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Morphological and Chemical Studies for *Pulicaria undulata* L. (Compositae) in Iraq

Khansaa R. Al-Joboury

Iraq Natural History Research Center and Museum, University of Baghdad, Baghdad, Iraq
E-mail: dr.khansaa@nhm.uobaghdad.edu.iq

Abstract: The morphological features of *Pulicaria undulata* (L.) C. A. Mey. were observed. This species is a perennial plant, twiggy subshrub 30-120 cm high with a deep root system, leaves are lanceolate, semi-amplexicaul and decurrent on one side, Inflorescence is in irregular cymes, peduncles 4-5 cm long, involucre 5-7 × 3-4 mm, phyllaries numerous, linear, brown, hairy or glabrous. Kaempferol, kaempferol 3-methyl ether, 6-methoxykaempferol, quercetin, quercetin 3-methyl ether, quercetin 3,7-dimethyl were estimated using HPLC chromatography.

Keywords: Compositae, Chemical profile , Iraq, Morphological study, *Pulicaria undulata*

Pulicaria undulata (L.) C. A. Mey. (1831) (syn. *Francoeuria crispa* subsp. crispa, *F. crispa* var. *crispa*, *Pulicaria crispa* subsp. *crispa*, *P. crispa* var. *crispa*, *P. crispa* var. *gracillima* Maire, *P. undulata* var. *undulata*, belongs to the family compositae (asteraceae) (GBIF Secretariat 2020) . This is native in Iraq, Iran, Yemen, Afghanistan, Algeria, Benin, Chad, Djibouti, Egypt, Eritrea, Ethiopia, Gulf States, India (Dawar et al., 2002). This species very important medicinal plant known as *Dethdath*, and used medicinal plants to make traditional medicines all over the world since ancient times. The branches and flowers are used to prepare powders to repel insects (Khansaa et al., 2017). This species is used for a traditional medicine which act as tonic, antispasmodic, antihypoglycemic drugs and ingredients of perfumes (Ghazanfar and Edmondson 2019) and is rich source for large number of bioactive compounds such as flavonoids which are the secondary plant metabolites and are compounds of low molecular weight. They are chemically polyphenolic and their nature offers a common structure, benzo- γ-pyrone (Ahmed and Ibrahim 2018). This study aimed to characterize the plant through morphologic characteristics and to evaluate the flavonoids present in it.

MATERIAL AND METHODS

Twelve plant were collected from Al- Zafaraniyah/ Baghdad- Iraq in 2020 during the flowering period in April at 3 geographical locations, the coordinate of these stations was 33°15'49.0"N 44°29'16.6"E, 33°15'44.4"N 44°29'13.1"E and 33°15'34.7"N 44°29'17.4"E. The taxonomical key was used to identify the specimens of this species for precise identification (Ghazanfar and Edmondson 2019). After being air dried, the aerial parts of this species were grounded in a mortar and flavonoids were isolated from *Pulicaria undulata* in pure form. Five grams of plant material separated in 100 ml of methanol using maceration (48 h). Then removed in the vacuum with the temperature at 50ºC and the extracts were freeze-dried (Romanik et al., 2007).

RESULTS AND DISCUSSION

Morphological study: *Pulicaria undulata* is perennial plant and twiggy subshrub were 30-120 cm high with a deep root. Plant branches from the base, white-floccose or light gray in color, densely glandular, and take the form of extensive cushions. Its branches are many and may intertwine. The leaves are are very long at the bottom and shorter towards the top with shape as lanceolate, semi-amplexicaul and decurrent on one side. The margin of the leaves are very clearly undulating, 2-25×1-5 mm, base almost auriculate (Fig. 1). Inflorescence is irregular cymes, peduncles 4-5 cm long, involucre 5-7 × 3-4 mm, phyllaries numerous, linear, brown, hairy or glabrous Ghazanfar and Edmondson (2019) also mentioned similar observation. Corolla yellow, 2.75-3 mm long, the ligule only 1 mm, and the disc florets 2.5-3.5 mm long, with glandular hairs. Cypsela 0.8 mm long, glabrous, brown, 5-ribbed, the bristles with a short narrow tuft of slightly longer hairs at the tip. Outer pappus is ring of scales and inner pappus of bristles (short stiff hair) joined at the base into a tube, each bristle with a narrow apical tuft of slightly longer hairs. The morphology gave as clear features of this species very useful for the delimitation and identification. There were two types in trichomes that spread densely in its parts. The non-glandular and glandular which spread and concentrated in all parts organs: leaves, stems and flowers (Abid and Qaiser 2002) Trichome diversity were divided into 4 groups.

N**on-glandular trichome:** These are found in all plant parts and are simple non-glandular unicellular trichomes, different lengths ranging from short to very long about 10-860µm, curved all with acute apex (Fig. 2. A 1- A 3) (Krak and Mraz 2008).

Non-glandular multicellular trichomes: These are also found in all parts of plants, some trichome fragmented from ending with a thin flagellum, others have basal cell broader, 3- 7 cells long and the apical cell like a conical shape, others consists of two cells of different lengths, straight or curved and all with obtuse apex (Fig. 2. A 3- A7) (Al-dobaissi et al., 2016).

Stellate trichomes: The sparse stellate hairs are on the involucral bracts (Fig. 2. A 8).

Glandular trichome: These were multicellular divided into head and stalk (Fig. 2. B1) (Valkama et al., 2003, Ciccarelli et al., 2007).

Chemical profile: Six different flavonoids were extracted and identified: Kaempferol, kaempferol 3-methyl ether, 6-methoxykaempferol, quercetin, quercetin 3-methyl ether, quercetin 3,7-dimethyl ether (Fig. 3). The peaks for target flavonoids eluted at retention times 47.82, 52.38, 44.71, 34.41, 83.22 and 40.32 min, respectively, through the sample extract (Table 1). Fahmi et al (2019) also made similar observation. Kaempferol recorded the highest value of160.55 but quercetin recorded the lowest value both in retention time and area which was 36.66 and 34.41, respectively. The highest concentration recorded for kaempferol was 0.26 mg/mL. Flavonoids protect plants against different biotic and abiotic stresses, and responsible resistance to frost,

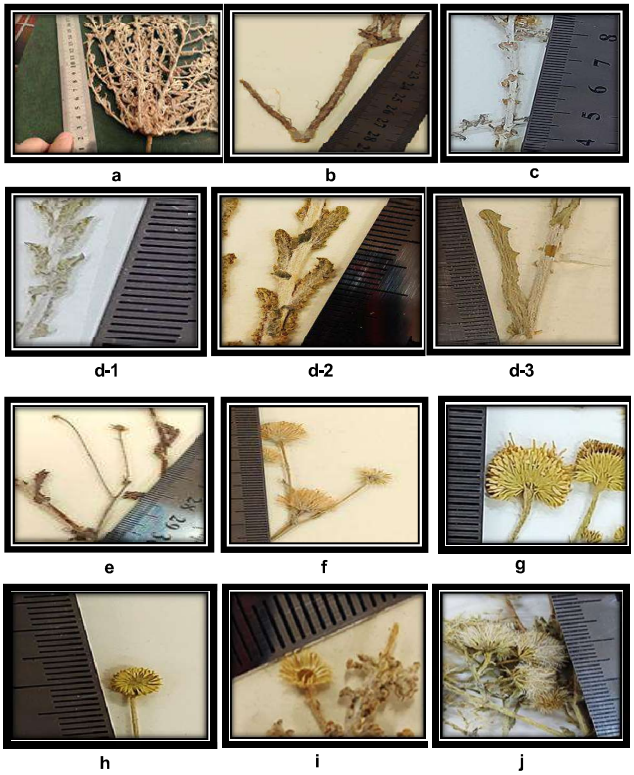

Fig. 1. Morphological characteristics of *Pulicaria undulata*a: Whole plant, b: Root, c: the stem, d1-3: Different lengths of leaves, e-i: Inflorescence, j: Pappus calyx

Table 1. Flavonoids component with retention time and area of this species

Flavonoid compounds	Retention time (mints)	Area	Concentration mg/mL
Kaempferol	47.82	160.55	0.26
Kaempferol 3-methyl ether	52.38	50.32	0.11
6-Methoxykaempferol	44.71	40.13	0.05
Quercetin	34.41	36.66	0.04
Quercetin 3-methyl ether	83.22	90.71	0.15
Quercetin 3,7-dimethyl ether	40.32	110.53	0.20

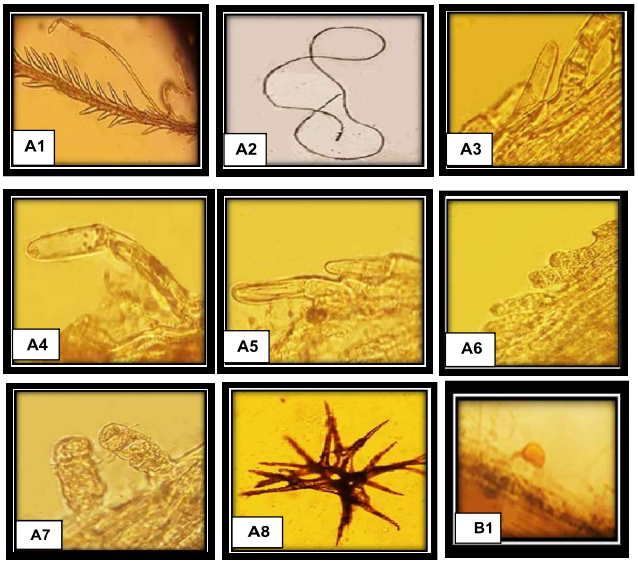

Fig. 2. Morphological characteristics for the trichomes of the species *Pulicaria undulata* A1-8: Non-glandular trichomes (300x), B1: Glandular trichomes (400x)

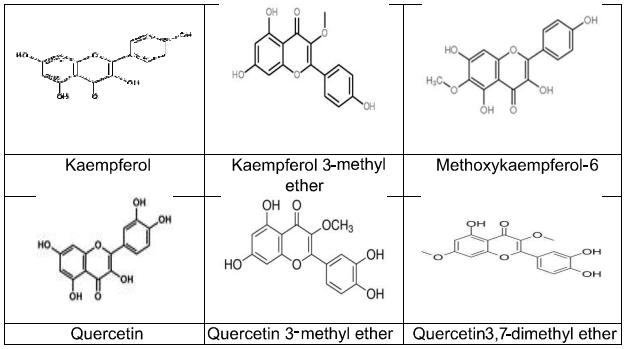

Fig. 3. Morphological form for the flavonoid compounds of the species *P. undulata*

hardiness, drought resistance, also have a functional role for plant heat acclimation and freezing tolerance (Vieira et al., 2003). Mierziak et al. (2014) reported that the essential oil of the aerial parts for *P. gnaphalodes* has shown the presence of flavonoids, but studies on the concentrations of flavonoids are very rare in Iraq.

CONCLUSION

The study verified the morphological features of *Pulicaria undulate* (L.) C. A. Mey. (Asteraceae) which collected from Al-Zafaraniyah/ Baghdad-Iraq. Trichomes (hairs) were mainly divided into non-glandular and glandular .Various chemical kaempferol, kaempferol 3-methyl ether, 6-methoxykaempferol, quercetin, quercetin 3-methyl ether, quercetin 3,7-dimethyl were estimated by HPLC chromatography. This will be helpful for medicinal use and further investigations.

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