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Chemical Constituents of *Descurainia sophia* L. and its Biological Activity

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Abstract: Seven coumarin compounds were isolated for the first time from the aerial parts of *Descurainia Sophia* L. identified as scopoletine, scopoline, isoscopoline, xanthtoxol, xanthtoxin, psoralene and bergaptane. Three flavonoids namely kaempferol, quercetine and isorhamnetine and three terpenoid compounds β-sitosterol β-amyrine and cholesterol were also isolated and identified by physical and chemical methods; melting point, R_f values, UV and ^{1}H NMR spectroscopy. Qualitative and quantitative analyses of free and protein amino acids using amino acid analyzer were performed. The plant contains 15 amino acids as free and protein amino acids with different range of concentrations. Fatty acid analysis using GLC, revealed the presence of 10 fatty acids, the highest percentage was palmitic acid (27.45 %) and the lowest was lauric acid (0.13%). Biological screening of alcoholic extract showed that the plant is highly safe and has analgesic, antipyretic and anti-inflammatory effects.

Keywords: *Descurainia sophia*; coumarins; flavonoids; terpenoids; biological activity.

1. Introduction

Descurainia sophia L. Webb ex Prantl (=*Sisymbrium sophia* L.) belonging to Cruciferae (Brassiaceae) family. It is a large family with 390 genera and 3000 species, numerous species have food economic importance such as cabbage, cauliflower, turnip and rape [1]. The species are utilized as salad plants due to their content of antiscorbutic and low content of erucic acids. Many Cruciferous species are known for their use in folk medicine for the treatment of snake bites. Moreover, they are used as antimicrobial agent for relief of biliary colic and wound sores. They have enhancing detoxification effect of chemical carcinogen and some species exhibit hypoglycemic and hypotension effects [2]. *Descurainia sophia* is used in China for the preparation of health cigarette with a group of

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Chinese herb medicinal raw materials [3]. It is also used in mixtures of Chinese herbs to prevent lung cancer [4].

On reviewing the literature of *Descurainia sophia*, it was noticed that three new compounds from alcoholic extract of the seed were isolated, two of which are lactones and the other is phenolic compound [5]. From the alcoholic extract of its seed 15 flavonoids were isolated which are kaempferol, quercetine and isorhamnetine derivatives [6]. Two new compounds from its seed were named as descurainin A and descurainoside B [7]. Seeds of *Descurainia sophia* have 40 % linolenic acid which suggests that the plant could be used in industrial utilization [8].

The aim of the present work is on the isolation of chemical constituents of *Descurainia sophia* and investigation of their biological activities.

2. Materials and Methods

2.1. Plant material

The aerial part of *Descurainia sophia* L. was collected during 2004-2005 from the Northern West Coast, Egypt. The plant was identified in the Herbarium of Agricultural Museum, Dokki, Egypt and Desert Research Centre (20/77/1). Moreover, it was compared with plant description in Flora of Egypt [9] and Student Flora of Egypt [10]. The plant was air dried in shad and grinded to fine powder.

2.2. Amino acid contents

Free and protein amino acid contents were determined by qualitatively and quantitatively using LKB 4151 plus amino acid analyzer [11].

2.3.Lipoidal matters

2.3.1. Extraction

Sample of *Descurainia sophia* was extracted in a soxhlet apparatus using light petroleum (bp 60-80 °C) then the solvent free extract was kept for further investigation.

2.3.2.Separation and investigation of unsaponifiable matter fraction using GLC

The extracted lipid of *Descurainia sophia* was saponified by refluxing with alcoholic KOH on a boiling water bath for 24 hrs [12]. Gas-liquid chromatography apparatus, equipped with flame ionization detector, was used in identification of unsaponifiable matter. The obtained data that published before [13,14] were used as a guide to characterize some of the unknown compounds. The relative percentage of each unsaponifiable compound was determined using triangulation method [15].

2.3.3. Separation and identification of saponifiable fraction

After removal of the unsaponifiable fraction with ether, the soapy solution was converted into the corresponding free fatty acids by means of 2.5 % sulphuric acid and extracted with ether. The extracted fatty acids and the standards were converted to the corresponding methyl esters [14]. The methyl esters of the fatty acids were analyzed with a GCV Pye-Unicam series 304 gas chromatographic apparatus, column OV-17 (methyl phenyl silicon). Peak identification was performed by comparing the relative retention time of each compound with those of standard materials. The relative percentages of each individual compound were estimated as the ratio of the partial areas to the total area as mentioned [16, 17].

2.4. Isolation and identification of chemical constituents

The air dried powder of the aerial part of *Descurainia sophia* (1.5 kg) was extracted by maceration with 90% methanol (7 L) yielding 95 g of total extract. The residue was dissolved in water and fractionated with petroleum ether and ethyl acetate to give 9 g and 45 g respectively.

For the isolation of *Tepenoids,* Column chromatography of the petroleum ether fraction (9 g) was performed on neutral alumina and eluted with light petroleum then increasing the polarity by benzene, fraction of 200 ml was collected. Column fractions were combined on the basis of their TLC patterns into three main fractions (A-C) using system (a) benzene: ethyl acetate 86:14 (v/v). Fraction A (20% benzene/petroleum ether), (1.4 g) was applied on Silica gel (60-120) column (25 g, 1.5*25 cm) using hexan-ethyl acetate mixture with increasing polarity, fractions 30 ml each were collected and combined on the basis of TLC pattern using system (a) which give white needle crystals (compound 1,45 mg). The same procedure was done for compounds 2 (32 mg) and 3 (21 mg).

The isolation and purification of coumarin and flavonoid compounds isolated from ethyl acetate extract of species. The ethyl acetate fraction (45 g) of *Descurainia sophia* was chromatographed on silica column (2.5*80 cm) using chloroform as eluting solvent and the polarity was increased gradually till 100% ethyl acetate. Fractions of 300 mL were collected, applied to TLC using systems (a) and (b); ethyl acetate: methanol: water (30: 5: 4 v/v/v). The chromatogram was visualized under UV and sprayed with reagents KOH solution and hydroxyl amine ferric chloride [18]. Column fractions were combined on the basis of TLC pattern and three main fractions (D-F) were obtained.

Fraction D (0.9 g) was applied to sephadex LH20 column, eluted with MeOH and the fractions of 30 mL were collected. Collective fractions D-1, D-2 and D-3 were subjected separately to silica gel column (1*25 cm) using $CHCl_3$/EtOAC mixture as eluting system to obtain pure compounds 4(18 mg), 5 (17 mg) and 6 (21 mg).

Isolation of remaining compounds in fractions E and F was carried out using the same chromatography procedures (Sephadex column followed by silica column) to obtain compounds; 7 (16 mg), 8 (22 mg), 9 (21 mg), 10 (17 mg), 11 (15 mg), 12 (27 mg) and 13 (31 mg). The purified compounds were identified by UV and NMR spectrum using UV-Vis. spectrometer (Thermo spectronic, UniCam UV- 300 spectrophotometer) and Varian spectrometer NMR, 400 MHz.

The purified compounds isolated from *Descurainia sophia* were analyzed using UV, ^{1}H and ^{13}C- NMR spectra which were compared with previously published data [26,27,28].

2.4.1.Steroidal compounds

Sterol compounds isolated from *Descurainia sophia* were identified by comparison with authentic samples, R_f- value, melting point and ^{1}H- NMR spectra. The physical and spectral data of compounds 1-3 were identical with those of published before [27].

Cholesterol **(1)***:*White crystals R_f = 0.65 (system a) This compound was identified by R_f with authentic marker and using GLC analysis as mentioned before.

β-amyrine **(2)***:*White crystals, R_f = 0.60 (system a) m.p. = 183-184 °C ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm): 5.18 (1H, t, J =1.5 Hz`), δ 3.19 (1H, dd, J =8 Hz`), δ 1.08 (3H, s), δ 0.96 (3H, s), δ 0.94 (3H, s), δ0.89 (3H, s), 0.83 (3H, s) δ 0.78 (3H, s) and 0.75 (3H, s).

β-sitosterol: **(3):** White crystals R_f = 0.44 (system a), m.p. = 137-139 °C. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm): 5.33 (1H, d`), δ 3.50 (1H, m`), δ 2.24 (2H, m), δ 1.48 (2H, m), δ 0.96 (3H, s), δ0.78 (3H, s), 0.76 (3H, s) δ 0.75 (3H, s) 0.74 (3H, s), 0.73 (3H, s) and δ 0.64 (3 H,s).

2.4.2. Isolated coumarins and flavonoids

Scopoletin **(4):**White needle crystals, m.p. =203-204 ^{o}C, its R_f = 0.33 system (a); UV (λ max in MeOH): gives bands at 228, 275 and 350 nm. Addition of NaOAc; 228, 277 and 420 nm causes bathochromic shift (+70 nm) which indicates presence of free OH at position 7. ^{1}H-NMR (400 MHz, DMSO-d_6) δ (ppm): δ 8.0 (1H, d, J= 9Hz, H-4), δ 7.2 (1H, s, H-5), δ 6.75 (1H, s, H-8), δ 6.2 (1H, d, J= 9 Hz, H-3) and δ 3.8 (3H, s, OCH3).

Isoscopoletin **(5):** White needle crystals, m.p. =202-203 ^{o}C, its R_f = 0.33 system (a); UV (λ max in MeOH): gives bands at 228, 295, 344. No shift on addition of NaOAc indicates substitution at position 7. ^{1}H-NMR (400 MHz, DMSO-d_6) δ (ppm): δ 8.0 (1H, d, J= 9 Hz, H-4), δ 7.2 (1H, s, H-5), δ 6.75 (1H, s, H-8), δ 6.2 (1H, d, J= 9 Hz, H-3) and δ 4 (3H, s, OCH_3).

Scopoline **(6):**White needle crystals, m.p. =126-128 ^{o}C, its R_f 0.45 system (b); UV (λ max in MeOH): gives bands at 360 and 280 nm for band I and band II, addition of NaOAc cause no shift which indicate the occupation of position 7; ^{1}H-NMR (400 MHz, DMSO-d_6) δ (ppm): δ 7.9 (1H, d, J= 9 Hz, H-4), δ 7.3 (1H, s, H-5), δ 7.1 (1H, s, H-8), δ 6.3 (1H, d, J= 9 Hz, H-3) and δ 3.8 (3H, s, OCH_3). Sugar moiety, δ 5.1 (1H, d, J= 9 Hz, H-1` glucose), δ 3-3.8 (m, remaining sugar protons) [28]. $^{13}$C –NMR (100 MHz, DMSO-$d_6$):δ (ppm) δ (160.4 C-2), 112 (C-3), 145.8 (C-4), 109.6 (C-5), 113.2 (C-6), 149.8 (C-7), 102.9 (C-8), 153.6 (C-9), 112.2 (C-10), 100.6 (C-1` glucose), 73.3 (C-2` glucose), 76.7 (C-3` glucose), 69.4 (C-4` glucose), 77 (C-5` glucose), 61 (C-6` glucose) and 55.9 (OCH_3).

Psoralene **(7):** White crystals, R_f = 0.70 system (a), m.p. =290-292 ^{0}C; UV (λ max in MeOH): gives bands at 220, 250 and 298 nm. ^{1}H-NMR (400 MHz, DMSO-d_6) δ (ppm): δ 8.2 (1H, d, J= 10 Hz, H-4), δ 8.12 (1H, d, J=3 Hz, H-7), δ 8.03 (1H, s, H-5), δ 7.68 (1H, s, H-9), δ 7.12 (1H, d, J=3 Hz, H-6) and δ 6.47 (1H, d, J= 10 Hz, H-3).

Xanthotoxol **(8):**White crystals, R_f = 0.67 system (a), m.p. =253-255 ^{0}C; UV (λ max in MeOH): gives bands at 221, 244 and 300 nm. ^{1}H-NMR (400 MHz, DMSO-d_6) δ (ppm): δ 8.21 (1H, d, J= 9.5 Hz, H-4), δ 8.13 (1H, d, J=3 Hz, H-7), δ 7.65 (1H, s, H-5), δ 7.11 (1H, d, J=3 Hz, H-6) and δ 6.44 (1H, d, J= 10 Hz, H-3). EI-MS m/z (% rel. int.): showed M^+ at 202(100), 186(26), 185(18), 173(16), 145(11) and 71(10).

Xanthotoxin **(9):** White crystals, R_f = 0.65 system (a), m.p. =145- 146 ^{0}C; UV (λ max in MeOH): gives bands at 218, 249 and 299 nm. ^{1}H-NMR (400 MHz, DMSO-d_6) δ (ppm): δ 8.22 (1H, d, J= 10 Hz, H-4), δ 7.79 (1H, d, J= 3 Hz, H-7), δ 7.43 (1H, s, H-5), δ 6.91 (1H, d, J=3 Hz, H-6), δ 6.41 (1H, d, J=10 Hz, H-3) and δ 3.9 (3H, s, OCH_3). EI-mass m/z (% rel. int.): showed M^+ at 216(100), 201(22) and 173 (56).

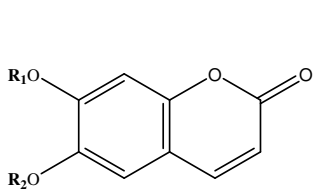
Bergapten **(10):** White crystals, R_f = 0.60 system (a), m.p. =188-190 ^{o}C; UV (λ max in MeOH): gives bands at 210, 260 and 310 nm. ^{1}H-NMR (400 MHz, DMSO-d_6) δ (ppm): δ 8.22 (1H, d, J=10 Hz, H-4), δ 7.69 (1H, d, J=3 Hz, H-7), δ 7.16 (1H, s, H-9), δ 7.10 (1H, d, J=3 Hz, H-6), δ 6.31 (1H, d, J=10 Hz, H-3) and δ 3.8(3H, s, OCH_3).

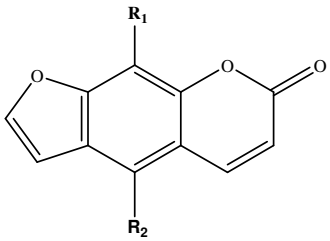
Kaempferol **(11):** UV (λ max in MeOH): gives bands at 268 and 367, NaOMe; 285, 321 and 430, NaOAc; 276, 300 and 380, H_3BO_3; 267, 319 and 380, $AlCl_3$; 264, 350 and 420 while HCl; 264, 350 and 420. ^{1}H-NMR (400 MHz, DMSO-d_6) δ (ppm): δ (ppm) 8.0 (2H, d, J = 8 Hz, H-2` and H-6`), δ 6.9 (2H, d, J = 8 Hz, H-3` and H-5`), δ 6.4 (1H, d, J = 1.5 Hz, H-8) and δ 6.2 (1H, d, J = 1.5 Hz, H-6) [28]. EI-MS m/z (% rel. int): 285 (M+) (100), 258 (15), 229 (16), 184 (8), 121 (22) and 93 (10).

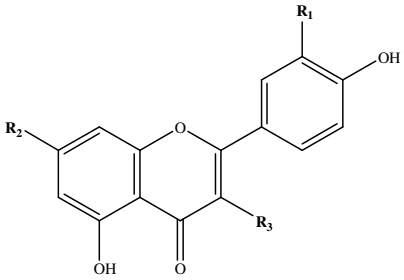
Quercetin **(12):** UV (λ max in MeOH): gives bands at 255, 300 and 370, NaOMe; 290, 330 and 440, NaOAc; 260, 335 and 381, H_3BO_3; 260, 295 and 365, $AlCl_3$; 270, 312 and 445 while HCl; 265, 305

and 425. ^{1}H-NMR (400 MHz, DMSO-d_6) δ (ppm): δ (ppm) 7.7 (1H, d, J = 8.5 Hz, H-2`), δ 7.5 (1H, dd, J = 8.5, J=2.5 Hz, H-6`), δ 6.8 (1H, d, J = 8.5 Hz, H-5`), δ 6.5 (1H, d, J = 1.5 Hz, H-6), and δ 6.2 (1 H, d, J=1.5 Hz, H-8) [28].

Isorhamnitine **(13):** UV (λ max in MeOH): gives bands at; 253, 267 and 370, NaOMe; 271, 328 and 435, NaOAc; 259, 270 and 391, H_3BO_3; 257, 272 and 360, $AlCl_3$; 253, 268 and 410 while HCl; 252, 269 and 359. ^{1}H-NMR (400 MHz, DMSO-d_6) δ (ppm): δ 7.9 (1H, d, J = 2 Hz, H-2`), δ 7.45 (1H, dd, J = 2, 8.5, J=2.5 Hz, H-6`), δ 6.9 (1H, d, J = 8.5 Hz, H-5`), δ 6.35 (1H, d, J = 2 Hz, H-8), δ 6.15 (1 H, d, J=2 Hz, H-6) and 3.8 (s, OMe) [28].







	R_1	R_2		R_1	R_2		R_1	R_2	R_3
4	H	CH_3	**7**	H	H	**11**	H	OH	OH
5	CH_3	H	**8**	OH	H	**12**	OH	OH	OH
6	Glucose	CH_3	**9**	OCH_3	H	**13**	OCH_3	OH	OH
			10	H	OCH_3				

Figure 1. Isolated coumarins and flavonoids from *Descurainia sophia*

2.5. Biological Activity Assesments

The air dried and powdered sample of *Descurainia sophia* was extracted with ethanol (70%) in a soxhlet apparatus and the concentrated extract was suspended in water pH 6-7. Different concentrations of the alcoholic extract were prepared for the biological activity.

2.5.1. Determination of median lethal dose (LD_{50})

LD_{50} of the studied extract was determined [19].

2.5.2. Antipyretic activity

Rats (20) were divided into 4 equal groups. All rats were made hyperthermic by subcutaneous injection of Brewer's yeast in physiological saline solution in a dose of 150 mg/kg b.wt.[20]. After 17 hours, the initial body temperature of each rat was measured rectally. The first group was left as control while the 2nd one was given diclofenac sodium (standard). The 3rd and 4th groups of the rats were orally given the extract (200 and 400 mg/kg b.wt.). The temperature of each rat was then recorded at l hr intervals for 4 h.

2.5.3. Anti-inflammatory activity

This method depends on induction of pedal inflammation in rat's foot by formalin (4 %) [21]. Rats (20) were divided into 4 equal groups. The 1st group was kept as a control while the 2nd one was given (Phenyl butazone). Rats of the 3rd and 4th groups were orally administered (200 and 400 g/kg^{-1}). After 30 minutes, inflammation was induced by subcutaneous injection of 0.1 mL of formalin into the left paw. The anti-inflammatory effect was determined by measuring the thickness of injected paws in mm. using a caliber at 1 h interval after administration 4 successive hours.

2.5.4. Analgesic Activity

The analgesic effect of the tested extract was compared with that of the standard (paracetamol) by using the writhing method [22]. Twenty mice of both sexes weighing from 20-25 g were divided into 4 equal groups. 1st group was kept as a control while 2nd one was injected subcutaneously with 20 mg/100 g b. w. of paracetamol. The 3rd and 4th groups were orally given the tested extract in doses of 200 and 400 mg/kg b.wt. respectively. After 30 min, each mouse was injected intraperitoneally with 0.25 mL of p-benzoquinone aqueous solution (0.1 mg/mL). Therefore, mice in each group were observed for writhing every 1 h for 4 h. Animals devoid of writhing in each group were counted and the analgesic potency of the tested extract was determined as % protection against writhing. The effect of paracetamol and the tested extract were recorded.

3. Results and Discussion

3.1. Phytochemical Analysis

Free and total amino acid contents of the species have been evaluated and 15 amino acids as free and protein amino acids with different range of concentrations determined Table (1). Proline and glutamic acids are the major components of protein and free amino acids, respectively, while tyrosine is the minor component in both free and protein amino acids. The high percent of proline may be due to increase in soil salinity. The salinity inhibited the transmission reactions, then the glutamic acid accumulated and transformed to other nitrogenous compounds such as proline [23]. High proline concentrations may help to protect cell metabolism and facilities recovery after stress [24]. Also proline improved the growth of salt stressed to cell cultures and that was attributed to the role of proline as an osmoprotectant for enzymes and membranes against salt inhibition [25].

Table 1. Free and protein amino acids of *Descurainia sophia* using amino acid analyzer.

No.	Amino acid	RT	Free a. a. (mg/100g)	Protein a. a (mg/100g)
1	Aspartic	10.45	39.1	11.3
2	Threonine	13.84	8.3	5.5
3	Serine	15.09	45.2	5.3
4	Glutamic acid	16.40	59.9	13.6
5	Proline	19.16	58.5	27.2
6	Glycine	24.41	5.7	5.8
7	Alanine	25.60	13.6	7.3
8	Valine	32.14	15.1	8.5
9	Isoleucine	38.34	2.9	5.8
10	Leucine	40.39	13.0	8.9
11	Tyrosine	44.54	1.4	2.1
12	Phenylalanine	47.16	6.0	6.9
13	Histidine	49.17	3.6	4.6
14	Lysine	54.92	3.5	7.8
15	Argenine	62,97	2.8	4.6

RT = Retention time

The saponifiable matter (fatty acids) composition of *Descurainia sophia* was estimated using GLC technique. The relative percentages of each component were calculated, Table (2). Data revealed the presence of 10 fatty acids. The highest percentage was of palmitic acid (27.45 %) and the lowest was lauric (0.13%). While the unsaponifialbe (hydrocarbons and sterols) composition of *Descurainia sophia* was determined using GLC technique, the relative percentages of each component were calculated in Table (3). Data revealed the presence of 15 hydrocarbons, the highest percentage was of eicosane while the lowest was tetracosane.

Table 2. GLC of fatty acids of *Descurainia sophia*

Compounds	No. of carbon atoms	RT	Relative %
Capric acid	10:0	11.98	1.6
Lauric acid	12:0	13.56	0.1
Myristic acid	14:0	15.06	3.2
Cis-9-Tetradecenoic acid	14:1	16.51	1.9
Palmitic acid	16:0	18.63	27.4
Cis-9-Hexadecenoic acid	16:1	21.88	4.2
Stearic acid	18:0	25.40	18.1
Oleic acid	18:1	27.48	13.1
Linoleic acid	18:2	31.03	21.8
Linolenic acid	18:3	37.06	4.8

RT = Retention time.

3.2. Biological Activity

3.2.1. Determination of median lethal dose (LD_{50})

It was noticed that *Descurainia sophia* is *n*on toxic in doses up to 2500 mg/kg b. wt., the tested plant is considered to be highly safe since substances possessing LD_{50} higher than 50 mg/kg b. wt are non toxic [29].

Table 3. GLC of hydrocarbons and sterols of *Descurainia sophia*

Name	No. of carbon atoms	RT	Relative %
Tetradecane	14	9.11	0.5
Hexadecane	16	12.83	0.6
Heptadecane	17	14.03	1.9
Octadecane	18	14.78	0.8
Nonadecane	19	15.21	1.2
Eicosane	20	16.36	21.1
Henicosane	21	17.45	1.6
Docosane	22	18.73	13.2
Tricosane	23	20.50	2.1
Tetracosane	24	21.40	0.5
Pentacosane	25	22.70	2.6
Hexacosane	26	23.98	2.1
Octacosane	28	25.33	7.9
Cholesterol	27	34.80	13.9
β-sitosterol	29	35.86	17.9

RT = Retention time

3.2.2.Antipyretic activity

The antipyretic activity of *Descurainia sophia* is nearly the same as Diclofenac sodium in a dose of 400 mg/kg b.wt. as shown in Table (4).

Table 4. Antipyretic effect of (70%) alcoholic extract in hyperthermic rats. (n=5).

Sample	Dose (mg/kg^{-1})	Rectal temp. (^oC) after (h).			
		1	2	3	4
Control	0.0	38.94 ±0.46	38.83 ±0.37	38.92±0.42	38.79±0.42
Diclofenac sodium	50	37.62*±0.37	37.51*±0.38	37.52*±0.36	37.61*±0.38
Extract	200	38.60±0.37	38.51 ±0.40	38.55±0.39	38.54±0.39
	400	37.80 ±0.31	37.50*±0.32	37.52*±0.42	37.90±0.40

Significant at: * $p \leq 0.05$

3.2.3. Anti-inflammatory activity

Descurainia sophia has anti-inflammatory activity especially after 2 and 3 hours compared with the control and that of injected with phenyl butazone, Table (5). It significantly decreased the paw thickness in comparison to the control group. The effect appeared at 2 h and persisted for a period of 3 h post-administration.The anti-inflammatory activity of the plant could be due to the presence of coumarins [30].

Table 5. Anti-inflammatory effect of *Descurainia sophia*. 70% alcoholic extract.

Sample	Dose (mg/kg^{-1})	Thickness of paw in mm after (h)			
		1h	2h	3h	4h
Control	0.0	6.89 ± 0.34	7.17±0.33	7.57 ± 0.35	7.22 ± 0.36
Phenyl butazone	50	5.56** ±0.30	5.54** ±0.31	5.60*** ±0.33	5.89* ±0.35
Extract	200	6.32 ± 0.35	6.39 ±0.32	6.42 ± 0.32	6.46 ± 0.34
	400	6.11* ±0.36	6.16 * ±0.32	6.19 * ±0.36	6.24 ± 0.35

3.2.4. Analgesic activiy

The plant extract has analgesic activity compared with the control and paracetamol, Table (6). Small dose of (70%) alcoholic extract produced 20% protection against writhing induced by p-benzoquinone while high dose produced 40% protection corresponding to 100% protection for diclofenac sodium.

Table 6. Analgesic effect of *Descurainia sophia*. extract in mice (n=5).

Sample	Dose (mg/kg^{-1})	Percentages of protection against writhing after			
		1hr	2hr	3hr	4hr
Control	0.0	0	0	0	0
Paracetamol	50	100	80	60	40
Extract	200	40	20	20	0
	400	80	60	40	20

As a conclusion, *Descurainia sophia* is rich in chemical constituents which could be used as treatment agents. The plant extract also showed a promising biological activity which could be attributed to the presence of phenolic compounds. So, checking out of the biological activities and the active agents from medicinal plants reported in traditional medicine is of interest as they may act also as templates for drug derivatization.

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