

## TRADITIONAL USES, PHYTOCHEMICAL AND BIOLOGICAL ACTIVITIES OF *PULICARIA ARABICA* (L.) CASS.

A. SASSOUI<sup>1,2,\*</sup>, D. SARRI<sup>1</sup>, N. HENDEL<sup>3</sup>, M. SARRI<sup>1,\*</sup>

<sup>1</sup>Mohamed Boudiaf University, Department of Nature and Life Sciences, M'Sila / ALGERIA

<sup>2</sup>May 8, 1945 University, Laboratory of Biology, Water and Environment (LBWE), Guelma/ ALGERIA

<sup>3</sup>Mohamed Boudiaf University, Department of Microbiology and Biochemistry, M'Sila / ALGERIA

\*Corresponding authors: [ammar.sassoui@univ-msila.dz](mailto:ammar.sassoui@univ-msila.dz) / [madani.sarri@univ-msila.dz](mailto:madani.sarri@univ-msila.dz)

**Abstract:** This article aims to overview the traditional uses, chemical compositions and biological activities of essential oils and extracts of *Pulicaria arabica* which is considered a traditional medicinal plant in the treatment of various diseases.

The *P. arabica* is used in the treatment of several diseases such as antidiarrheal, anti schistosomiasis, digestive disorders, ulcers, anti-tobacco and skin diseases. Several different biological properties have been reported such as antimicrobial, antioxidant, analgesic, antipyretic, anti-inflammatory, insecticidal, hepatoprotective and nephritic effects. The chemical investigation of the *P. arabica* (aerial parts, leaves, stems and flowers) showed some qualitative and quantitative differences in the chemical composition, for example the major compounds for essential oils (Thymol,  $\gamma$ -Cadinene,  $\alpha$ -Cadinol and *epi*- $\alpha$ -Cadinol), flavonoids and Caryophyllene derivatives.

**Keywords:** Asteraceae, *Pulicaria arabica* (L.) Cass., Ethnomedecine, Chemical composition, Bioactivities.

### 1. Introduction

*Pulicaria arabica* (L.) Cass. (Asteraceae, Inuleae) its basionym are *Inula arabica* L. This species its native range is South and East Mediterranean basin to Pakistan and Arabian Peninsula (Fig.1a) [1]. There are 12 species of *Pulicaria* that grow naturally in Algeria [2,3], among them *P. arabica* is a grass that shelters wet places and marshes. The plant is traditionally used in Algeria, Egypt, Saudi Arabia and other countries [4-6].

The phytochemical study of the essential oil of *P. arabica* showed a significant chemical variation in different countries such as Egypt [7 10], Saudi Arabia [11-13], Algeria [4,14].

Some publications reported bioactivities of *P. arabica* as antibacterial [4,15-17], antioxidant [4,16], antiviral [18], analgesic, antipyretic and anti-inflammatory in hepatic and nephretic [19] and insecticidal [14].

This article aims to give the relevant literature of the medicinal uses, chemical compositions, and biological activities of *P. arabica* growing in Algeria comparing with other countries.

### 2. Taxonomic tree of *Pulicaria arabica* (L.) Cass.

Kingdom	: Plantae
Subkingdom	: Tracheobionta
Order	: Asterales
Division	: Magnoliophyta
Family	: Asteraceae
Class	: Magnoliopsida
Subclass	: Asteridae
Genus	: <i>Pulicaria</i> Gaertn.
Species	: <i>Pulicaria arabica</i> (L.) Cass.

### 3. Vernacular names of *Pulicaria arabica* (L.) Cass.

Arabic : Rara ejub, abu- ain-safra, deithouth, hatassa, arba'a Aiuyûb.

English: Ladies' false fleabane

French: Pulicaire d'Arabie

Spanish : Arrudena, coniza, yerba de las pulgas, yerba pulguera

Portugal : Herba piolheira, tagueda.

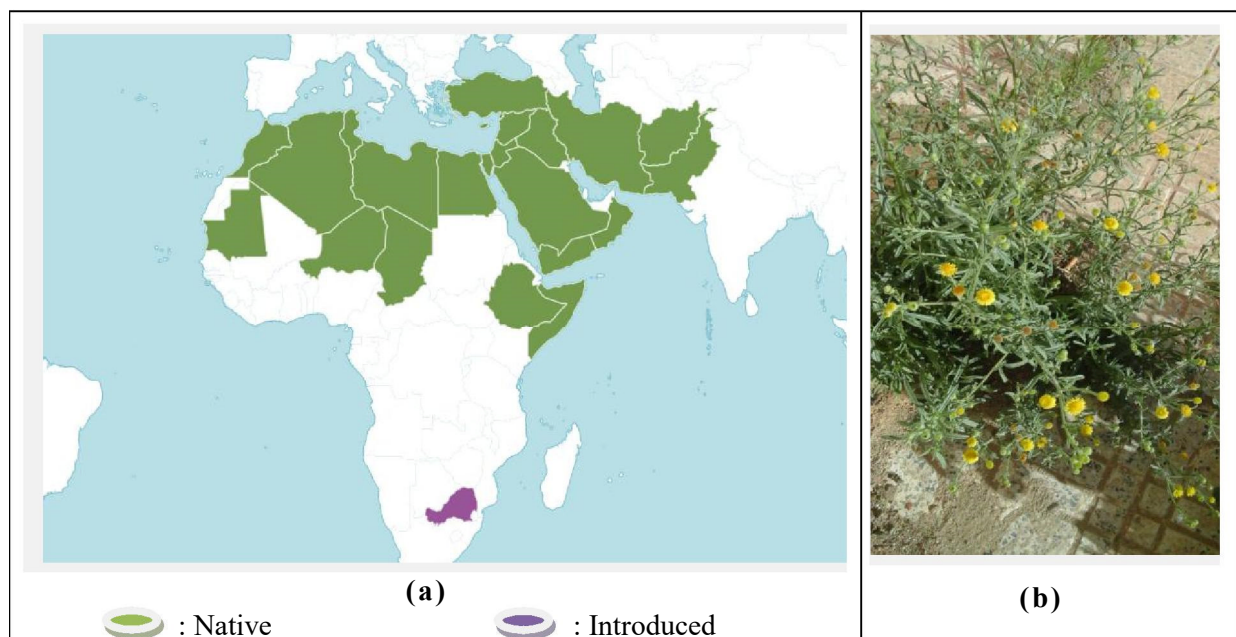
#### 4. Botanical description

Perennial plant with yellow flowers (Fig.1b) [1], erect 10-60 cm, with erect branches. Dichotomous, paniculate inflorescence. Capitula heterogamous, multi-florous, long stalked, large or fairly large, 10-20 mm in diameter, with spreading ligules, fairly long, amply exceeding the involucre and flowers of the disk the tubular and hermaphroditic.

Receptacle flat, bare, with alveolate spines. Involucre (bracts on a few rows, generally narrow, the outer ones are short or foliaceous)

densely hairy, hispid achenes with fairly long double pappus, the outer one is short, free, cupuliform, made up of flakes more or less horny at the base, free or more or less fused with the inner, the inner is composed of long, scabrous bristles.

Leaves are linear, oblong lanceolate, entire, slightly or subdentate, not embarrassing, nor rolled up, tuberculous, rough, hairy or not [2].



**Fig.1.** Distribution in the world <sup>(a)</sup> [1] and specimen harvested in Algeria <sup>(b)</sup> of *P. arabica* (L.) Cass.

#### 5. Traditional uses

*Pulicaria* species are used in the treatment of several diseases such as hypoglycemia, fever, spasmodic diseases, cancers, microbial and

inflammation [20,21]. However, the *P. arabica* (L.) Cass. is used in folk medicine in the form of various remedies (Table 1).

**Table 1.** Traditional uses of *P. arabica* (L.) Cass.

Traditional uses	References
- antidiarrheal agent and antischistosomiasis	[6]
- treatment of painful swellings and boils	[4]
- treatment of digestive disorders	[5,12]
- treatment of ulcers	[ 2 2 ]
- anti-tobacco	[18]
- use as lotion for curing skin diseases	[ 2 3 ]
- the powder of the plant is used as an sneeze, by nasal intake, in the treatment of certain Oto-Rhino-Laryngology diseases and headaches	[ 2 4 ]

## 6. Phytochemical investigation

The analysis of chemical components identified in *Pulicaria* genus essential oils shows that the oil consists of several groups of components, which are monoterpenes hydrocarbons, oxygenated monoterpenes, sesquiterpene hydrocarbons, oxygenated sesquiterpenes, aldehydes, and ketones [21].

In addition, Table 1 summarizes the previous investigations of authors on the phytochemical studies from *P. arabica* that characterize the presence of volatile oil [4,11,14,25], flavonoids [7,10,12], and caryophyllene derivatives [8]. The

comparison of the chemical composition of the essential oil of *P. arabica* (aerial parts, leaves, stems and flowers) shows some qualitative and quantitative differences in the composition of the oil from Saudian, Tunisian and Algerian of the plant studied [4,11,14,25].

Other research on the *P. arabica* species has reported the isolation of certain flavonoids compounds and caryophyllene derivatives (Table 1).

**Table 2:** Major chemical components of *P. arabica*

Country	Parts / Major components		References
	A) Essential oils		
Algeria	Aerial parts		[4]
	<ul style="list-style-type: none"> <li>■ Bicyclo(4.4.0) dec-1-ene2-Isopropyl-5-methyl-9-methylene (17.2%)</li> <li>■ 1H-indene.1-ethylideneoctahydro (13.2%)</li> <li>■ A-Cadinene (13.0%)</li> <li>■ <math>\alpha</math>-Muurolene (5.9%)</li> <li>■ R-Ocimene (5.8%)</li> </ul>		
	Aerial parts		[14]
	<ul style="list-style-type: none"> <li>■ <i>epi</i>-<math>\alpha</math>-Cadinol (23.9%)</li> <li>■ S-Cadinene (21.1%)</li> <li>■ <math>\alpha</math>-Cadinol (19.8%)</li> <li>■ Germacrene D-4-ol (8.4%)</li> </ul>		
Saudi Arabia	Aerial parts		[11]
	<ul style="list-style-type: none"> <li>■ R-Selinene-2<math>\alpha</math>-ol (3.4%)</li> <li>■ R-Cedrene (2.5%)</li> <li>■ Carbonyl compounds and acids (2%)</li> <li>■ (Z)-Jasmone</li> </ul>		
Tunisia	Stems		[25]
	<ul style="list-style-type: none"> <li>■ Thymol (15.2%)</li> <li>■ <i>cis</i>-Calamenene (9.1%)</li> <li>■ Carbonyl compounds and acids (7.5%)</li> <li>■ <i>α-epi</i>-Cadinol (6.6%)</li> </ul>		
	Flowers		
	<ul style="list-style-type: none"> <li>■ <math>\gamma</math>-Cadinene (11.7%)</li> <li>■ <i>cis</i>-Calamenene (9.5%)</li> <li>■ <math>\alpha</math>-Cadinol (8.6%)</li> </ul>		
	Leaves		
	<ul style="list-style-type: none"> <li>■ <math>\alpha</math>-Cadinol (10.3%),</li> <li>■ <i>α-epi</i>-Cadinol (8%)</li> <li>■ <i>cis</i>-Calamenene (7.9%)</li> </ul>		
<b>B) Flavonoids</b>			
Saudi Arabia	Aerial parts		[12]
	<ul style="list-style-type: none"> <li>■ Quercetagetin-3,6,7-trimethyl ether</li> </ul>		
Egypt	Leaves and flowers		[7]
	<ul style="list-style-type: none"> <li>■ Quercetagetin-3,7-dimethyl ether</li> <li>■ Quercetagetin-3,5,7-trimethyl ether</li> </ul>		

	<ul style="list-style-type: none"> <li>■ Quercetagetin-3,5,7,3'-tetramethyl ether</li> <li>■ Quercetin 3-glucoside</li> <li>■ 3-glucuronide</li> </ul>	
	Aerial parts	
	<ul style="list-style-type: none"> <li>■ Quercetagetin-3,5,6,7,4'</li> <li>■ 3,5,6,7,3'-pentamethyl ethers</li> <li>■ Quercetagetin-3',4'-dimethyl ether</li> </ul>	[10]

**Table 2:** Major chemical components of *P. arabica* (Continued)

Country	Parts / Major components	References
	C) Caryophyllene derivatives	
	Aerial parts	
Egypt	<ul style="list-style-type: none"> <li>■ 12-Hydroxy-5<math>\beta</math>-methoxy-6(14)-dehydro-5,6-dihydrocaryophyllen-7-one</li> <li>■ 12-Acetoxy-5<math>\beta</math>-methoxy-6(14)-dehydro-5,6-dihydrocaryophyllen-7-one</li> <li>■ 12-Acetoxy-5<math>\alpha</math>-methoxy-6(14)-dehydro-5,6-dihydrocaryophyllen-7-one</li> <li>■ 5<math>\alpha</math>,12-dihydroxy-5,6-dihydrocaryophyllen-7-one</li> <li>■ 12-Acetoxy-7<math>\alpha</math>,14-dihydroxy-5E-caryophyllene</li> <li>■ 12-Acetoxy-14-methoxy-5E-caryophyllen-7-one</li> <li>■ Bis-[SZ-7-oxo-caryophyllene]-14-O-ether</li> </ul>	[8]

## 7. Biological activities

In the literature, various biological activities have been reported on the genus *Pulicaria*. Most studies have been reported on antimicrobial [4,17,26-30], and antioxidant [4,27-32].

In addition, *Pulicaria* species have other activities such, analgesic, antipyretic, anti-inflammatory, hepatoprotective and nephritic effects [19], antihistaminic [33], anticancer [30,34-37], leishmanicidal [38,39] and insecticidal [14,40].

Few works have been cited on biological activities, either on essential oils or extracts of *P. arabica*. In summary, the ethanolic extract of *P. arabica* induces potent analgesic, antipyretic and anti-inflammatory with significant hepatic and nephritic protective actions.

In addition, the disturbance of liver and kidney function parameters induced by CCl<sub>4</sub> intoxication was recovered by *P. arabica* extract [19]. The microbiological effect of the essential oil of *P. arabica* show a significant inhibitory action against bacteria and yeasts [14], in addition, the ethanolic extract of *P. arabica* show activity against *Enterococcus faecalis*, Methicillinresistant *Staphylococcus aureus* [17];

The potential extended spectrum  $\beta$ -lactamase (ES $\beta$ L) suppressing activities of crude extracts of *P. a arabica* show a inhibitory activities [15]; and that *in vitro* antioxidant activity of essential oils of *P. arabica* was achieved using DPPH indicated a average capacity [4], but, the evaluation of the antiradical test of the methanolic extract of *P. arabica* shows a high capacity [4].

Also, the essential oils of *P. arabica* show a very marked insecticidal activity against *Spodoptera littoralis* [14].

## 8. Conclusion

*Pulicaria arabica* (L.) Cass. is an important medicinal plant utilized for the treatment of different diseases. The literature revealed that the phytoconstituents and biological activities are available in the *Pulicaria* genus.

The species *P. arabica* remains the least studied species in terms of biological activities compared to other species of the genus; this article has summarized the few works cited in the literature, and our objective is to encourage researchers to value as an example the biological activities such as those of insecticidal, anti-inflammatory, anticancer and leishmanicidal of the species *P. arabica*.

## 9. References

1. Kew. Plants of the world Online (2022). <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:240490-1>
2. Quezel P., Santa S. Nouvelle flore de l'Algérie et des régions désertiques méridionales, Paris. *Centre National de la Recherche Scientifique*, 2 (1963) 798-990.
3. Ozenda P. La flore du Sahara, Paris. Editions *Centre National de la Recherche Scientifique*, (1983) 430-432.
4. Djermane N., Gherraf N., Arhab R., Zellagui A., Rebbas K. Chemical composition, antioxidant and antimicrobial activities of the essential oil of *Pulicaria arabica* (L.) Cass. *Der Phar Let*, 8 (2016) 1-6.
5. Zedan Z.I. and Hatem A.S. Phytochemical and pharmacological studies on *Pulicaria orientalis* Jaub & SP. *Bull. Pharma. Sci. Assiut University*, 6(2) (2002) 189-200.
6. Ali S.A., Natural products as therapeutic agents for schistosomiasis. *Res. J. Med. Plant.*, 5 (2011) 1-20.
7. EL Negoumy S.I., Mansour R.M.A., Saleh N.A.M. Flavonols of *Pulicaria arabica*, *Phytochemistry*, 21(4) (1982) 953-954.
8. Hafez S., Sarg T.M., El Domiaty M.M., Ahmed A.A., Melek F.R., Bohlmann F. Caryophyllene derivatives from *Pulicaria arabica*, *Phytochemistry*, 26(12) (1987), 3356-3358.
9. Ramadan M.A., Flavonoids from *Pulicaria arabica* (L.) Cass. Assiut University, *Bull. Pharm. Sci.*, 21 (1998) 103-108.
10. Malek F.R., El Ansari M.A., Hassan A., Regaila A., Ahmed A.A., Abary T.J. Methoxylated flavonoid aglycones from *Pulicaria arabica*, *Revista Latinoamérica Química*, 19 (1988) 119.
11. Mossa J.S., Hifnawy M.S., Al-Yahya M.A., Al-Meshal I.A., Mekkwawi A.G. Aromatic plants of Saudi Arabia (part 8), GC/MS analysis of essential oils of *Pulicaria arabica* and *P. undulata*., *Pharm Biol.*, 25 (1987) 113-119.
12. Mossa J.S., Hifnawy M.S., Alyahya M.A., Hafez M.M., Shehata A.A., Elferaly F.S. Flavonoids and coumarins from three Saudi Arabian Compositae Species, *Int. J. Crude Drug Res.*, 26 (2) (1988) 181-184.
13. Al Hazimi H.M.G., Al Khathlan H.Z. Chemistry of various *Pulicaria* species (Asteraceae). *Journal Chemical Society of Pakistan*, 14 (1992) 233-233.
14. Sassoui A., Hendel N., Sarri D., Sarri M., Filippo M., Maurizio B., Donato R. Angelo C., Roman P. Giovanni B. Essential oils from three Algerian medicinal plants (*Artemisia campestris*, *Pulicaria arabica*, and *Saccocalyx satureioides*) as new botanical insecticides?, *Environ. Sci. Pollut. Res.*, 27 (2020), 26594-26604.
15. Abdallah H.M., Asfour H.Z., El Halawany A.M., Elfaky M.A. Saudi plants as a source of potential  $\beta$ -lactamase inhibitors, *Pak. J. Pharm. Sci.*, 31(1) (2018) 325-332.
16. Djermane N., Gherraf N., Rebbas K., Arhab R. Comparative evaluation of the antiradical and antimicrobial activities of organic extracts of Algerian *Pulicaria arabica* (L.) Cass. with reference products. *Der Pharma Chemica*, 9(12) (2017) 114-118.
17. Ozdemir N.E., Bilgin M, Gurdal B. Antimicrobial activity of *Pulicaria* species from Turkey. *Experimed.*, 11(3) (2021) 195-1199.
18. Mouhajir F. Medecinal plants used by Berber and Arab peoples of Morocco: *Ethnopharmacology and phytochemistry*. PhD in University of British Columbia, Vancouver, (2002) 245.
19. Yusufoglu H.S. Analgesic, antipyretic, anti-inflammatory, hepatoprotective and nephritic effects of the aerial parts of *Pulicaria arabica* (Family: Compositae) on rats. *Asian Pac J Trop Med*, 7(1) (2014) S583-S590.
20. Liu L.L., Yang J.L., Shi Y.P. Phytochemicals corroand biological activities of *Pulicaria* Species. *Chem. Biodivers.* 7 (2010) 327-349.
21. Salleh W.M.N.H.W, Kassim H. Tawang A. Volatile components and biological activities of *Pulicaria* essential oils. A review. *La Rivista Italiana Delle Sostanze Grasse*, 98(1) (2021) 49-58.
22. Provencal P. The arabic plant names of Peter Forsskal's *Flora Aegyptiaco-Arabica*. ISBN: 978-87-7304-345-5, 161 (2010).
23. Meinardus Otto F.A. *The Virgin Mary as mediatrix between Christians and Muslims in*

- the Middle East," *Marian Studies*: Article 10, 47 (1996).
24. Bellakhdar J. La pharmacopée marocaine traditionnelle : médecine arabe ancienne et savoirs populaires. Edition Ibis Press, Paris, (1997) 764.
  25. Abed N.E. Harzallah-Skhiri F., Boughalleb N. Chemical composition and antifungal activity of the essential oil of *Pulicaria arabica* (L.) Cass. from Tunisia, *Agric Segment*, 1(2010) 1530-1534.
  26. Ezoubeiri A., Gadhi C.A., Fdil N., Benharref A., Jana M., Vanhaelen M. Isolation and antimicrobial activity of two phenolic compounds from *Pulicaria odora* L. *J Ethnopharmacol*, 99 (2005) 287-292.
  27. Foudah A.I., Alam A., Soliman G.A., Salkini M.A., Ahmed E.O.I., Yusufoglu H.S. Pharmacognostical, antioxidant and antimicrobial studies of aerial part of *Pulicaria crispa* (Family: Asteraceae). *Bull Env Pharmacol Life Sci*, 4 (2015) 19-27.
  28. Elshiekh Y.H., Abd El Moniem M.A. Phytochemical, antibacterial screening and antioxidant activity of *Pulicaria crispa* extracts. *Pharm Innov J*, 3 (2015) 12-15.
  29. Lougraimz H., M'sou S., Bouaichi A., Kotba I, El Hassan A. Chemical characterization and *in vitro* evaluation of the antioxidant and antibacterial activity of *Pulicaria incisa* (Lam.) DC. essential oil. *Nat. Volatiles and Essent. Oils*, 7(2) (2020) 35-43.
  30. Mohammed H.A., Al-Omar M.S., Khan R.A.; Mohammed S.A.A.; Qureshi, K.A., Abbas M.M., Al Rugaie O., Abd-Elmoniem E., Ahmad A.M., Kandil Y.I. Chemical profile, antioxidant, antimicrobial, and anticancer activities of the water ethanol extract of *Pulicaria undulata* growing in the Oasis of Central Saudi Arabian Desert. *Plants*, 10 (2021) 1811.
  31. Algabr M.N., Mekkiou R., Ameddah S., Menad A., Boumaza O., Seghiri R., Benayache F. Antioxidant activities from the aerial parts of *Pulicaria jaubertii*. *Adv Nat Appl Sci*, 4 (2010) 63-71.
  32. Hussein S.R., Marzouk M.M., Soltan M.M., Ahmed E.K., Said M.M., Hamed A.R. Phenolic constituents of *Pulicaria undulata* (L.) C.A. Mey. sub sp. *undulata* (Asteraceae): Antioxidant protective effects and chemosystematic significances. *Journal of Food and Drug Analysis*, 25 (2017) 333-339.
  33. El Maghraby A.S., Shalaby N., Abd-Alla H.I., Ahmed S.A. Khaled H.M., Baghat M.M. Immunostimulatory effects of extract of *Pulicaria crispa* before and after *Schistosoma mansoni* infection. *Acta Pol Pharm*, 67(1) (2010) 75-79.
  34. Fawzy G.A., Al Ati H.Y., El Gamal A.A. Chemical composition and biological evaluation of essential oils of *Pulicaria jaubertii*. *Pharm. Mag.*, (9)33 (2013) 28-32.
  35. Bhanu S.H., Thyagaraju K. Anticancer, antimicrobial and antioxidant activities of the essential oils of some aromatic medicinal plants (*Pulicaria wightiana* - Asteraceae). *World J. Pharm. Pharm. Sci.*, 6(10) (2017) 1370-1381.
  36. Dekinash M.F., Abou-Hashem M.M., Beltagy A.M., El-Fiky F.K. GC/MS profiling, *in vitro* cytotoxic and antioxidant potential of the essential oil of *Pulicaria crispa* (Forsk.) growing in Egypt. *Int. J. Pharmacogn. Chinese Med.*, 3(3) (2019) 1-7.
  37. Emam M.A., Khattab H.I., Hegazy M.G.A. Assessment of anticancer activity of *Pulicaria undulata* on hepatocellular carcinoma HepG2 cell line. *Tumor Biol.*, 41 (2019) 1010428319880080.
  38. Asghari G., Zahabi F., Eskandarian A., Yousefi H., Asghari M. Chemical composition and leishmanicidal activity of *Pulicaria gnaphalodes* essential oil. *Res. J. Pharmacogn.* 1(4) (2014) 27-33.
  39. Fadel H., Sifaoui I., López-Arencibia A., Reyes-Batlle M., Hajaji S., Chiboub O., Jiménez I.A., Bazzocchi I.L., Lorenzo-Morales J., Benayache S., Pifiero J.E. Assessment of the antiprotozoal activity of *Pulicaria inuloides* extracts, an Algerian medicinal plant: leishmanicidal bioguided fractionation. *Parasitology Research*, (2018) S00436-017-5731-4.
  40. Khani A., Asghari J. Insecticide activity of essential oils of *Mentha longifolia*, *Pulicaria gnaphalodes* and *Achillea wilhelmsii* against two stored product pests, the flour beetle, *Tribolium castaneum*, and the cowpea weevil, *Callosobruchus maculatus*. *J. Insect. Sci.* 12 (2012) 1-10.

