The Pharma Innovation Journal 2023; 12(7): 2924-2928

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(7): 2924-2928

www.thepharmajournal.com
Received: 03-05-2023
Accepted: 13-06-2023

Subham
School of Agriculture, Dev Bhoomi Uttarakhand University, Dehradun, Uttarakhand, India

Sushila Arya
School of Agriculture, Dev Bhoomi Uttarakhand University, Dehradun, Uttarakhand, India

Tapor Pakpu
School of Agriculture, Dev Bhoomi Uttarakhand University, Dehradun, Uttarakhand, India

Manisha
School of Agriculture, Dev Bhoomi Uttarakhand University, Dehradun, Uttarakhand, India

Corresponding Author:
Subham
School of Agriculture, Dev Bhoomi Uttarakhand University, Dehradun, Uttarakhand, India

Chemical composition and herbicidal activity of *Albizia lebbeck* (L.) Benth. Seed oleoresin

Subham, Sushila Arya, Tapor Pakpu and Manisha

Abstract
Albizia lebbeck (L.) is a leguminous plant belonging to the family Fabaceae, has number of therapeutic properties. The purpose of this study was to assess the herbicidal activity of *Albizia lebbeck* (L.) Benth. seed chloroform oleoresin. The oleoresin exhibited significant herbicidal action against the *R. raphanistrum* seeds. GC-MS analysis revealed thirty-five constituents, accounting for 80.21% of the overall oleoresin composition. The major constituents identified were n-Hexadecanoic acid (7.06%), Hentriacontane (5.46%), and Triacontane (5.56%). These findings provide valuable insights on the potential applications of *Albizia lebbeck* (L.) Benth. oleoresin in the pharmaceutical and nutraceutical industries.

Keywords: *Albizia lebbeck*, n-Hexadecanoic acid, Herbicidal, Oleoresin

Introduction
The Fabaceae family is the second-largest family of medicinal plants, with approximately 490 medicinal plant species, the vast majority of which have been utilized as traditional remedies. There are 31 medicinal plant species classified into 20 genera. These species have significant therapeutic capabilities and are commonly employed as constituents in pharmaceutical products [1]. *Albizia* is a genus of over 150 species, chiefly trees and shrubs endemic to Asia and Africas tropical and subtropical climates [2]. The genus belongs to the subfamily Mimosoideae, which includes 82 genera and around 3335 species of nitrogen-fixing shrubs and trees (rarely herbs) [3, 4]. *Albizia lebbeck* is an Asian native that has been acquaint with tropical locations across the world as a shelter tree for cash crops, erosion management, a feed crop, and a supply of hardwood. The plant is adaptable to an array of temperatures and soil types [5, 6]. *Albizia lebbeck* is a perennial, deciduous tree that can grow as high as 30 m in height and 1 m in diameter at maturity, but it is more commonly 15-20 m tall and 50 cm in diameter [7]. It is employed in conventional medicine and has been found to have a number of biological activities such as anti-asthmatic, anti-inflammatory, anti-fertility and anti-diarrhoeal, antiseptic, anti-dysenteric, anti-tubercular, leprosy, paralysis, helminth infection, allergic rhinitis, astringent, to treat the eye, psychoactive, flu, lung problems, pectoral problems, cough, gingivitis and abdominal tumours [8, 9, 10]. The current investigation concentrated on the phytochemical analysis and evaluation of the herbicidal activity of *Albizia lebbeck* (L.) Benth. seed chloroform oleoresin, which was collected from the Garhwal region of Uttarakhand.

Materials and Methods
Plant material collection
Albizia lebbeck (L) Benth. seed was collected in the month of February, 2023 from Harrawala, Dehradun (Altitude-666.00m, Latitude 30º15' 35.03" N and Longitude 78º5' 21.98" E) Uttarakhand, India.

Oleoresin preparation
Fresh seed of *Albizia lebbeck* (L.) Benth. were dried and pulverized into a coarse powder. Cold percolation method was employed to extract the pulverized seed particles in chloroform. A rotary evaporator was used to filter and condense the oleoresin. A mean oleoresin yields of 1.90% (w/w) was found. For additional chemical investigation and identification of biological activities, the oleoresin was placed at 40 °C.

GC-MS analysis

Gas chromatography-mass spectrometry (GC-MS) was applied for assessing the phytochemical composition of *Albizia lebbeck* (L.) Benth. seed chloroform oleoresin using GCMS-QP 2010 Plus apparatus. It was performed employing the GC capillary column DB-5 (0.25 mm, i.d. 0.25 m). Helium at a flow rate of 1.0 mL/min served as the carrier gas, and A split ratio of 50.1, and the injector temperature was set at 210 °C. By examining the mass spectrum fragment pattern and RI values with the MS library (NIST14.lib.) [11] and by comparing the spectra with published data, the components of oleoresin were determined.

Herbicidal activity

Chloroform oleoresin from *Albizia lebbeck* (L) Benth. seed was evaluated at various concentrations (250-1000 µL/mL) against *R. raphanistrum* subsp. sativus (Wild radish) [12]. In order to evaluate seed germination, root and shoot length inhibition various chloroform oleoresin concentrations (250-1000 µL/mL) were generated in 1% Tween-20 aqueous solution. The herbicidal activity was conducted on seed that had been surface sterilized for 15 minutes in a 5% sodium hypochlorite solution. Each of the petri dishes had seven *R. raphanistrum* seeds, and the bottoms of the dishes had been lined with filter papers to keep the seeds moist enough for germination. Thee plates were then filled with 2 mL of varying concentrations of the tested sample and the seeds were allowed to germinate in an incubator at 25±1 °C for 12 hours. Once all of the seeds in the control had sprouted, the experiment was measured, followed by measurements of the root and shoot length. The experiment was assessed in comparison to a control and a pendimethalin. The formula was used to determine seed germination inhibition, as well as root and shoot length inhibition:

$$\% \text{ Inhibition} = 100 \times (1 - St/Sc)$$

Where

St – number of seeds under treatment

Sc – numbers of seeds under control.

Results

Chemical composition of extract: *Albizia lebbeck* (L.) Benth. chloroform seed oleoresin undergone GC-MS analysis, revealing the presence of 35 components that made up 80.21% of the overall extract composition. n-Hexadecanoic acid (7.06%), Hentriacontane (5.46%) and Triacontane (5.56%) was shown to be the major component of the oleoresin followed by 9,12-Octadecadienoic acid (4.7%), Octadecanoic acid, 4-hydroxy, methyl ester (3.00%), Octadecanoic acid (3.07%), Phthalic acid, bis(2-pentyl) ester (2.17%), 17-Pentatriacontene (3.44%), Phthalic acid, dec-2-yl pentyl ester (3.03%), Hexadecanoic acid, 2- hydroxy-1-(hydroxymethyl) ethyl ester (2.59%), alpha.-Tocopherol-.beta.-Dmannoside (4.79%), Vitamin E (2.61%), 13-Docosenamide, (Z)- (4.09%), Methyl octadecyl dichlorosilane (2.37%), Campesterol (3.94%), didecan-2-yl phthalate (4.34%), Tetradecane (1.18%), 9-octadecenyl ester, (Z,Z)-(1.32%), Tetrapentacontane, 1,54- dibromo (1.34%), Phthalic acid, butyl dec-2-yl ester (1.7%), Fumaric acid, 2-butyl hexadecyl ester (1.15%) and 2,3- dihydroxypropyl ester (1.6%). However, Isopropyl myristate (0.94%), Diamyl phthalate (0.98%), Phthalic acid, 6-methylhept2-yl pentyl ester (0.82%), Phthalic acid, cycloheptyl pentyl ester (0.75%), 1,8-Diazacyclotetradecane2,7-dione (0.75%), Phthalic acid, 6-ethyloct-3-yl 2-ethylhexyl ester (0.71%), di-5-nonyl phthalate (0.81%), 9,12-Octadecadienoic acid (Z,Z)-, 2-hydroxy-1-(hydroxymethyl)ethyl ester (0.64%), Hexadecane, 2,6,10,14-tetramethyl (0.66%), n-Hexadecanoic acid (0.64%), Dibutyl phthalate (0.79%) and 1,2-Benzenedicarboxylic acid, dinonyl ester (0.57%) were contributed less than 1.0% of the total oleoresin. The chemical composition of chloroform seed oleoresin of ALSO is represented in (Table 1) and ion-chromatogram of ALSO is shown in (Figure 1).

Table 1: Chemical composition of *Albizia lebbeck* (L) Benth. chloroform seed oleoresin (ALSO)

S. No.	Compound Name	R.T.	% Composition	Molecular Formula	Method of Identification
1.	n-Hexadecanoic acid	20.48	7.06	$C_{16}H_{32}O_2$	M^+=256 m/z; 212,184, 156,148, 129,73,71,60,57
2.	9,12-Octadecadienoic acid	22.91	4.7	$C_{18}H_{32}O_2$	M^+=110 m/z; 109, 96, 95, 82, 81,79, 68, 67, 55.1
3.	Octadecanoic acid, 4- hydroxy, methyl ester	22.96	3.00	$C_{19}H_{38}O_3$	M^+=112 m/z;111, 99, 98, 97, 85, 84, 83, 69, 55.1
4.	Octadecanoic acid	23.23	3.07	$C_{18}H_{36}O_2$	M^+=284 m/z; 184, 148, 128, 83, 73, 71, 60, 57.1, 55.1
5.	Phthalic acid, bis(2-pentyl) ester	26.30	2.17	$C_{18}H_{26}O_4$	M^+=237 m/z; 168, 166, 149, 148, 103, 85, 71, 70, 57
6.	Hentriacontane	26.46	5.46	$C_{31}H_{64}$	M^+=266 m/z; 224, 113, 111, 99, 97, 85, 83, 71.1, 57
7.	Triacontane	26.57	5.56	$C_{30}H_{62}$	M^+=141.1 m/z; 127, 113, 99, 97, 85, 83, 71.1, 69, 57
8.	17-Pentatriacontene	26.72	3.44	$C_{35}H_{70}$	M^+=237 m/z; 166, 148, 111, 97, 83, 82, 71, 69, 57
9.	Phthalic acid, dec-2-yl pentyl ester	27.17	3.03	$C_{23}H_{36}O_4$	M^+=238 m/z; 237, 219, 166, 149, 148, 103, 97, 84, 56
10.	Hexadecanoic acid, 2- hydroxy-1- (hydroxymethyl)ethyl ester	27.39	2.59	$C_{19}H_{38}O_4$	M^+=256.9 m/z; 239, 134, 112, 98, 84, 83, 74, 57.1, 55.1
11.	α-tocopherol-β-dmannoside	27.47	4.79	$C_{35}H_{60}O_7$	M^+=430 m/z; 429, 204, 176, 166, 164, 163, 136, 121, 57
12.	Vitamin E	29.64	2.61	$C_{29}H_{50}O_2$	M^+=429.9 m/z; 169.9, 163.9, 98, 97, 85, 83, 71, 57, 55

13.	(Z)-13-Docosenamide	30.99	4.09	$C_{22}H_{43}NO$	M^+=126 m/z; 112, 98, 95, 83, 72, 69, 60, 59, 55.1
14.	Methyloctadecyldichlorosilane	31.07	2.37	$C_{19}H_{40}Cl_2Si$	M^+=400 m/z; 288, 141, 127.1, 113.1, 99.1, 97, 85, 71, 57.1
15.	Campesterol	31.13	3.94	$C_{28}H_{48}O$	M^+=400 m/z; 382, 315, 289, 255, 212, 160, 158, 144, 107
16.	Didecan-2-yl phthalate	31.51	4.34	$C_{28}H_{46}O_4$	M^+=307 m/z; 168, 166.9, 149, 148, 141, 97, 85, 71, 57
17.	Tetradecane	12.28	1.18	$C_{14}H_{30}$	M^+=198.2 m/z; 99, 98, 85, 84, 71, 70, 57, 56, 55
18.	(Z,Z)-9-Hexadecenoic acid, 9- octadecenyl ester	23.99	1.32	$C_{34}H_{64}O_2$	M^+=149 m/z; 148, 97, 96, 95, 83, 82, 81, 71, 57
19.	Tetrapentacontane, 1,54- dibromo	25.71	1.34	$C_{54}H_{108}Br_2$	M^+=394 m/z; 141, 134.9, 99, 97, 85, 83, 71, 69, 57
20.	Phthalic acid, butyl dec-2-yl ester	26.18	1.7	$C_{22}H_{34}O_4$	M^+=224 m/z; 222, 205, 166, 149, 148, 103, 97, 84, 56
21.	Fumaric acid, 2-butyl hexadecyl ester	29.56	1.15	$C_{24}H_{44}O_4$	M^+=129 m/z; 116,113, 99, 97, 85, 83, 71, 69, 57
22.	Octadecanoic acid, 2,3- dihydroxypropyl ester	30.01	1.6	$C_{21}H_{42}O_4$	M^+=267 m/z; 134, 98, 97, 85, 84, 83, 74, 71, 57
23.	Isopropyl myristate	18.24	0.94	$C_{17}H_{34}O_2$	M^+=228 m/z; 228, 211, 184, 128, 102, 73, 61, 60, 57
24.	Diamyl phthalate	23.07	0.98	$C_{18}H_{26}O_4$	M^+=236 m/z; 220, 219, 150, 149, 148, 120, 105, 103, 76
25.	Phthalic acid, 6-methylhept2-yl pentyl este	22.00	0.82	$C_{21}H_{32}O_4$	M^+=236 m/z; 219, 166.9, 149, 148, 103,70, 69, 68, 55
26.	Phthalic acid, cycloheptyl pentyl ester	22.50	0.75	$C_{20}H_{28}O_4$	M^+=236 m/z; 166, 149, 148, 122, 103, 81, 71, 70, 69
27.	1,8-Diazacyclotetradecane2,7-dione	24.62	0.75	$C_{12}H_{22}N_2O_2$	M^+=416 m/z; 226, 197, 150, 140, 113, 112, 100, 98, 86
28.	Phthalic acid, 6-ethyloct-3-yl 2-ethylhexyl ester	27.59	0.71	$C_{26}H_{42}O_4$	M^+=430 m/z; 316, 279, 166, 149, 148, 120, 113, 71, 57
29.	di-5-nonyl phthalate	28.09	0.81	$C_{26}H_{42}O_4$	M^+=234 m/z; 168, 166, 149, 148, 141, 85, 71, 69, 57
30.	9,12-Octadecadienoic acid (Z,Z)-, 2-hydroxy-1-(hydroxymethyl)ethyl ester	29.28	0.64	$C_{21}H_{38}O_4$	M^+=148 m/z; 130, 129, 116, 96, 95,82, 81, 67, 55
31.	2-(8Z,11Z)-Heptadeca-8,11- dien-1-yl)-4,5-dihydrooxazole	25.14	0.64	$C_{20}H_{35}NO$	M^+=261.9 m/z; 247, 207, 193, 153, 148, 112, 98, 85, 67
32.	Hexadecane, 2,6,10,14- tetramethyl	16.28	0.66	$C_{20}H_{42}$	M^+=155 m/z; 127, 113, 91, 85, 84, 71, 70, 69, 57
33.	n-Hexadecanoic acid	20.48	0.64	$C_{16}H_{32}O_2$	M^+=240 m/z; 127, 113, 99,87, 85, 83, 71, 69, 57
34.	Dibutyl phthalate	21.78	0.79	$C_{16}H_{22}O_4$	M^+=236 m/z; 222, 204, 149, 148, 120, 105, 103, 76, 57
35.	1,2-Benzenedicarboxylic acid, dinonyl ester	28.98	0.57	$C_{26}H_{42}O_4$	M^+=292 m/z; 166, 149, 148, 130, 127, 71, 70, 69, 57

Classes of composition	**% composition**
Fatty Acid (FA)	33.46
Organic Compounds (OC)	37.5
Hydrocarbons (H)	6.64
Terpenoids (T)	2.61
Total (%)	80.21

ALSO= *Albizia lebbeck* (L.) Benth. chloroform seed oleoresin; RT= Retention time

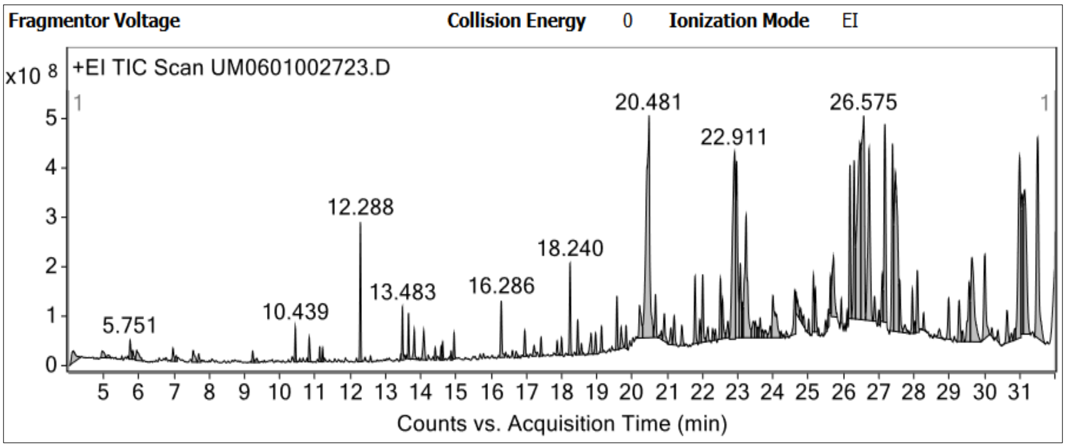

Fig 1: Ion-chromatogram of *Albizia lebbeck* (L.) Benth. seed chloroform oleoresin ALSO

Herbicidal activity
Seed germination inhibition
In a dose-dependent manner, the oleoresin has significant herbicidal activity. The percent inhibition of seed germination by *Albizia lebbeck* (L.) Benth. seed chloroform oleoresin was 58.00%, 65.00%, 75.66%, and 91.66% from lowest to highest concentrations (250-1000µL/mL). The IC_{50} value of *Albizia lebbeck* (L.) Benth. seed chloroform oleoresin was determined to be 118.86±22.00 µL/mL, which was calculated at the level where 100% germination was attain in the control and was employed to evaluate the comparative herbicidal activity in terms of inhibition of seed germination at various concentrations ranging from 250-1000 µL/mL. *Albizia lebbeck* (L.) Benth. seed chloroform oleoresin IC_{50} value and percent seed germination inhibition are shown in (Tables 2 and 5).

Table 2: Percent seed germination inhibition by ALSO

S. No.	Sample	% Inhibition of germination (Mean±SD)			
		250 µL/mL	500 µL/mL	750 µL/mL	1000 µL/mL
1	ALSO	58.00±1.00	65.00±1.00	75.66±0.57	91.66±0.57
2	Pendimethalin	100.00±0.00	100.00 ±0.00	100.00 ±0.00	100.00 ±0.00

ALSO= *Albizia lebbeck* (L.) Benth. chloroform seed oleoresin

Root length inhibition
From lowest to highest concentrations (250-1000 µL/mL), the percent root length inhibition of the oleoresins was observed to be 59.00%, 65.33%, 75.00%, and 98.00%, respectively. IC_{50} value of *Albizia lebbeck* (L.) Benth. seed chloroform oleoresin was 144.15±18.10µL/mL which was used to compare the relative herbicidal measures in terms of preventing root growth in the samples. This value was calculated at the time when 100% germination was reached in the control. *Albizia lebbeck* (L.) Benth. chloroform seed oleoresin IC_{50} value and percentage root length inhibition are shown in (Tables 3 and Tables 5).

Table 3: Percent root length inhibition of ALSO

S. No.	Sample	% Inhibition of root length (Mean±SD)			
		250 µL/mL	500 µL/mL	750 µL/mL	1000 µL/mL
1	ALSO	59.00±1.00	65.33±0.57	75.00±1.00	98.00±1.00
2	Pendimethalin	100.00±0.00	100.00 ±0.00	100.00 ±0.00	100.00 ±0.00

ALSO= *Albizia lebbeck* (L.) Benth. chloroform seed oleoresin

Shoot length Inhibition
The percent shoot length inhibition of oleoresins was measured at various concentrations of 250-1000 µL/mL, when 100% germination was attained. From lowest to highest concentrations, the chloroform oleoresin of *Albizia lebbeck* (L.) Benth. seed was shown to inhibit the length of the roots by 59.00%, 65.33%, 78.66%, and 93.00%. IC_{50} value was 104.05±13.41 µL/mL which was used to calculate the relative herbicidal measures in terms of preventing shoot growth in the samples. *Albizia lebbeck* (L.) Benth. chloroform seed oleoresin IC_{50} value and percentage inhibition of shoot length are shown in (Tables 4 and Tables 5).

Table 4: Percent inhibition of shoot length by ALSO

S. No.	Sample	% Inhibition of shoot length (Mean±SD)			
		250 µL/mL	500 µL/mL	750 µL/mL	1000 µL/mL
1	ALSO	59.00±1.00	65.33±0.57	78.66±1.15	93.00±2.00
2	Pendimethalin	100.00±0.00	100.00±0.00	100.00±0.00	100.00±0.00

ALSO= *Albizia lebbeck* (L.) Benth. chloroform seed oleoresin

Table 5: IC_{50} values of seed germination, root length and shoot length inhibition by ALSO

IC_{50} values in µL/mL (Mean±SD)		
Seed germination inhibition	**Root length inhibition**	**Shoot length inhibition**
118.86±22.00	144.15±18.10	104.05±13.41

IC_{50}-half maximal inhibitory concentration; SD- Standard deviation

Conclusion

According to the findings of the current study, it would be reasonable to conclude that *Albizia lebbeck* (L.) Benth. seed oleoresin exhibits significant herbicidal action at different concentrations. The presence of major compounds like n-hexadecanoic acid, hentriacontane, triacontane, α-tocopherol-β-dmannoside, 13-docosenamide, and (Z)- didecan-2-yl-phthalate may be the cause of the oleoresin herbicidal effect. However, minor or other major compounds may also have an allelophatic effect. The results supporting its use in the development of a natural and organic biological herbicides that can be used for the management of weeds. The outcomes of the present investigation pave the groundwork for the development of innovative, more selective, biodegradable, and ecologically friendly natural bio-herbicides that can be employed as an alternative of synthetic herbicides.

Acknowledgment

The authors would like to acknowledge Advance Research Facility (AIRF) SIMA Labs, Haridwar (Uttarakhand, India) for giving a GC-MS analytical facility.

References

1. Ting Gao, Hui Yao, Jingyuan Song, Chang Liu, Yingjie Zhu, Xinye Ma, Xiaohui Pang, Hongxi Xu, Shilin Chen. Identification of medicinal plants in the family Fabaceae using a potential DNA barcode ITS2 vol. 2010;130:116-121.
2. Parrotta JA. *Albizia lebbeck*. In: Tropical Tree Seed Manual, Agriculture Handbook 721 [ed. by Vozzo JA]. Washington DC, USA: USDA Forest Service. 2002;899.
3. Stevens PF. Angiosperm Phylogeny Website. 2012. http://www.mobot.org/MOBOT/research/APweb/
4. Arya S, Kumar R, Prakash O, Kumar S, Mahawer SK, Chamoli S, de Oliveira M. S. Chemical composition and biological activities of *Hedychium coccineum* Buch.-Ham. ex Sm. essential oils from Kumaun hills of Uttarakhand. Molecules. 2022;27(15):4833
5. Rojas-Sandoval J, Datiles M. J, Acevedo-Rodriguez P. *Albizia lebbeck* (Indian Siris). 2017. https://doi.org/10.1079/cabicompendium.4008
6. Arya S, Kumar R, Prakash O, Rawat A, Mahawer SK, Rawat DS, de Oliveira M. *Hedychium coronarium* J Koenig: traditional uses, phytochemistry, biological activities and future aspects. Current Organic Chemistry, 2022;26(18):1676-1690.
7. Lowry JB, Prinsen JH, Burrows DM. Albizia lebbeck - a promising forage tree for semiarid regions. Forage tree legumes in tropical agriculture. 1994;75-83: 24 ref.
8. Subhadeep Sasmal, Shiuraj Kumar P, Bharathi K. Pharmacognostical, phytochemical and pharmacological evaluation of alcoholic leaf extract of *Albizia lebbeck* benth. 2013;2.
9. Arya S, Mahawer SK, Karakoti H, Kumar R, Prakash O, Kumar S, Rawat DS. Study of the Variability of the Chemical Profile, and Biological Activity Approaches of *Hedychium coronarium* J Koenig Essential Oil from Different Habitats of Uttarakhand, India. Journal of Food Quality. 2023.
10. Arya S, Kumar R, Prakash O, Latwal M, Pandey G, Srivastava SKR. Chemical composition, nematicidal, insecticidal and herbicidal activities of *Hedychium coronarium* J Koenig rhizome oleoresin. The Pharma Innovation Journal. 2022;11(6):761-766.
11. Adams RP. Identification of essential oil components by gas chromatography/mass spectrometry. Carol stream, IL: Allured Publishing Corporation. 2007;456.
12. Sahu, Devkota. Allelopathic effects of Aqueous extract of leaves of mikania micrantha on seed germination and seedling growth of *Oryza sativa* L. and *Raphanus sativus* L. scientific world, Vol.11. 2013.