	3
C3	0.441	27.74	0.71	5.61	2.81	144	2
C4	0.413	27.92	1.00	5.61	2.81	204	6
C5	0.372	27.01	1.43	6.41	3.21	220	1
C6	0.493	27.37	1.86	8.01	4.01	144	4
C7	0.439	27.92	1.43	4.81	2.40	204	5
C8	0.434	27.92	0.43	4.01	2.00	220	3
C9	0.416	27.37	1.00	3.21	1.60	184	5
C10	0.368	26.47	1.29	4.01	2.00	208	2
C11	0.474	27.92	1.00	4.81	2.40	220	2
C12	0.439	28.28	1.14	4.01	2.00	224	6
C13	0.455	27.92	1.43	5.61	2.81	196	1
C14	0.421	27.56	1.71	2.40	1.20	252	4
C15	0.481	28.10	1.29	3.21	1.60	184	5
C16	0.466	27.92	0.71	8.01	4.01	208	4
KD1	0.436	27.74	1.14	6.41	3.21	192	2
KD2	0.483	27.56	1.00	4.01	2.00	184	6
KD3	0.443	27.92	0.71	12.02	6.01	144	1
KD4	0.453	27.56	1.00	3.21	1.60	204	4
KD5	0.44	27.37	0.86	2.40	1.20	220	3
KD6	0.425	27.37	1.00	2.40	1.20	184	5
KD7	0.465	27.56	1.57	1.60	0.80	208	2
KD8	0.421	27.56	0.86	5.61	2.81	192	2
KD9	0.434	28.28	0.86	2.40	1.20	204	6
KD10	0.442	27.92	1.43	4.01	2.00	256	1
KD11	0.434	28.46	1.43	3.21	1.60	184	4
KD12	0.459	26.83	1.14	1.60	0.80	144	5
KD13	0.441	27.19	1.57	1.60	0.80	204	4
KD14	0.437	27.92	1.43	5.61	2.81	220	3
KD15	0.426	28.10	1.57	3.21	1.60	144	1
KD16	0.451	27.92	1.14	2.40	1.20	204	1
KD17	0.436	27.19	1.14	4.01	2.00	220	3
KD18	0.462	26.47	0.71	5.61	2.81	184	1
KD19	0.442	27.01	1.00	7.21	3.61	208	1
KD20	0.425	27.92	1.43	2.40	1.20	220	4
KD21	0.437	28.46	1.29	3.21	1.60	224	2
KD22	0.439	28.28	0.71	3.21	1.60	196	4

KD23	0.443	27.92	1.71	4.01	2.00	252	6
KD24	0.458	27.01	1.43	5.61	2.81	184	1
KD25	0.441	27.37	0.86	7.21	3.61	208	2
KD26	0.439	28.28	1.29	2.40	1.20	192	3
KD27	0.445	28.82	1.43	3.21	1.60	184	1
KD28	0.443	27.56	1.71	6.41	3.21	144	1
KD29	0.451	27.37	1.00	4.01	2.00	204	4
KD30	0.415	27.92	1.00	3.21	1.60	220	5
KD31	0.443	26.83	1.14	4.81	2.40	184	3
KD32	0.428	28.82	1.14	4.81	2.40	208	5
KD33	0.439	28.46	1.00	5.61	2.81	192	2
KD34	0.431	27.37	1.29	4.01	2.00	184	6
KD35	0.465	27.92	1.43	2.40	1.20	244	1
KD36	0.436	27.37	1.00	4.01	2.00	184	2
KD37	0.441	27.56	1.14	5.61	2.81	224	2
KD38	0.414	27.92	1.57	1.60	0.80	196	2
KD39	0.436	27.19	1.00	6.41	3.21	252	6
KD40	0.444	26.65	1.43	3.21	1.60	184	1
KD41	0.456	28.82	1.86	2.40	1.20	208	2
KD42	0.412	28.82	1.00	1.60	0.80	192	3
KD43	0.434	28.46	0.86	4.01	2.00	184	1
KD44	0.462	28.10	2.14	5.61	2.81	144	2
KD45	0.427	28.46	0.71	1.60	0.80	204	4
KD46	0.441	27.92	1.43	4.81	2.40	220	6
KD47	0.458	28.28	1.00	4.81	2.40	184	1
KD48	0.447	27.74	0.86	1.60	0.80	208	2
KD49	0.464	27.37	0.43	4.01	2.00	192	3
KD50	0.443	27.01	0.86	5.61	2.81	184	1
KD51	0.451	26.65	1.14	3.21	1.60	244	1
KD52	0.429	27.19	1.00	2.40	1.20	184	4
KD53	0.436	27.56	1.00	3.21	1.60	248	5
KD54	0.441	27.74	1.71	4.01	2.00	208	3
KD55	0.442	27.74	1.43	2.40	1.20	220	5
KD56	0.427	28.28	1.29	2.40	1.20	224	2
KD57	0.46	27.37	0.71	7.21	3.61	196	6
KD58	0.439	28.82	1.86	2.40	1.20	236	1
KD59	0.431	27.92	1.14	2.40	1.20	224	4
KD60	0.448	27.56	1.57	1.60	0.80	196	5
KD61	0.441	28.10	1.29	4.81	2.40	252	4
KD62	0.445	27.56	1.71	4.01	2.00	184	6
KD63	0.441	27.92	1.43	5.61	2.81	208	4
KD64	0.439	27.19	1.14	1.60	0.80	220	3
KD65	0.411	27.92	1.00	7.21	3.61	140	4
KD66	0.4366	27.37	1.71	4.81	2.40	204	2

KD67	0.458	27.01	1.00	2.40	1.20	220	6
KD68	0.461	27.74	0.86	3.21	1.60	264	1
KD69	0.447	28.46	1.00	3.21	1.60	208	2
KA1	0.446	28.82	1.71	4.01	2.00	220	3
KA2	0.464	27.37	1.43	5.61	2.81	224	1
KA3	0.448	27.56	1.71	3.21	1.60	196	3

Conclusion

Current world scenario is booming towards organic agriculture due to which there is a high demand for biopesticides by organic growers as they cannot use conventional agrochemicals. Seeds of *S.glauca* are abundantly available, hence screening of such plants for botanicals added one more source as natural insecticide that reduces the risk of toxicity. The present study has shown that *S.glauca* with an array of bioactive compounds with requisite physicochemical properties which are responsible for the insecticidal activity and may be considered as a potential biopesticide for use in sustainable organic agricultural production.

References

1. Koul O (2008). Phytochemicals and insect control: an antifeedant approach. Crit Rev Plant Sci 27:1–24.
2. Hoftmann, E., 1970. Recent advances in Photochemistry; Runeck;ensad, V. Steehnk, C. (ed). Appleton Century New York, Vol.3.
3. Galvao, M. S., Narain N and Nigam N., Food Sci. Technol. 2014, 34, 539.
4. Monson, R.S. 1971. Advanced Organic Synthesis – Methods and Techniques. Academic Press 1-209.
5. Silva, C., Garcia, V.A.S. and Zanette, C.M (2016). Chia (*Salvia hispanica* L.) oil extraction using different organic solvents: oil yield, fatty acids pro□le and technological analysis of defatted meal. International Food Research Journal 23(3): 998-1004.
6. Laei G, Bihamta M. R, Azizinezhed R, Kojour F. D (2016). Relationship of percentage and oil yield with the physicochemical properties of native castor genotypes from Iran.Orient J Chem, 32(4).
7. Koutroubas, S.D., Papakosta, D.K and Doitsinis, A (1999). Adaptation and yielding ability ofcastor plant (Ricinuscommunis L.) genotypes in a Mediterranean climate. Eur. J. Agron. 11, 227-237.
8. Isman M.B (2006) Botanical insecticides, deterrents, and repellents in modern agriculture and an increasingly regulated world.Annu Rev Entomol 51:45–66.
9. Ananthakrishnan T.N., Senrayan R., Annadurai R.S. and S. Murugesan, Proc. Indian.Acad.Sci. (Anim. Sci.)., 1990. 99(1),39-52.
10. S. Murugesan, Advances in Plant Sciences, 2004, 17(1): 203-206.
11. Kim, S.I., J.S. Yoon, J.W. Jung, K.B. Hong, Y.J. Ahn and H.W. Kwon, 2010. Toxicity and repellency of origanum essential oil and its components against *Triboliumcastaneum* (Coleoptera: Tenebrionidae) adults. J. Asia-Pac. Entomol., 13: 369-373.
12. Adebowale KO and Adedire CO.2006. Chemical composition and insecticidal properties of the underutilized *Jatrophacurcas* seed oil. African Journalof Biotechnology, 5(10): 901-906.