INFRASPECIFIC VARIATION OF ONOBRYCHIS MELANOTRICHA BOISS. (FABACEAE) IN RELATION TO ITS HABITATS IN HAMEDAN PROVINCE, IRAN

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Onobrychis melanotricha (*Fabaceae*) is an endemic perennial herb in Iran and has two varieties. For investigating on infraspecific variation within *O. melanotricha*, 14 releves were performed in its different habitats in Hamedan province according to the Braun-Blanquet method and samples were gathered using phytosociological approach. Results showed that each variety occupies one of main mountainous and sub-mountainous habitats. They correlate together by a continuous gradient in morphological characters. In addition, different patterns of variation and related effective factors are discussed. *O. melanotricha* var. *ecbatanaica* is described and illustrated from Hamedan Province as a new variety. It differs from the type variety by having the large simple leaves.

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Key words. clinal variation, endemic, FCA, Hamedan, Iran, *O. melanotricha*, PCA, phytosociology, UPGMA.

بررسی تنوع درون‌گونه‌ای Onobrychis melanotricha (Fabaceae) در ارتباط با زیستگاههای آن در استان همدان

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Onobrychis melanotricha Boiss. گونه‌ای علفی چندساله متعلق به تیره پروانه‌آسا است که انحصاری ایران بوده و دارای دو واریته می‌باشد. در این مطالعه، ١٤ رولوه در زیستگاههای مختلف این گونه در استان همدان براساس روش براون–بلانکه زده شد و گونه مورد مطالعه به همراه داده‌های جامعه‌شناختی گیاهی مربوط به رولوه‌ها برداشت گردید. نتایج نشان می‌دهند که هر واریته یکی از زیستگاههای اصلی کوهپایه‌ای یا کوهستانی را اشغال می‌کند. واریته‌ها به واسطه شیب پیوسته‌ای از ویژگی‌های ریخت‌شناختی با هم ارتباط دارند. همچنین الگوهای تنوع و عوامل موثر در آنها مورد بررسی قرار گرفت. *Onobrychis melanotricha* var. *ecbatanaica* Ranjbar & Behjou به عنوان واریته‌ای جدید از استان همدان شرح داده می‌شود. این واریته با دارا بودن برگهای ساده بزرگ از واریته تیپ متمایز می‌شود.

INTRODUCTION

For a long time, it is implicated that individuals of a species are not completely similar and its populations differ from each other. These differences can be spontaneous or related to geographical or ecological condition (Bidault 1971). However, infraspecific variation has attracted little taxonomic attention recently (Snaydon 1984). But several studies have been undertaken for different purposes such as taxonomy, ecology, biogeography and agricultural evaluation in the infraspecefic level (e.g. Given 1972; Prentice 1979; Fakhre Tabatabaei et al. 2000; Akhani & al. 2003; Jothi & Manickam 2005). New approaches for presenting ecological information and reappraisal of infraspecific categories need to be made before ecology can become a major direct tool in plant taxonomy (Heywood 1973). Plant associations as index of ecological conditions that govern a region can be used in classification (Guinochet 1973). *Onobrychis melanotricha* Boiss. is a palatable perennial herb that is endemic to eastern

Table 1. Quantitative morphological characters studied in different individuals of *O. melanotricha.*

R	Characters	R	Characters
1	Plant habit (0 = decumbent, 1 = erect)	17	Calyx [length mm]
2	Plant indumentum (0 = pilose, 1 = villous)	18	Calyx teeth [length mm]
3	Stem [length cm]	19	Corolla [length mm]
4	Stipule [length mm]	20	Standard [length mm]
5	Leaf [length cm]	21	Standard [width mm]
6	Petiole [length cm]	22	Standard length/width ratio
7	Leaflet pair number	23	Wing [length mm]
8	Leaflet [length mm]	24	Wing length/width ratio
9	Leaflet [width mm]	25	Keel [length mm]
10	Leaflet length/width ratio	26	Keel [width mm]
11	Peduncle [length cm]	27	Keel claw [length mm]
12	Raceme [length cm]	28	Keel length/width ratio
13	Flower number	29	Pod [length mm]
14	Bract [length mm]	30	Pod stipe [length mm]
15	Bracteole [length mm]	31	Pod length/width ratio
16	Pedicel [length mm]	32	Pod setae [length mm]

natural sub-steppic ranges of Zagrous Mountains (Karimi 2005). It belongs to the tribe *Hedysarae*, family *Fabaceae*, genus *Onobrychis*, subgenus *Sisyrosema* and section *Heliobrychis.* It is a problematic species taxonomically and has two varieties of var. *melanotricha* Boiss. and var. *villosa* Bornm., which have been cited by Rechinger (Rechinger 1984; Lock & Simpson 1991). The aims of this work are to study infraspecific variation of *O. melanotricha* using morphological characters and its associated taxa as an index of habitat condition, to investigate the variation patterns and effective ecological factors, and to study the possible congruence between taxonomy and ecology of the species.

MATERIALS AND METHODS

O. melanotricha distributes in western, southern and also in central parts of Iran. This study was carried out in Hamedan province in western Iran. Information about distribution of the species were obtained from Flora Iranica (Rechinger 1984), herbarium specimens preserved in herbarium of Agricultural and Natural Resources Research Center of Hamedan and also from many excursions throughout Hamedan province in spring-summer 2006. After identification of the habitats, 14 populations at sufficient abundances were selected and then sample releves performed according to the Braun-Blanquet method (Guinochet 1973; Mueller-Dombois & Ellenberg 1974; Westhoff & Van der Maarel 1978). The minimal area of each releve was determined by area-species curve based on Cain method (Cain & Castro 1959). In addition, several mature individuals of *O. melanotricha* and the required floristic-ecologic information were collected for each releve. Data were duly entered in proper forms. Then, floristic composition of each releve was determined using available Floras (Rechinger 1963-2005; Assadi 1988-2005) and Species/Releve matrix was prepared by Braun-Blanquet's composition coefficient of A-D for each species in the releves (Guinochet 1973; Mueller-Dombois & Ellenberg 1974). For phenetic analysis, 32 quantitative morphological characters (based on description of the species according to Boissier (1872) and Širjaev (1926) and private observation on herbarium specimens) were studied in collected specimens of different populations of *O. melanotricha* (Table 1). Then the mean values of characters were used for Character/OTUs matrix (Stace 1989). All specimens were preserved in herbarium of the Bu-Ali Sina University (BASU), Hamedan, Iran. At first, data analysis was performed for Species/Releve matrix based on floristic composition of each releve using Anaphyto software (Briane 1991) by FCA (Factorial Correspondence Analysis) method. Then, Character/OTU matrix of different populations of *O. melanotricha* was analysed using MVSP software ver. 3.1 (Kovach 1985-2002) by UPGMA (Unweighted Pair Group Mean Average) and PCA (Principal Components Analysis) methods.

RESULTS

Phytosociological data were obtained from individuals of *O. melanotricha* together with 154 associated species from 14 releves (Table 2, Fig. 1). They showed 3 releve clusters indicating 3 distinctive habitats (Fig. 2). Altitude of sub-mountainous habitat ranges from 1756 to 1820 m with predominantly herbaceous plants included the releves 1-4. Altitude of mountainous

Table 2. Localities and features of the sample releves in different habitats of *O. melanotricha* in Hamedan province and its voucher specimens.

R	Locality	Altitude (m)	Slope orientation	Inclination (degree)	Date	Voucher specimens
1	Hamedan: 18 km on Hamedan-Tehran road	1797	SW	8	26.5.2006	9607
2	Hamedan: 20 km on Hamedan-Tehran road	1820	N	6	26.5.2006	9580
3	Hamedan: 22 km on Hamedan-Tehran road	1756	W	17	30.5.2006	9558
4	Hamedan: 22 km on Hamedan-Tehran road	1792	E	5	30.5.2006	9506
5	Hamedan: 40 on Hamedan-Tehran road, Asadabad neck	2185	W	14	2.6.2006	9458, 9459
6	Hamedan: 35 on Hamedan-Tehran road, near Zamanabad	1935	S	8	6.6.2006	9785, 9786, 9787
7	Hamedan: 25 on Hamedan-Tehran road, near Pesijan	2154	SW	18	9.62006	9757, 9758
8	Hamedan: 30 km on Hamedan-Kermanshah road, near Chutash	2032	NE	13	9.6.2006	9726, 9727
9	Hamedan: 50 km on Hamedan-Bijar road, near Kandtappeh	2241	NW	27	10.6.2006	9691
10	Hamedan Saeidiyeh	2052	NE	25	11.6.2006	9654, 9655
11	Hamedan: 100 km on Hamedan-Zanjan road, near Aqbolaq-aqdaq	2028	E	15	13.6.2006	9952, 9953
12	Hamedan: Tuyserkan, near Vardavard	2068	NW	22	14.6.2006	9897, 9898, 9899, 9900
13	Hamedan: Malayer, Lashgardar protected area	2213	NE	25	20.6.2006	9865, 9866
14	Hamedan: 70 km on Hamedan-Bijar road, before Saray-e-jogh	2020	SW	8	22.6.2006	9825, 9827, 9829, 9831

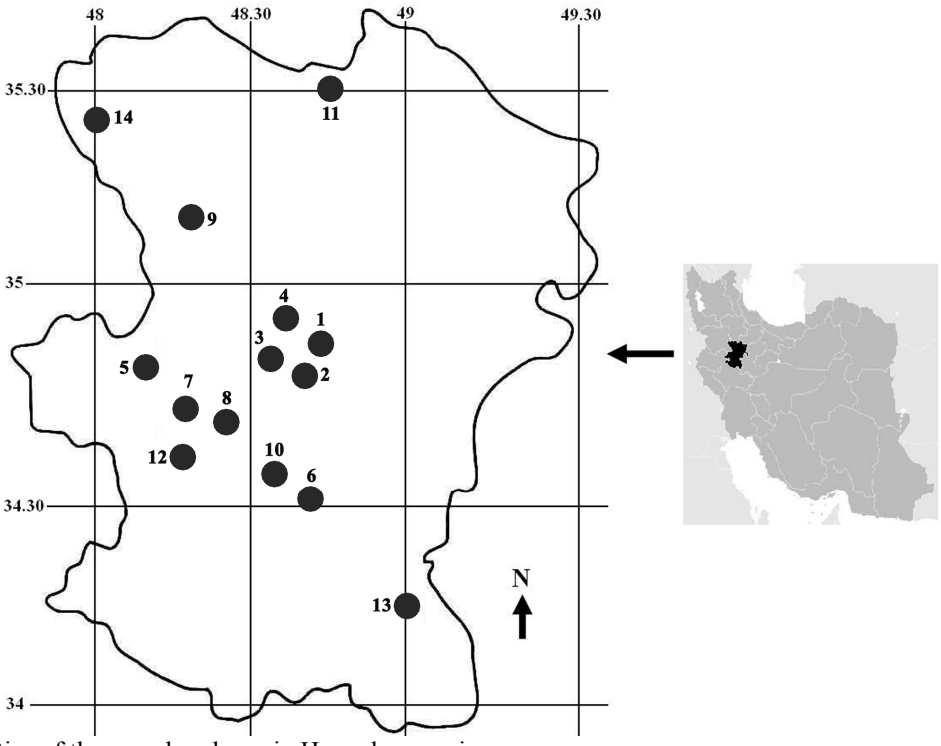

Fig. 1. Localities of the sample releves in Hamedan province.

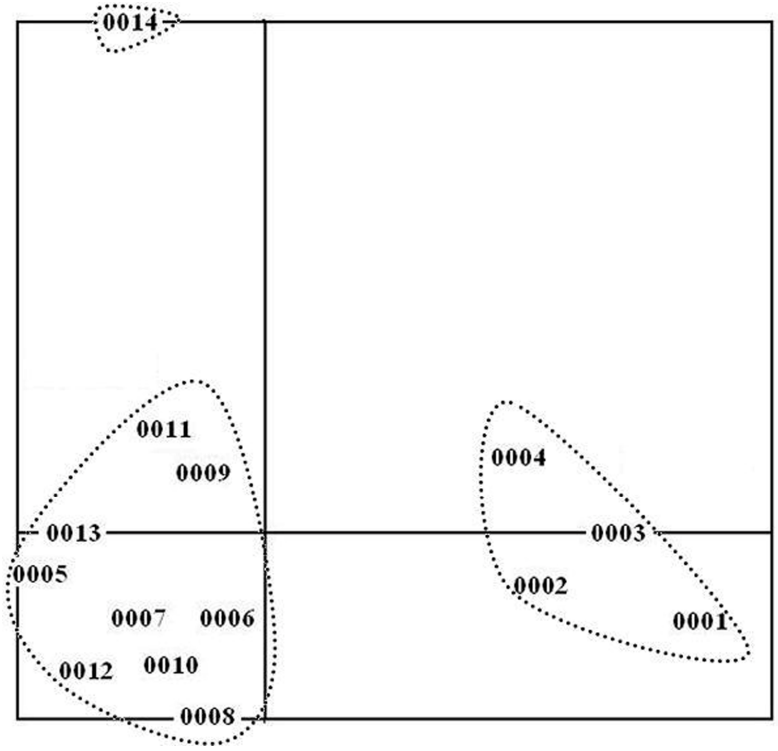

Fig. 2. FCA ordination of associated species of *Onobrychis melanotricha* showing 3 distinct habitats.

habitat ranges from 1935 to 2241 m with predominantly bush plants included the releves 5-13. A habitat near farming areas (altitude of 2020 m) with predominantly herbaceous plants included only releve 14, which was affected by anthropogenic activities.

In addition, phenetic analysis of morphological characters related to different populations of *O. melanotricha* resulted in 3 groups at the phenon line 8.5 representing 3 morphologic types (Fig. 3). The group 1 included decumbent plants with appressed pilose indumentum and corolla length 8-10 mm. It was divided itself into two subgroups at the phenon line 7.5 (Fig. 3). The subgroup I included plants with imparipinnate leaves and leaflets in (1) 2-5 pairs. It occurred in northern, western and southern slopes and included individuals of the releves 1, 2, 3, 6 and 10 (Fig. 5). The subgroup II included plants with predominantly simple leaves. It occurred in eastern slopes and included individuals of the releves 4 and 11. This subgroup was considered as a new variety that described below (Fig. 6). The group 2 included erect plants with spreading villous indumentum and corolla length 10-14 mm. It included individuals of the releves 5, 7, 8, 9, 12 and 13 (Fig. 7). The group 3 with erect plants has sub-appressed indumentum, pod setae length 5-7 mm, included individuals of the releve 14. Three groups resulted from ordination of morphological data by PCA method that confirmed the presence of three morphologic types (Fig. 4). The first 3 principal components explained 69.71% of total morphological variation. The first, second and third axes explained 34.24%, 18.71% and 16.75% of total variation, respectively (Table 3). The mean values of the measured characters for each morphologic type are presented in Table 4.

O. melanotricha is phytosociologically found in *Bromus danthoniae-Taeniatherum crinitum* community. Table 5 represents the species composition and their abundance-dominance in this community. The associated floristic composition included 3 species sets that were accompanied with *O. melanotricha* and determined morphologic types with different frequencies. Diagnostic species were nearly exclusive for each morphologic type. Characteristic species accompanied with the species at high frequencies (35-85% of releves) and other species at low frequencies (less than 30 % of releves) (Table 5).

NEW VARIETY

Onobrychis melanotricha Boiss. var. ***ecbatanaica*** Ranjbar & Behjou, var. nov. (Fig. 6)

Typus. Iran, Prov. Hamedan, 22 km on Hamedan-Tehran road, [$34^0 59.218' N, 48^0 36.501' E$], 1792 m., 30.5.2006, Ranjbar & Moradi Behjou 9506 (holotypus BASU).

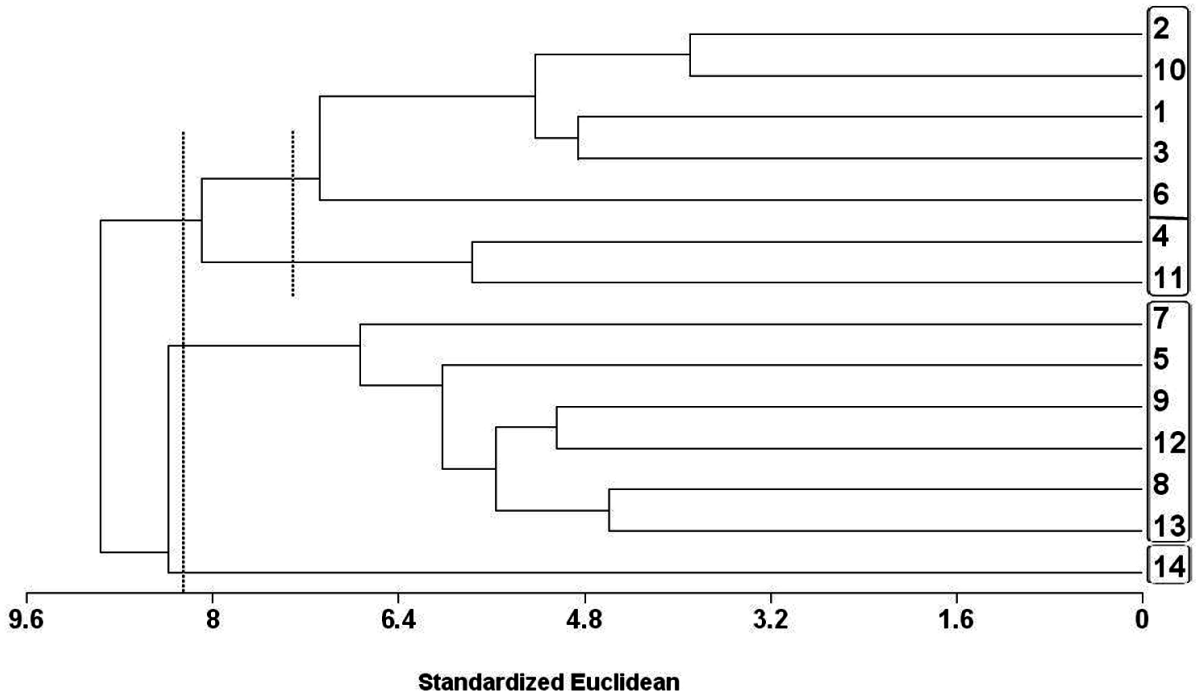

Fig. 3. UPGMA clustering of *Onobrychis melanotricha* poulations showing 3 morphologic types (phenon lines showed by discontinuous lines).

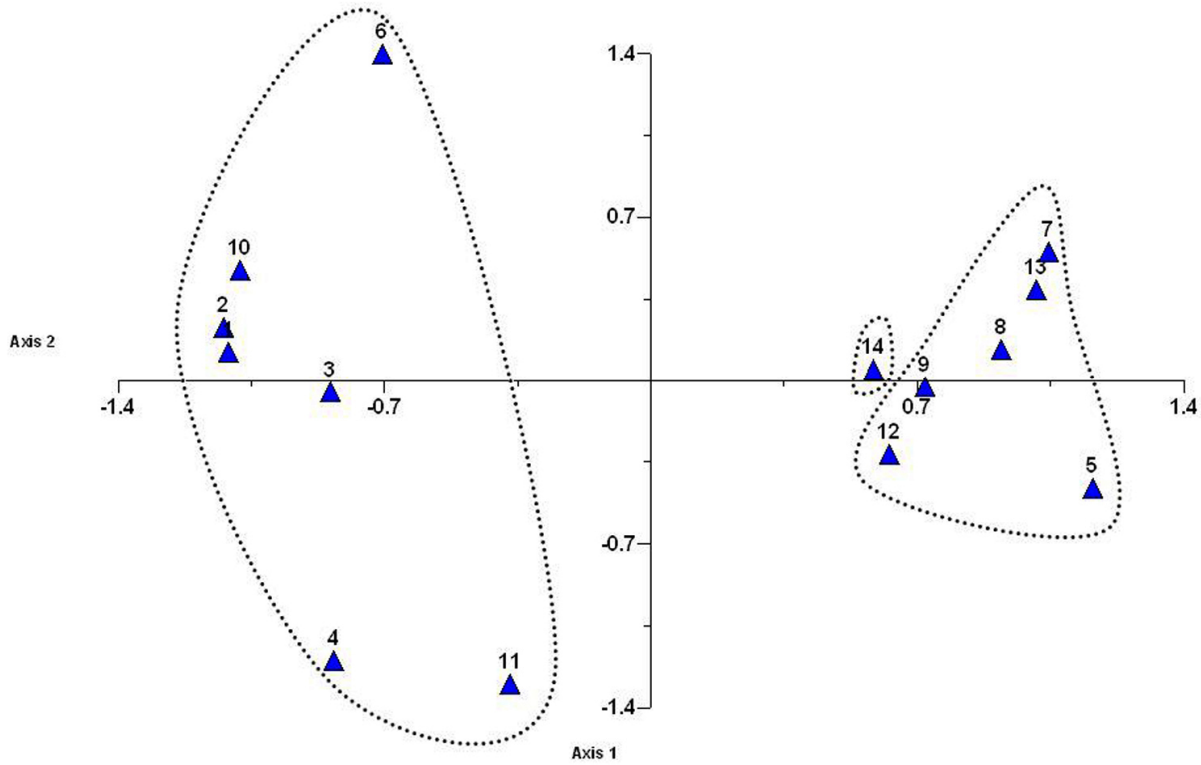

Fig. 4. PCA ordination of *Onobrychis melanotricha* populations based on morphological characters.

Figs. 5 & 6. Morphologic type 1: Subgroup I. *Onobrychis melanotricha* var. *melanotricha* (5); Subgroup II. *Onobrychis melanotricha* var. *ecbatanaica* (6). − A: habit; B: calyx; C: standard; D: keel; E: wings; F: androecium; G: pistil, H: pod. − Scale bar: A = 1 cm, B-H = 0.5 cm.

A typo foliis saepe unicis, magnis differt.

Further material examined. – Iran, Prov. Hamedan, 100 km on Hamedan-Zanjan road, near Aqbolaq-aqdaq village, [$35^0 35.845' N, 48^0 27.261' E$], 2028 m, 13.6.2006, Ranjbar & Moradi Behjou 9952 (BASU).

This variety differs easily from *O. melanotricha* var. *melanotricha* by largely simple leaves versus compound leaves in 4-5 pairs in type variety (Boissier 1872) (Table 6).

Key to the varieties of *Onobrychis melanotricha* in Hamedan province

1. Leaves paucifoliolate with a single, terminal or rarely a pair of leaflet var. *ecbatanaica*
- Leaves plurifoliolate with (1) 2-5 pairs of leaflets 2

Fig. 7. Morphologic type 2. *Onobrychis melanotricha* var. *villosa* − A: habit; B: calyx; C: standard; D: keel; E: wings; F: androecium; G: pistil; H: pod. − Scale bar: A = 1 cm, B-H = 0.5 cm.

Table 3. Eigenvalues of 7 vectors, percent eigenvalues and cumulative percent variation explained by each vector (eigenvalues >1 shown in Table).

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7
Eigenvalue	11.300	6.175	5.528	3.202	1.572	1.235	1.032
Percentage	34.24	18.71	16.75	9.70	4.76	3.74	3.13
Cum.Percentage	34.24	52.96	69.71	79.41	84.17	87.92	91.04

Table 4. Mean characters differences of measured morphological characters for 3 morphologic types (numbers correspond to character list in Table 1).

	Type 1		Type 2	Type 3
Characters	Subgroup I	Subgroup II	-	-
1	0	0	1	1
2	0	0	1	1
3	0	0.75	0.53	2
4	8.1	9.25	8.417	11
5	9.5	7.5	12.17	11.5
6	6.1	4.4	6.83	7
7	3.1	1.1	3.17	3
8	13	26	15.58	30
9	6.84	15	6.2	13
10	1.92	1.75	2.5	2.3
11	19.4	16	20.83	28
12	7.8	7	7.75	15
13	24.8	20	23	28
14	1.92	2.7	2.57	3
15	0.64	0.35	0.3	0.8
16	1.28	1	1.45	1.7
17	3.18	4.25	4.4	4.5
18	1.62	2.5	2.42	2.7
19	8.48	9.25	10.92	9
20	8.78	9.85	11.75	9
21	7.64	9.75	10.03	8.5
22	1.16	1	1.17	1.1
23	4	4.2	5.78	4.2
24	2.1	2.1	2.58	2.6
25	8.84	9.4	11.7	9.5
26	4.32	4.9	5.58	4.7
27	2.96	3.05	3.88	3
28	2.04	1.9	2.1	2
29	8.44	8.95	8.7	8.5
30	2.26	2.85	2.57	2.5
31	1.2	1.1	1.25	1.3
32	3.66	4.15	4.42	6

2. Plant appresed pillose, corolla length 8-10 mm
var. *melanotricha*
- Plant spreading villous, corolla length 10-12(14) mm
var. *villosa*

DISCUSSION

The populations belong to morphologic type 1 occur in the altitude ranges of 1756-2052 m and include subgroups I and II. They differ from each other by leaf characters. Individuals of these two subgroups were found together in the same locality. However, slope orientation is a factor can separate them well (subgroup I in N, W and S against subgroup II in E). Nevertheless, individuals of the subgroup I showed higher abundances and frequencies than subgroup II in the same locality. Thus, it seems that ecologic divergence of the subgroup II from the subgroup I has been occurred recently. The populations of morphologic type 2 occurred in the altitude ranges of 2032-2241 m that its individuals show a great variation in morphological characters. The morphologic type 3 occurs near a farming area with nearly the altitudes of 2020 m.

Individuals of this population represent considerable variation in morphological characters, so all observed variation in other morphologic types can be seen in this locality. Furthermore, looking for other specimens in one kilometer radius far from this locality resulted in individuals share similarity with type 1. Thus, this variation can be assigned to anthropogenic factor and then this type can be named "anthropogenic type".

Generally, *O. melanotricha* distributes in the altitude ranges of 1756-2241 m that includes two main habitats: sub-mountains with the altitude less than to nearly 2000 m that was occupied by type 1 and mountains with the altitude more than 2000 m that was occupied by type 2. Also type 3 occurs in an artificial (anthropogenic) habitat with altitude of about 2000 m. Morphological study of the identified types showed that they represent a continuous gradient of variation in relation to altitude. So that, with increasing of the altitude, type 1 can be replaced by type 2. This gradient was distinguished in some characters such as decumbent/erect habit, appressed pilose/spreading villous indumentum, ovate-elliptic/narrowly elliptic-lanceolate leaflet shape, calyx size 3-4/4-5 mm and corolla size 8-10/10-14 mm. Thus, gradient or clinal variation (Böcher 1967) was observed in several morphological characters that co-orientated with altitude (Table 7). The observed incongruence between the altitudinal ranges and morphological types in individuals of the releves 6, 10 and 11 referred to clinal variation of the species; so that, the releves placed in the mountainous habitats in altitudinal aspect (1935, 2052 and 2028 meters, respectively), but morphologically placed in the type 1 that mainly occupied sub-mountainous habitats. It can be inferred that they are placed in the border extent of the type 1 on this cline that reaches to the type 2 in mountainous habitat.

Comparison of these morphological types with the cited varieties of *O. melanotricha* (Boissier 1872; Bornmuller J. 1911; Rechinger, 1984) showed that the types 1 (subgroup I) and 2 are equal to var. *melanotricha* and var. *villosa*, respectively. These varieties occupied two ends of clinal variation (the lowest and highest extremes of altitudinal distribution). It is probably that pasturage or palatable significance of the species is an important factor that causes this variation pattern. The species experience heavy grazing pressure in the areas with low altitude. Thus, *O. melanotricha* var. *melanotricha* has been the subject of selection of decumbent habit with small flowers under a high herbivore pressure in the sub-mountainous habitat. In contrast, *O. melanotricha* var. *villosa* has been the subject of selection of erect habit with large flowers because of little availability and a low herbivore pressure in the mountainous habitat. The subgroup II of type 1 can be described as a new variety (*Onobrychis melanotricha* var. *ecbatanaica* Ranjbar & Behjou). The type 3 has an intermediate position between the verities and shows all variation of them, but it hasn't distinctive characters enough for introducing as a new taxon. In conclusion, we propose further investigations in whole distribution ranges of *O. melanotricha* armed with the different biosystematical approaches.

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Table 5. Species composition of the *Bromus danthoniae-Taeniatherum crinitum* community (habitat of *Onobrychis melanotricha*) based on 14 phytosociological releves from sub-steppic ranges from Hamedan province. The symbols [r, +, 1, 2] indicate abundance-dominance of each species in each releve according to the Braun-Blanquet's method along with diagnostic, characteristic and other accompanying species for *Onobrychis melanotricha* and 3 morphologic types.

Morphologic Types	1							2						3	Frequ
Subgroups	I					II		-						-	ency
Releves	1	2	3	6	10	4	11	5	9	12	7	8	13	14	(%)
Diagnostic species															
Stachys inflata	1	1	1		+	1	1		1						50
Gagea alexeenkoana	1	+	r			r	r						r		42.9
Tanacetum canescens	1	+	1			1	+								35.7
Astragalus gossypinus		+		r	+		1			+					35.7
Echinops ritrodes				r	+		+						r		28.6
Onobrychis melanotricha var. *melanotricha*	1	1	1	+	1										35.7
Astragalus curvirostris	r		r		r										21.4
Polygonum paronychioides	r		r	r											21.4
Scutellaria pinnatifida	1	+			r										21.4
Onobrychis melanotricha var. *ecbatanaica*						r	r								14.3
Hypericum helianthemoides						+	r		r						21.4
Lagochilus aucheri			+			r	+								21.4
Onobrychis melanotricha var. *villosa*								1	1	1	1	1	+		42.9
Eremopoa persica					r		+		+	r	+	+	r		50
Festuca ovina					1		r	1	1	2		+			42.9
Bromus tomentellus							+	2	r	1			1		35.7
Acantholimon olivieri					+			+		r	+	+			35.7
Euphorbia cheiradenia					r			+		+	+	1			35.7
Onobrychis melanotricha (x)														2	7.1
Trigonella persica				+										r	14.3
Tragopogon longirostris					+									1	14.3
Eremopoa boneapartis						+								+	14.3
Hypecum pendulum						+								+	14.3
Roemeria hybrida						+								+	14.3
Androsace maxima							r							1	14.3
Teucrium orientale								+						1	14.3
Ceratocephala falcata									r					+	14.3
Scabiosa argentea									+					+	14.3
Cousinia calcitrapa													1	1	14.3
Characteristic species with high frequencies in releves															
Bromus danthoniae	+	+	+	+	r	1	+	+		+		+	+	2	85.7
Taeniatherum crinitum	+	+	+	+	r	2	+			+	+	+	+	+	85.7
Boissiera squarosa	+	+	r		r	1	+		r	+	+	+		+	78.6
Bromus tectorum	+	+	r	2		+			+	+	1	+		+	71.4
Heteranthelium piliferum		+	+	+	r	+	+		r	+	+	+			71.4
Poa bulbosa		+	+	+	r		r	+	+	+		+	+		71.4
Cousinia bijarensis			1	r	+	+	1	+	+	+		+	+		71.4
Astragalus floccosus			+	2	+	+		2	2	1	2	2			67.2
Crepis sancta	r			r	+	r			r	r	+	r			57.1
Xeranthemum longipapposum				1	+	r		r		r			+	+	57.1
Ziziphora tenuir			r	r	r	+	r				r	r		+	57.1
Phlomis olivieri			1	1	1					r	1	+	1		50
Eryngium billardieri			r		1		+			1	+	r	+		50
Alyssum minus				r	r		+			+	+	+	r		50

Stipa arabica	+	1	+			+			+			1			42.9
Buffonia capsularis					1		r				1	+	1	+	42.9
Scariola orientalis				+	+	1		1	+		+				42.9
Allium stamineum			r		r	r	r					r	r		42.9
Centaurea virgata				+			+	+		+				1	35.7
Anthemis odontostephana	+	r	r			r								+	35.7
Astragalus macropelmatus	+	r	r			r						r			35.7
Minuartia meyeri					r		r		r		r			r	35.7
Pterocephalus canus					+		r	+	+				+		35.7
Scabiosa flavida				r		r						r	r	1	35.7
Bellevalia glauca	+	+	r			r		r							35.7
Other species with low frequencies in releves															
Astragalus supervisus	1	+	+			+									28.6
Aegilops umbellata				+	r					r	r				28.6
Turgenia latifolia					+				r				r	+	28.6
Alyssum szowitsianum					r					r	r	r			28.6
Noaea mucronata						+	+		r		+				28.6
Senecio vernalis					r	r					r	+			28.6
Rosa persica	1										2	r			21.4
Tanacetum polycephalum						+						+	+		21.4
Astragalus spachianus			r				+							+	21.4
Astragalus effusus		1	1											1	21.4
Agropyron desertorum							r	+						3	21.4
Teucrium polium			+				+		r						21.4
Thymus fallax					+			1					+		21.4
Salvia multicaulis							1			+			2		21.4
Acanthophyllum microcephalum			2		+							1			21.4
Silene aucheriana			+										r	+	21.4
Dianthus crinitus										r			+	1	21.4
Holosteum glutinosum							r				+			r	21.4
Fibigia suffroticosa							r	1					+		21.4
Alyssum lanigerum	r		+						r						21.4
Verbascum songaricum					1		r		+						21.4
Convolvulus urosepalus	1		r			r									21.4
Papaver argemone					R		r				r				21.4
Gundelia tournefortii		+									r				14.3
Ziziphora clinopodioides									r	+					14.3
Cerastium dichotomum											+		r		14.3
Astragalus alyssoides							r		r						14.3
Asrtagalus ecbatanus			r			r									14.3
Astragalus campylorrhynchus				r								r			14.3
Astragalus tribuloides		r	r												14.3
Astragalus caspicus							r						1		14.3
Melica persica			+		1										14.3
Nardurus subulatus			r			r									14.3
Arenaria tetrasticha										+		r			14.3
Scandix stellata			r						+						14.3
Euphorbia macroclada				1						+					14.3
Euphorbia peplus			r			1									14.3
Andrachne fruticulosa			r			+									14.3
Asperula glomerata	r												r		14.3
Acantholimon mobayenii	r					r									14.3
Acantholimon sanganense			+				+								14.3
Valerianella oxyrrhyncha			r			r									14.3
Allium scabriscapum			+			1									14.3
Allium shelkovnikovii						r			r						14.3

Table 6. Diagnostic characters of *O. melanotricha* var. *melanotricha* and *O. melanotricha* var. *ecbatanaica*.

Characters	var. *melanotricha*	var. *ecbatanaica*
Number of leaflet pairs	Imparipinnate; 4-5	Simple; rarely 1
Leaflet [length mm]	5-9	16-35
Leaflet shape	ovate-orbicular	ovate

Table 7. Taxonomic status and diagnostic characters of morphologic types in comparison to description of *Onobrychis melanotricha* [description is based on Boissier (1872) and Širjaev (1926)].

Morphologic type	1		2	3	Description
Subgroups	I	II	-	-	-
Taxonomic status	var. *melanotricha*	var. *ecbatanaica*	var. *villosa*	X	*O. melanotricha*
Altitude [m]	1756-2028	1792-2028	2032-2241	2020	1600-2500
Habitat [slope orientation]	N, W, S	E	N, W	W	-
Plant habit	decumbent	decumbent	erect	erect	-
Plant indumentum	appressed pilose	appressed pilose	spreading villous	subappressed pilose	pilose or villous
Number of leaflet pairs	(1) 2-5	single, terminal leaflet or rarely 1	2-5	1-6 or rarely single, terminal leaflet	(3) 4-5 (6)
Leaflet [size mm]	6-20 (25) × 3-9 (13)	16-35 × 10-21	7-20 × 4-9	12-30 (45) × 5-15 (20)	5-18 (25) × 3-6 (9)
Leaflet shape	ovate-elliptic	ovate	narrowly elliptic-lanceolate	narrowly ovate-elliptic	ovate or oblong-elliptic
Calyx [length mm]	3-4	4-5	4-5	4-5	4-6
Corolla [length mm]	8-10	8-10	10-12 (14)	8-11	(7) 8-12 (15)
Wing [length mm]	3-4.5	4-4.5	5-7 (8)	4-5	4-6 (8)

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