



Autecology of *Melica persica* in Khorassan

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Abstract

Over exploitation of range plants caused reduced vegetation cover and biodiversity, risk extinction of species, soil erosion and generally unsustainable ecosystems. Preventing this unsustainability involved having enough information about autecological requirements of important plants (their environment and interactions). *Melica persica* as a perennial grass with a wide adaptability is an important range plant especially for soil conservation. It is native to Iran, where it is most common in the Irano-torani and Hirkani regions. This research was conducted to study autecology of *M. persica* in Khorassan, 1997-2000. Objectives were to study taxonomy and morphology, distribution, topography, climatic conditions, edaphic parameters, geology, vegetation cover, phenology, regeneration strategies and seed longevity. Geology and climatic parameters were studied using related maps, field check and climatological data of nearest stations. Quadrates of one square meter were used to study vegetation cover. Phenology was studied on 10 marked plants in 10-15 days intervals on 3 habitats. Results indicated that *M. persica* is a widely distributed and well-established range plant in most of rocky foothills (altitude 900-2900 m) from north to south of Khorassan. Temperature and precipitation of *M. persica* habitats were 5-15 degree centigrade and 125-600 millimeters, respectively. 80% of habitats are located in 3 climates of very cold semi-arid, very cold Mediterranean and cold semi-arid. *M. persica* prefer loam, silt loam, sandy loam and gravelly well-drained soil with pH=7-8 and EC=0.5-1.5 ds/m. Parent materials are Sheil, Volcanic and Lime stone. Vegetative stage initiated from middle-March and changed to reproductive stage late in May. After seed shedding from July, it goes summer dormancy and regrowths in autumn. It regenerates both sexually and asexually. The best time for seed collection was dough to hard seed stage. Seed viability was not reduced after 5 years storage at room temperature.

Keywords: *Melica persica*, grass, Autecology, Phenology, Seed viability, Regeneration, Khorassan

Introduction

Biodiversity is the foundation of life and survival, so human activity depend on it. Over exploitation of plants caused reduced vegetation cover and biodiversity, risk extinction, soil erosion and unsustainable ecosystems (Grime et al., 1988). This caused 100 million hectares of lands exposed to wind and water erosion, so that annual soil erosion in Iran is about 1.5 billion tons. Controlling this unsustainability involved having enough information about autecological requirements of important plants, their environments and interactions. *Melica persica* as a perennial grass with a wide adaptability is an important range plant, especially for soil conservation. Five *Melica* species have been identified in Iran (*M. persica* Kunth, *M. eligulata* Boiss, *M. inaequiglumis* Boiss, *M. ciliata* L., *M. jacquemontii* Decne) (Rashed Mohasel et al., 1992, Rechinger, 1984). *M. persica* is native to Iran, where it is most common in the Irano-torani and Hirkani regions. There is not enough information about *M. persica* in Iran and most of them refer to its distribution and taxonomy.

Material and methods

Distribution map was provided by field works and available references. Geology was studied using geological maps (1:250000). Soil samples were collected from different habitats in



order to analyze physico-chemical parameters such as soil texture, pH, EC, Na⁺, K⁺, Ca²⁺, Mg²⁺, lime and gypsum. Three habitats were selected in north and south of Khorassan. Climatological data were gathered from nearby stations. Data layers (Khalilli, 1991) were also used to provide isotherm, isohyet and climate map for *M. persica*. Some plants were marked in each three habitats and phenology was studied on marked plants in 10-15 days intervals. Quadrates of one square meters were used to study vegetation cover, density and frequency.

Results and discussion

Distribution

Melica persica is limited to Iran, Pakistan, Afghanistan, Iraq, Torcomanica and central Asia (Rechinger, 1984). It is widely distributed in Irano-torani and Hirkani regions in Iran. It grows in most of rocky foothills from north (Hezar-masjed and Binalood mountains) to south (Gonabad, Birjand and Nehbandan) of Khorassan (figure 1).

Morphological characteristics

M. persica is a perennial grass, cespitose to shortly rhizomatus with erected culms of 19-24 cm, often forming a based corm. Leaves and sheaths are pilose. Leaves are developed with 12 cm length and 2-4 mm width. Inflorescence is panicle with spiklets of 8-11 mm length (figure 2). Each spiklet have 2 fertile florets and sterile ones form a short club-like structure (figure 3). Lemma is completely pilose with 4-5 mm length and palea ½ as big as lemma (figure 4). Fruit (seed) is caryopse with bright brown color, 1.5-2.5 mm length and longitudinally furrowed (figure 5) (Rechinger, 1984). Nodes and leaves numbers are both 5-6 when flowering. *M. persica* has brown spread roots that may grow into depth of 90 cm (figure 6). Roots penetrate into the rock gaps, so well-established in rocky foothills and steep slopes (figure 7). Massive and dense roots hold soil so control soil erosion.

Topography

Results showed that altitudinal range of *M. persica* habitats is 900 meters in Khorassan to 3300 meter in Lorestan. *M. persica* mostly appears in 1900-2200 meter in Khorassan. It grows in all geographical directions and slopes, even walls and cliffs.

Climatic conditions

According to Jamab data layers (Khalilli, 1991), precipitation and temperature of *M. persica* habitats ranged 125-600 mm and 5-15°C, respectively. Climatic data of nearest stations have been showed in table 1. Nearly 80% of *M. persica* habitats are located in three climates of very cold semi-arid, very cold Mediterranean and cold semi-arid.

Table 1. Climatic data of nearest stations to studied habitats

Station	Position			Temperature (Degree Centigrade)			Annual precipitation (millimeter)		Drought period (month)	year
	Longitude	Latitude	Altitude (meter)	Min.	Max.	Mean	Mean	Max.		
Zoshk	59° 12'	36° 20'	1885	9.9	12.5	9.6	351.3	639.5	4.5	1972-2001
Bar	58° 42'	36° 27'	1560	-18	39.5	13	299.8	477	6	1985-2000
Torogh	59° 33'	36° 10'	1240	12.7	14.8	13.8	277.8	436.3	5	1977-2001



Geology and edaphic parameters

M. persica is a well-established plant on gravelly, light texture and well-drained soils. Physico-chemical analysis of soil samples revealed that *M. persica* prefer loam, silt loam and sandy loam soils with pH=7-8 and EC=0.5-1.5 ds/m. Low Na and EC indicated that *M. persica* needs soils with less salinity (table 2). Parent materials are Sheil, Volcanic and lime stone.

Table 2. Soil physico-chemical parameters in some *M. persica* habitats

Locality	Texture	Lime (%)	pH	EC	Na (ppm)	K (ppm)	Ca (Meq gr/li)	Mg (Meq gr/li)
Tandooreh (Dargaz)	Silt loam	2-10	6.9	0.7	30	-	4.5-8	2-3
Asalmeh (Bajgiran)	Silt loam	17.3	6.6	0.9	30.5	-	7-8	1.5-33
Dizbad-e-olya (Nishaboor)	Sandy loam	8	7.8	1.2	36	14.2	4.8	0.8
Dehbar (Mashhad)	Loam	3.7	7.1	0.98	31	48	2.4	3.6
Robat-e-Khakestari (Torbat-e-heidarieh)	Sandy loam	15	8.4	1.5	39	43	10.5	4
Kalat-e-sheikhi (Gonabad)	Loam	12.3	7.9	0.5	39	60.7	2.4	2
Shafi (Binalood mountains)	Silt loam Sandy loam	18.2-27	7.5	0.8	14-75	3-4	4-7	40-90
Torogh dam (Mashhad)	Silt loam	3.9-4.4	7.5	0.6	5.5-12	3- 4.5	1-4	10-20

Vegetation cover

The most important plant types, total vegetation cover, *M. persica* cover percentage, density and frequency were measured (table3).

Table 3. Vegetation cover situation in studied habitats

Habitat	Plant type	Total cover (%)	<i>Melica</i> cover (%)	Frequency (%)	Density
Dizbad-e-olya (Nishaboor)	Artemisia Ziziphora Achantholimon	48.7	14.9	43	0.8
Dehbar (Mashhad)	Artemisia Ziziphora Achantholimon	52.3	3.6	20	0.4

Phenology

Phenological stages within a single species may vary considerably according to latitude, altitude, habitat conditions, management and year of observation (Anonymous,1954; Grime,1988;West1967). It is very important to know phenological stages for grazing management. Figure 8 shows phenology of *M. persica* in three studied habitats. Generally, vegetative stage initiated from mid-March and changed to reproductive stage late in May (figure 9). After seed shedding in July, it goes summer dormancy and regrowth in autumn.

Seed germination and longevity

Over 90% of *M. persica* seeds were germinable soon after maturity when seed was rather hard. Seeds were also able to germinate at late dough seed stage only 5%, but after reducing



their moisture, they got nearly hard and germinated 60-70%, suggesting that *M. persica* seeds may not have an innate or induced dormancy mechanism (Agrawal,1992; Haferkamp,1953; Toole,1950). Seed germination was determined soon after gathering and within storing at room temperature. Results showed that storage was not significantly affected on seed viability, so that seed viability was not reduced after 5 years storage (figure 10).

Regeneration strategies

M. persica regenerates both sexually and asexually. Numerous tillers terminated to panicle produce enough seed to make a rich seed bank. High seed viability and longevity may result in maintained seed germinability for a long time period. Germination occurs when conditions are favorable. Glumella are pilose so seed disseminate easily by wind (figure 4). Since *M. persica* is rhizomatous, easily propagated by dividing.

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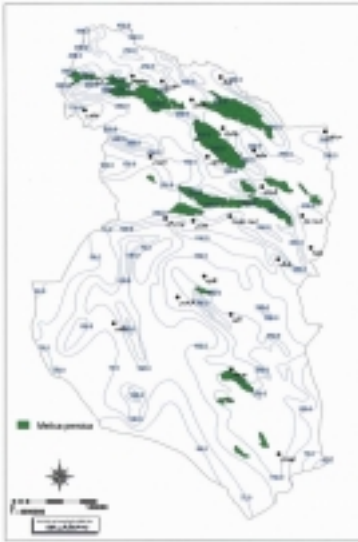


Figure 1. Distribution of *M. persica* in Khorassan

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Figure 2. Different parts of *M. persica*

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Figure 1. Root system of *M. persica*



Figure 3. Components of a single spiklet



Figure 4. A fertile single floret, Lemma is completely pilose



Figure 5. Seed of *M. persica*



Figure 7. A single well-established plant on rock gaps



Melica persica in it's natural habitat

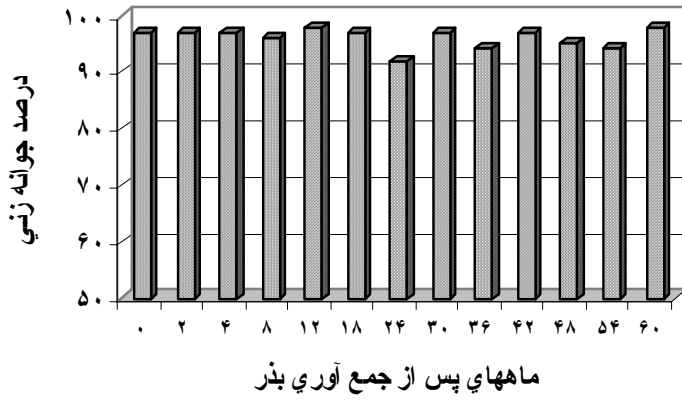


Figure 10. Seed longevity of *M. persica* after 5 years storage



Figure 9. *Melica persica* at hard seed stage

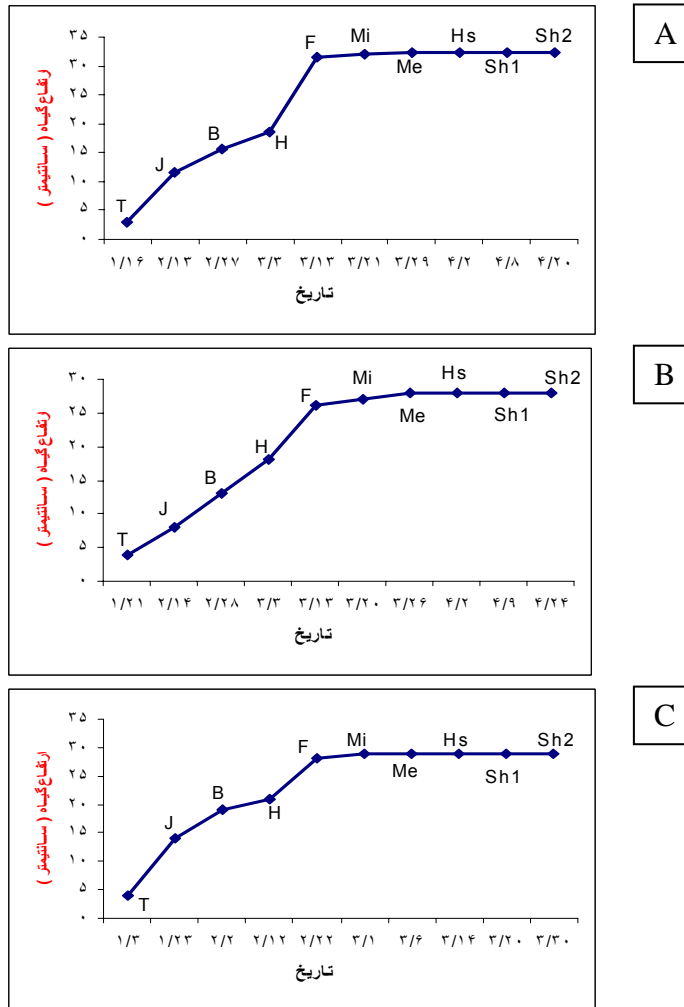


Figure 8. Phenological stages of *M. persica* in three studied habitats, 1999.

A) Dehbar B) Dizbad-e-olya C) kalat-e-sheikhi.

T= Tillering, J= Jointing, B= Booting, H= Heading, F= Flowering, Mi = Milk seed, Me = Dough seed, Hs = Hard seed, Sh1= Seed shedding initiation, Sh2= Completely seed shedding.