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Ecological Study of *Carduus pycnocephalus* L. Weed and Associated Species in Hamedan Province, Iran

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Authors' contributions

This work was carried out in collaboration between all authors. Author MH designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors SMM and MA managed the analyses of the study. Author MA managed the literature. All authors read and approved the final manuscript.

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ABSTRACT

Slender thistle is one of the species of *Asteraceae*. It is native to: In the Mediterranean region of southern Europe, North Africa, West Asia, East Europe, Caucasus and the Indian subcontinent are scattered. This study carried out for determination associated species on intraspecific variation of *Carduus pycnocephalus* L. (Italian Thistle) in Hamedan Province (Iran).In this order, vegetation studied to D.S.S method (Determination of Special Station). Based on, 14 special stations for this species were determined. In this investigation, 59 plant species distinguished as associated species that belonging to 53 genera and 19 families. Among the families, *Asteraceae* and *Poaceae* have many species. Most of this species are weed plant. The most life form spectrum showed Therophyte that reflects the region's dry climate. Spectrum of plant species is as follow:

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Hemichryptophyte forms of the *plants* indicate the possibility of adaptation of Maditerranean and cold temperate affected them. Decreasing of Chamephytes and Hemicryptophytes species and lacking geophytes Indicates a weakening of the vegetation in this area.

Keywords: Italian thistle; associated species; D.S.S method; Hamedan (Iran); slender thistle; weed plant

1. INTRODUCTION

Hamedan province lies between longitudes 48°28′ and 49°1′ E and latitudes 34°36′ and 35°9′ N and is shown in Fig. 1. The climate of the study area is considered to be semi-arid, the annual average precipitation being approximately 300 mm, of which about 37% occurs during winter. Another feature characterizing the precipitation in the study site is its irregular yearly distribution. The mean air monthly temperature is highest during August (23.45°C) and lowest during January (−1.91°C) with an annual average of 10.88°C [1]

Italian thistle commonly occurs in disturbed, often moist habitats, in canyon bottoms, along roadsides, open grassland, fallow fields, grazed areas, the margins of cultivated fields, and along irrigation canals [2,3,4,5,6]. This plant is a native of Mediterranean Europe and North Africa, it is naturalized in Australia, New Zealand, South Africa, Europe, and western Asia, where it is considered invasive [2,6].

Genus *Carduus* which belongs to the family Astraceae includes approximately 100 species worldwide [7]. *Carduus* species grow in waste areas, old fields, pastures, roadsides, and railroad embankments. They can invade open natural areas such as meadows, prairies and grasslands [8,9]. Establishment of vegetation units “releves” is carried out randomly in each special station for the study of floristic ecotypes [10]. In each special station, there could be one or several releve. Finally data analyses leads to plant associations of vegetation study. Since floristic composition in each environment reflects ecological conditions that influence in plant variation, special station with similar floristic composition are in similar environments. For studying inter and intraspecific diversity by D.S.S method, a special station determines the base on the presence of species in its stations [11]. Several studies have been done with this method for example: *Tanacetum polycephalum* L., *Tanacetum parthenium* (*L.*) *Schultz Bip*., *Artemisia spicigera* L. [12,13,14]. Perrino et al [15] were studied Plant communities in the National Park of Alta Murgia (Southern Italy). They introduced *Carduus pycnocephalus* L. subsp. *pycnocephalus*, such as one of the dominating vegetation [15]. Yavari et al. [16] investigated biological spectrum life of 213 species of Khan-Gormaz Protected Area in Hamadan Province, Iran [16]. The purpose of this study was to find associated species life forms of *C. pycnocephalus* L., their relationship to regional climate and its determination.

2. MATERIALS AND METHODS

C. pycnocephalus spreads in western, southern and also in central parts of Iran. This study was carried out in 14 locations at Hamedan area (western Iran) (Fig. 1). Information about distribution of the species was obtained from Flora Iranica [17]. In D.S.S method of this study is used special stations. In this method is an area of vegetation that homogenous view point of Floristic-Ecologic. In each special stations, location of establishment for each vegetation unit “releve” established on base of presence of individual studied species, minimal area determined by using the area-species method with area-species curve [18]. After identification of the habitats, 14 special stations were selected for investigation in study area (Table.1). All specimens were preserved in herbarium of the Razi University Herbarium (RUH), Kermanshah, Iran and Bu-Ali Sina University (BASU), Hamedan, Iran. At the end of, the life forms of this species wa determined using published data and available literature [19,20,21,22]. Families and specific names of studied species listed in Table.2 with information about their life form.

3. RESULTS AND DISCUSSION

The results of field investigation were collection and identification of 59 associated species belonging to 53 genera and 19 families. Asteraceae and Poaceae were the most abundant plant families of the area. In considered cases, Hemichryptophyte and Therophyte are the prevailing life form (Table. 2).

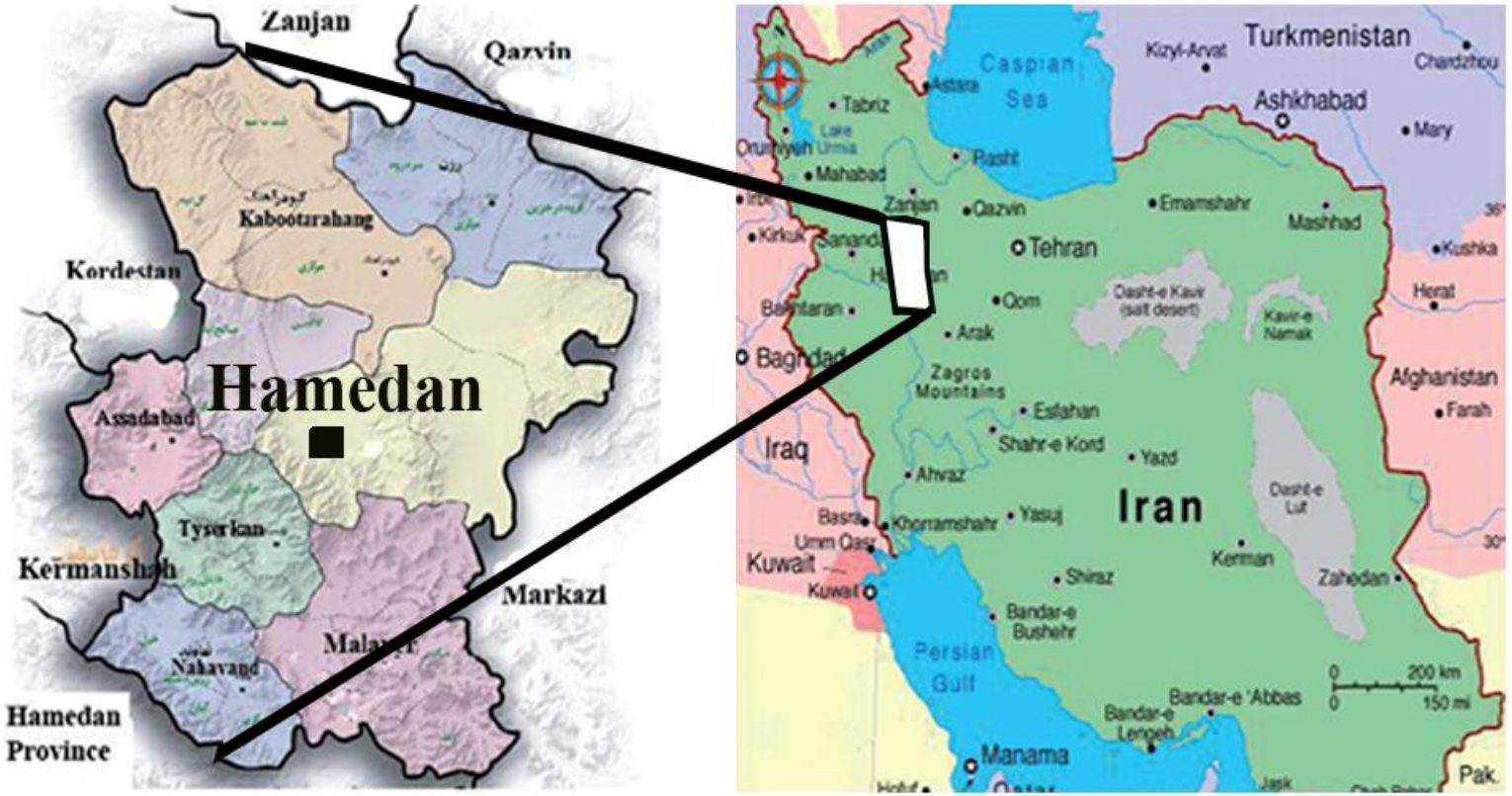

Fig. 1. A map of Iran that shows Hamedan Province in the west of Iran with special stations in this Province

Table 1. Localities of the special stations in different habitats of *C. pycnocephalus* in Hamedan Province

Spatial station	Locations	Geographical coordinates	Collector	Date of collection
1	Hamedan, Giyanmirage	N: 34°08' 33.21" E: 48°13' 15.13"	Heidarian	4 June 2011
2	Hamedan, Lashkardar Conservative area	N: 34°15' 15.82" E: 48°51' 02.46"	Heidarian	4 June 2011
3	Hamedan, Kabodarahang, beside of mountain	N: 34°14' 50.14" E: 48°50' 34.54"	Heidarian	25 May 011
4	Hamedan, Assadabad	N: 34°49' 46.15" E: 48°10' 54.34"	Heidarian	4 June 2011
5	Hamedan, Malayer, Avarzan Village	N: 34°16' 04.66" E: 48°30' 31.90"	Heidarian	4 June 2011
6	Hamedan, Firoozan to Nahavand	N:34°22' 46.27" E:48°05' 19.87"	Heidarian	6 June 2011
7	Hamedan, Toyserkan	N: 34°32' 29.00" E: 48°27' 20.62"	Heidarian	6 June 2011
8	Hamedan, Ghahavand	N: 34°59' 55.58" E: 48°57' 54.62"	Heidarian	8 June 2011
9	Hamedan, Heidareh, Near the mountain	N: 34°48' 19.79" E: 48° 28'52.95"	Heidarian	9 June 2011
10	Kermanshah, Kangavar to hamedan	N: 34°31'43.92" E: 48°01' 50.17"	Heidarian	9 June 2011
11	Hamedan, Heidareh, Agriculture university	N: 34°48' 18.82" E: 48° 29'00.25"	Heidarian	9 June 2011
12	Hamedan, Ganj nameh	N: 34°45'46.31" E: 48° 26'24.23"	Heidarian	11 June 2011
13	Hamedan, Kabodarahang, Gholiabad village	N: 34°14'50.14" E: 48°50'34.54"	Heidarian	25 May 2011
14	Hamedan, Nahavand toMalayer road, 20km	N: 34°12'56.97" E: 48°25'16.98"	Heidarian	10 June 2011

The floristic list of special stations in this study to following down:

Special station 1: *Carduus pycnocephalus* L., *Bromus danthoniae* Trin., *Hordeum glaucum* Steud., *Aegilops triuncialis* L., *Turgenia latifolia* (L.) Hoffm., *Heteranthelium peliferum* (Sol.) Hochst., *Trichodesma aucheri* DC., *Scariola orientalis* (Boiss.) Sodjak., *Echinops robustus* Bge., *Alyssum bracteatum* Boiss. and Bushe.

Special station 2: *Carduus pycnocephalus* L., *Rosa persica* Michx. ex. Juss., *Anthemis altissima* L., *Heteranthelium peliferum* (Sol.) Hochst., *Scariola orientalis* (Boiss.) Sodjak., *Helianthemum ledifolium* (L.) Mill., *Carthamus oxyacantha* M.B.

Special station 3: *Carduus pycnocephalus* L., *Aegilops triuncialis* L., *Lamium amplexicaule* L., *Zoega purpurea* Fresen., *Medicago polymorpha* L.

Special station 4: *Carduus pycnocephalus* L., *Carthamus oxyacantha* M.B., *Taeniatherum crinitum* (Schreb) Nevski .

Special station 5: *Carduus pycnocephalus* L., *Achillea Wilhelmsii* C. Koch, *Cardaria draba* (L.) Desv., *Hordeum glaucum* Steud. *Nonea persica* Boiss., *Poa bulbosa* L.

Special station 6: *Carduus pycnocephalus* L., *Galium aparine* L., *Vicia sativa* L. , *Bromus tectorum* L., *Centaurea depressa* L., *Centaurea solstitialis* L., *Aegilops triuncialis* L.

Special station 7: *Carduus pycnocephalus* L., *Scariola orientalis* (Boiss.) Sodjak., *Carthamus oxyacantha* M.B., *Bromus danthoniae* Trin., *Polygonum aviculare* L., *Achillea Wilhelmsii* C. Koch.

Special station 8: *Carduus pycnocephalus* L., *Capsella bursa-pastoris* L., *Alyssum strigosum* Bank & Soland., *Hordeum glaucum* Steud.,

Anthemis altissima L., *Achillea Wilhelmsii* C. Koch.

Special station 9: *Carduus pycnocephalus* L., *Cardaria draba* (L.) Desv., *Urtica dioica* L., *Dactylis glomerata*, *Bromus scoparius*, *Asperugo procumbens*, *Neslia apiculata* Fish.et Mey. ,*Rumex crispus* L., *Capsella borsa-pastoris*., *Cirsium congestum* Fisch. & Mey. ex DC., *Alyssum strigosum* Bank & Soland, *Sisymbrium ganbae* Rech .f. & Bornm.

Special station 10: *Carduus pycnocephalus* L., *Descarainia Sophia* (L.) Schur., *Hordeum glaucum* Steud., *Galium verum* L., *Capsella borsa-pastoris*, *Canvolvulus arvensis*, *Bromus sterilis*, *Papaver rhoeas* (L.).,*Veronica persica* Poir., *Sisymbrium ganbae* Rech .f. & Bornm. *Plantago lanceolata* L., *Alyssum strigosum* Bank & Soland.

Special station 11: *Carduus pycnocephalus* L., *Astragalus gossypinus* Fish., *Senecio vulgaris* L., *Euphorbia heteradena* Jaub et Spech., *Scariola orientalis* (Boiss) Sodjak., *Taeniatherum crinitum* (Schreb.) Neveski., *Stachys inflata* Benth., *Rosa persica*. *Cousinia cylindrica* Boiss.

Special station 12: *Carduus pycnocephalus* L., *Aegilops triuncialis* L., *Achillea Wilhelmsii* C. Koch., *Scariola orientalis* (Boiss.) Sodjak. , *Bromus tectorum* L., *Alhagi camelorum* Fish.

Special station 13: *Carduus pycnocephalus* L., *Descurainia sophia* (L.) Webb ex Prantl., *Callipeltis cucullaria* Stev., *Hordum glaucum* Steud., *Trigonella arcuata* C. A. Mey., *Anchusa iranica* Rech. f. & Esfand., *Bromus tectorum* L., *Centaurea solstitialis* L., *Aegilops triuncialis* L., *Vicia sativa* L., *Glaucium corniculatum* L., *Viola odorata* L., *Adonis aestivalis* L., *Ranunculus arvensis* L.

Special station 14: *Carduus pycnocephalus* L., *Hordeum glaucum* Steud., *Aegilops triuncialis* L., *Glycyrrhiza glabra* L., *Centaurea iberica* Trex.ex.Spreng., *Achillea Wilhelmsii* C. Koch

Table 2. Floristic list of total special stations

No. of plant	Family name	Specific name	Life form
1	Apiaceae	*Turgenia latifolia* (L.) Hoffm.	Th
2	Asteraceae	Achillea Wilhelmsii C. Koch	H
3	〃	*Anthemis altissima* L.	TH
4	〃	*Carduus pycnocephalus* L.	H
5	〃	*Carthamus oxyacantha* M.B.	Th
6	〃	*Centaurea depressa* L.	Th
7	〃	*Centaurea iberica* Trex. ex Spreng.	H
8	〃	*Centaurea solstitialis* L.	Th
9	〃	*Cirsium congestum* Fisch. & Mey. ex DC.	H
10	〃	*Cousinia cylindrica* Boiss.	H
11	〃	*Echinops robustus* Bge.	H
12	〃	*Scariola orientalis* (Boiss.) Sojak.	H
13	〃	*Senecio vulgaris* L.	Th
14	〃	*Zoega purpurea* Fresen.	H
15	Boraginaceae	*Anchusa iranica* Rech.f. & Esfand.	H
16	〃	*Asperugo procumbens* L.	Th
17	〃	*Nonea persica* Boiss.	Th
18	〃	*Trichodesma aucheri* DC.	Th
19	Brasiccaceae	*Alyssum bracteatum* Boiss & Bushe.	Th
20	〃	*Alyssum strigosum* Banks & Soland.	Th
21	〃	*Capsella bursa-pastoris* (L.) Medik.	Th
22	〃	*Cardaria draba* (L.) Desv.	Th
23	〃	*Descurainia sophia* (L.) Webb ex Prantl.	Th
24	〃	*Neslia apiculata* Fish.et Mey	Th
25	〃	*Sisymbrium ganbae* Rech .f.& Bornm.	Th
26	Cistaceae	*Helianthemum ledifolium* (L.) Mill.	Th
27	Convolvulaceae	*Convolvulus arvensis* L.	H
28	Euphorbiaceae	*Euphorbia heteradena* Jaub. & Spach.	H
29	Lamiaceae	*Lamium amplexicaule* L.	H

No. of plant	Family name	Specific name	Life form
30	〃	*Stachys inflata* Benth.	H
31	Papaveraceae	*Glaucium corniculatum* L.	Th
32	Papilionaceae	*Alhagi camelorum* Fish.	H
33	〃	*Astragalus gossypinus* Fish.	Ch
34	〃	*Glycyrrhiza glabra* L.	H
35	〃	*Medicago polymorpha* L.	Th
36	〃	*Trigonella arcuata* C.A.Mey	Th
37	〃	*Vicia sativa* L.	Th
38	Plantaginaceae	*Plantago lanceolata* L.	H
39	Poaceae	*Aegilops triuncialis L.*	Th
40	〃	*Bromus danthoniae* Trin. ex C.A.Mey.	Th
41	〃	*Bromus scoparius* L.	Th
42	〃	*Bromus sterilis* L.	Th
43	〃	*Bromus tectorum* L.	Th
44	〃	*Dactylis glomerata* L.	H
45	〃	*Hordeum glaucum* Steud.	Th
46	〃	*Heteranthelium piliferum* (Sol.) Hochst. ex Jaub.	Th
47	〃	*Poa bulbosa* L.	G
48	〃	*Taeniatherum crinitum* (Schreb.) Nevski.	Th
49	Polygonaceae	*Polygonum aviculave* L.	Th
50	〃	*Rumex crispus* L.	H
51	Ranunculaceae	*Adonis aestivalis* L.	Th
52	〃	*Ranunculus arvensis* L.	Th
53	Rosaceae	*Rosa persica* J.F.Gmel.	Ch
54	Rubiaceae	*Callipeltis cucullaria (L.) Steven.*	Th
55	〃	*Galium aparine* L.	Th
56	〃	*Galium verum* L.	H
57	Scrophulariaceae	*Veronica persica* Poir.	Th
58	Urticaceae	*Urtica dioica L.*	H
59	violaceae	*Viola odorata* L.	Th

H: Hemichryptophyte, Ch: Chamaephyte, G: geophyte, H: Hemichryptophyte, Th: Therophyte

Results from floristic composition of each special station show that Asteraceae and Poaceae have a lot of weed plant (Tables.1, 2). In fact, there are most of weed in two families. These results show that, some agricultural plants and weeds in some of their taxonomic features are common and probably they have common growth source [23]. According to Abbasvand et al. [24] Higher frequency of therophytes indicate dry climate [24]. In this studied more than half of the species in all of special stations are Therophytes. Therophyte adapted to the dryness of the region and shortage rainfall, because these plants spend vegetative period in the form of seed. According to Archibold [25], higher frequency of hemicryptophytes plants indicate a cold climate [25]. Hemicryptophyte adapted to condition of area. They adapted and developed themselves to area by using different ways such as: Reserving water, using ground water, reducing their water need by loosing their leaves and reduction of vegetative growth [26]. As observed, most of studied species have Hemichryptophyte and Therophyte life form that are their features.

4. CONCLUSION

As observed, most of studied species have Hemichryptophyte and Therophyte life form that are their features. Dry climate of the Hamedan Province has led many Therophytes of associated species with Carduus pycnocephalus. On the other hand, cold winters of the region has led to many Hemicryptophytes. Decreasing of Chamephytes and Hemicryptophytes species and lacking geophytes Indicates a weakening of the vegetation in this area.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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