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"Research Note"

DISCRIMINATIVE ANALYSIS OF 10 SPECIES OF *AEGILOPS* L. (POACEAE) NATIVE TO IRAN*

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Abstract – The genus *Aegilops* is one of the wheat relatives which comprise the main part of its gene pool. The identification of the *Aegilops* species is difficult due to their vast morphological similarities and gene flow among different species of *Aegilops* and cultivated wheat. Some morphological characters are used to distinguish different species in *Aegilops*. In this study, we evaluate all these characters and choose 9 quantitative morphological ones including culm number, reproductive culm number, the length of the longest culm, spike length including and excluding awns, length of longest inter-node, length of lowermost glume, and the length of the uppermost lemma and palea. These characters were measured for 64 populations of 10 species of *Aegilops* in Iran. Discriminative analysis was used to evaluate the correctness of classification. Results indicate a great confusion between two varieties of *Ae. triuncialis*, and these taxa as a whole with others. Discriminative analysis proved the diagnostic value of these 9 quantitative characters in *Aegilops* in Iran.

Keywords – *Aegilops*, discriminative analysis, Iran

1. INTRODUCTION

Genus *Aegilops* L. (Poaceae) is one of the wheat relatives with a wide distribution in Iran, and is capable of making different complexes with each other and with *Triticum* L. [1-4]. *Aegilops* is a western Asia-Mediterranean element found around the Mediterranean Sea and the western central part of Asia [1, 5]. Iran is one of the centers of distribution and variation of Aegilops in the world. Due to the importance of cultivated wheat, having a better knowledge about new genetic resources is necessary to improve wheat races. We can improve our knowledge by correct and fundamental classification of *Aegilops*. The aim of this study is to evaluate the correctness of classification based on some diagnostic morphological characters in the *Aegilops* accessions of Iran using discriminative analysis [6, 7, 8].

2. MATERIALS AND METHODS

We collected 66 accessions (64 populations) of 10 *Aegilops* species from different parts of Iran in the form of seed accessions and herbarium specimens (Table 1). Thirty six morphological characters were measured for 10 individuals of each accession (Table 2). We chose a set of nine characters with higher

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coefficients of variation for the discriminative analysis of 11 taxa by Mathlab software [9]. Characters were studied under a stereomicroscope with different magnitudes.

Table 1. Address of collected site of Aegilops populations in this study

Taxon	Accessions address	Code
Aegilops caudata L.	Sardasht/Khoramabad	1
Ae. columnaris Zhuk.	Neyriz/ Varedeh/Divandareh to Saghez	10
Ae. crassa Boiss.	Alligudarz/ Talkhab/Marvdasht/ Perspolis/Sanandaj/Pole kata Meymand Javanroud to Islamabad	7
Ae. cylindrica Host.	Khoramabad to Sephid Dasht/ Kiasar/ Varedeh/Between Sirjan & Baft Dashte Arjan	8
Ae. geniculata Roth.	Varedeh/ Saadat Shahr to Arsanjan/Amirabad before Yasouj	2
Ae. kotschyii *Boiss.*	Shoshtar/ 60 km after Kangan/ Ramhormoz to Mahshahr	9
Ae. neglecta Req. ex Bertol.	Izae to Naghan/ Arsanjan	3
Ae. tauschii Coss.	Lahijan/ Elangdareh/ Sari/ Douab	4
Ae. triuncilais var *persica* L.	Saadat Shahr to Sivand/ Semiroum/ Amirabad/ Pole kata / Mavarz/ Shiraz Uromiyeh/ Dareshahr to Illam/ Chame Divan/ Mallavi/ Songhor/Javanroud	11
Ae. triuncialis var *triuncialis* L.	Hersin/ Ravansar to Kamyaran/ Mashhad to Ghochan/ 60 km after Mashhad to Ghochan/ Chenaran/ Heydareh/ Varedeh/ Quazvin/ Boukan / Dehgolan Arsanjan to Saadatshahr/ Qavakh/ Marivan to Baneh/ Shahzand/ Sorkhehesar Imamzadeh Hashem/ Homande Absard/ Zidasht/ Yasouj/ Izae to Naghan/ near Sardasht /Douroud / Razan/ Armand	5
Ae. umbellulata Zhuk.	Chovar Protected Park	6

Table 2. Morphological characters used in the present study of *Aegilops* species

No	Character	No	Character	No	Character
1	Total number of culms*	13	Number of nodes	25	Nerve no of lowermost glume
2	Number of reproductive culms*	14	Glume color	26	Length* of uppermost lemma
3	Length of the longest culm*	15	Length of the longest inter-node	27	Width of uppermost lemma
4	Length of 1st (Flag) Leaf Blade	16	Spike length (including awn)*	28	Nerve no of uppermost lemma
5	Length of 2nd (Flag) Leaf Blade	17	Spike length (excluding awn)*	29	Length of lowermost lemma
6	Length of 3rd (Flag) Leaf Blade	18	Number of spikelets per spike	30	Width of lowermost lemma
7	Width of 1st (Flag) Leaf Blade	19	Number of rudimentary spikelets	31	Nerve no of lowermost lemma
8	Width of 2nd (Flag) Leaf Blade	20	Length of uppermost glume	32	Length*of palea
9	Width of 3rd (Flag) Leaf Blade	21	Width of uppermost glume	33	Width of palea
10	Length of 1st leaf sheaths	22	Nerve no of uppermost glume	34	Length of caryopsis
11	Length of 2nd leaf sheaths	23	Length* of lowermost glume	35	width of caryopsis
12	Length of 3rd leaf sheaths	24	Width of lowermost glume	36	Glume texture

*Characters with higher coefficient of variation

3. RESULTS AND DISCUSSION

Results of discriminative analysis are shown in Tables 3 and 4. The correctness proportion of grouping varied from 0.670 to 1.000. The highest proportion of misidentification was found between the two varieties of *Ae. triuncialis*. Merging two varieties of *Ae. triuncialis*, this proportion rises from 0.822 to 1.000 (Table 5). *Ae. triuncialis* have the greatest confusion with the other species. By exclusion of *Ae. triuncialis*, the mean proportion of correctness becomes very high (0.987). All species were clearly

distinguished from each other except *Ae. crassa* and *Ae. cylindrica*. These two species showed a few morphological similarities with each other and with *Ae. caudata*.

According to Tables 3 & 4, the proportion of identification correctness was 80.9% by all 11 taxa, 89.6% when varieties of *Ae. triuncialis* were merged, and 98.7% after *Ae. triuncialis* was excluded. This result clearly indicates that the identification problems of *Aegilops* species in Iran are closely related to *Ae. triuncialis*, a tetraploid with abundant distribution in many habitats of Iran. The separation of species with morphological similarities, as *Ae. triuncialis* var. *triuncialis*, *Ae. neglecta* and *Ae. kotschyi* is difficult. Discriminative analysis showed the efficiency of the morphological characters of this study in the separation of these three species (Table 5). The correctness of classification was 97.0%. There are also difficulties in distinguishing *Ae. umbellulata* from *Ae. geniculata*. Discriminative analysis shows the efficiency of our set of characters (Table 6). Discriminative analysis is a highly efficient method to evaluate the classification of taxa in species complexes of *Aegilops* in Iran.

Table 3. Result of discriminative analysis of 11 Aegilops taxa (10 species)

Group[1)]	True Group										
	1	2	3	4	5	6	7	8	9	10	11
1	20	0	0	0	0	0	0	1	0	0	1
2	0	30	0	0	0	0	0	0	0	0	0
3	0	0	40	0	7	0	2	0	0	0	2
4	0	0	0	40	0	0	0	0	0	0	2
5	0	0	0	0	161	0	2	0	0	0	25
6	0	0	0	0	0	10	0	0	0	0	0
7	0	0	0	0	24	0	65	1	0	0	11
8	0	0	0	0	2	0	0	47	0	0	0
9	0	0	0	0	0	0	0	0	20	0	0
10	0	0	0	0	0	0	0	0	0	30	0
11	0	0	0	0	46	0	1	1	0	0	79
Total	20	30	40	40	240	10	70	50	20	30	120
Correctness	20	30	40	40	161	10	65	47	20	30	79
%	100	100	100	1000	67.0	100	92.9	94	100	100	65

Table 4. Result of the present discriminative analysis of 9 species of the genus *Aegilops* after emitting *Ae. Triuncialis*

Group[1)]	True Group								
	1	2	3	4	6	7	8	9	10
1	20	0	0	0	0	0	1	0	0
2	0	30	0	0	0	0	0	0	0
3	0	0	40	0	0	2	0	0	0
4	0	0	0	40	0	0	0	0	0
6	0	0	0	0	10	0	0	0	0
7	0	0	0	0	0	68	1	0	0
8	0	0	0	0	0	0	48	0	0
9	0	0	0	0	0	0	0	20	0
10	0	0	0	0	0	0	0	0	30
Total	20	30	40	40	10	70	50	20	30
Correctness	20	30	40	40	10	68	48	20	20
%	100	100	100	100	67.0	97	96	100	100

1. No. used for taxa: See Table 2

Table 5. The use of discriminative analysis to distinguish *Ae. triuncialis* var. *triuncialis*, *Ae. neglecta* and *Ae. kotschyii*

Group	True Groups			
	Ae. neglecta	*Ae. triuncialis* var *Triuncialis*	*Ae. kotschyii*	
Ae. neglecta	40	9	0	
Ae. triuncialis var *triuncialis*	0	231	0	
Ae. kotschyii	0	0	20	
Total	40	240	20	300
Correctness	40	231	20	291
% of Correctness	100	96.2	100	97.0

Table 6. Result of discriminative analysis to distinguish *Ae. umbellulata* from *Ae. geniculata*

Group	*Ae. geniculata*	*Ae. umbellulata*	
Ae. geniculata	30	0	
Ae. umbellulata	0	10	
Total	30	10	40
Correctness	30	10	40
% of Correctness	100	100	100

REFERENCES

1. Davis, P. H. (1965). *Gramineae*. In Davis, PH (ed.) Flora of Turkey and the East Aegean Islands: *Vol. 1*. Edinburgh University Press.
2. Boissier, P. E. (1844). *Flora orientalis*: Vol. 5. Basel, Geneva, Switzerland: H. Georg.
3. Bor, N. L. (1968). *Gramineae*. In: Townsend, C. C., Guest, E. & Al-Rawi, A. (eds.), Flora of Iraq: *Vol. 9*. Baghdad, Iraq ministry of agriculture.
4. Bor, N. L. (1970). *Gramineae*. In: Rechinger, K. H. (ed.) Flora Iranica: *Vol. 70*. Graz, Austria: Akademische Druk-Und Verlagsanstalt. Wien.
5. Slageren Van., M. W. (1994). *Wild wheat*: a monograph of *Aegilops* L. and *Amblyopyrum* (Jaub. & Spach) Eig (Poaceae). Agric. Univ., Wageningen.
6. Jarvie, J. K. & Barkworth, M. E. (1992). Morphological variation and genome constitution in some perennial Triticeae. *Bot. J. Linn. Soc*., *103*, 167-180.
7. Baum, B. R. (1976). Taxonomy of the tribe Triticeae (Poaceae) using various numerical techniques. I. Historical perspectives, data accumulation and character analysis. *Can. J. Bot*. *55*, 1712-1740.
8. Knaggs, P., Ambrose, M. J., Reader, S. M. & Miller, T. E. (2000). Morphological characterization and evaluation of subdivision of *Aegilops tauschii* Coss. *WIS*. *91*, 15-19.
9. Johnson, R. A. & Wichern, D. W. (1992). *Applied multivariate statistical analysis* (2nd ed.), Englewood Cliffs, N. J., Prentice & Hall.