Bangladesh J. Plant Taxon. **24**(2): 241–244, 2017 (December) **- Short communication**

A NOTE ON *ASTRAGALUS* L. SECTION *CAPRINI* DC.

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Keywords: *Astragalus*; Iran; Phylogeny; Taxonomy.

Astragalus sect. *Caprini* DC. is a probably heterogeneous but mostly easily recognizable section within the genus. The members of this section are distributed in subalpine and alpine areas of Iran where that are considered as a secondary center of biodiversity for the section (Podlech, 1986; Mahmoodi *et al*., 2012). This section is characterized by having basifixed hairs; unilocular, bilocular, or semi-bilocular pods; and relatively large yellow flowers arranged in rather few-flowered short inflorescences (Podlech, 1999). After establishing by de Candolle (1825), the section was subdivided into various groups, mainly informal groups, by different authors (Bunge, 1869; Gontcharov *et al*., 1965; Podlech, 1988). Podlech's comprehensive work on the section *Caprini* led to the subsectional classification each in turn, comprised of several informal groups (Podlech, 1988). These infrasectional grouping were not reflected in taxonomic treatment of Iranian species of the section, accomplished by Maassoumi (2003). Based on recent molecular analyses of section *Caprini* and its allies, Riahi *et al*. (2011) concluded that all subsections of sect. *Caprini* in Iran are not monophyletic and thus introduced seven groups within section with a distinctive synapomorphy for each one. In a more recent comprehensive taxonomic revision of *Astragalus* in the Old World, subsectional classification were not considered by Podlech and Zarre, so that they put all members of the section within six morphological groups (Podlech and Zarre, 2013).

In the present study, we aim to examine the subspecific classification within Iranian native species, *A. macropelmatus* Bunge, using nrDNA ITS sequence. This species belongs to section *Caprini* group *Purpurascetes*, and contains two subspecies in Iran (Maassoumi, 2003). The plants of this group is characterized by having merely white pilose indumentum or sometimes glabrous, purple flowers and the upper surface of leaflets without indumentum and finely toothed corolla keel (Podlech and Zarre,2013). The main objective of this study is to evaluate the subspecific ranking validity under *A. macropelmatus* Bunge, based on nrDNA ITS phylogenetic analysis and morphology comparing.

A total of 13 taxa belonging to *Astragalus* sect. *Caprini* were included in a phylogenetic analysis using nrDNA ITS sequence (Table 1). Outgroups were selected according to previous studies (Riahi *et al*., 2011). Morphological characteristics, which are used to distinguish subspecies of *A. macropelmatus*, have been presented in Table 2. The length of aligned nrDNA ITS dataset among ingroups was 603 nucleotide sites, of which 26 sites were parsimony informative characters. In order to examine the occurrence of transitions/transversions among intended subspecies, nucleotide pair frequencies were compared and results represented in Table 3. The phylogenetic tree obtained from the Bayesian analysis with posterior probabilities (PP) and bootstrap values is presented in Fig. 1. This tree was similar to that of MP in general topology

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(tree not shown here). Based on present result, two subspecies of *A. macropelmatus* formed a sister group as a subclade at the base of tree (Fig. 1). The difference in the branch lengths of the phylogram (Fig. 1) indicates different evolutionary rates in the DNA sequence. *A. citrinus* and *A. curvipes* united together and *A. nephtonensis* Freyn placed as a sister to this group.

Table 1. Taxa included in the nrDNA ITS analysis.

Taxa	Locality, Voucher	GenBank accession no.
A. macropelmatus (=*A. macropelmatus* subsp. *macropelmatus*)	Isfahan, Ghamishloo: Yusefi, 980 (TARI)	LC128065
A. pseudobuchtormensis (=*A. macropelmatus* subsp. *Pseudobuchtormensis*)	Baluchestan, Zahedan: Assadi, 22822 (TARI)	LC128066
A. citrinus	Khorasan, Kalate Naderi: Assadi and Maassoumi, 55843 (TARI)	LC128064
A. aegobromus Boiss. & Hohen.	Mazandaran, Kandavan: Maassoumi 55116 (TARI)	AB051953
A.curvipes Trautv**.**	Khorasan, Quchan: Maassoumi 47553 (TARI)	AB051955
A.nephtonensis Freyn	Gorgan, Shahmirzad to Sari: Maassoumi 55006 (TARI)	AB051957
A.dieterlei Podlech	Afghanistan, Bamian: Mirtajaddini 19500 (TARI)	AB051961
A.vereskensis Maassoumi & Podlech	Mazandaran, Kiasar: Maassoumi 55016 (TARI)	AB051959
A.peltatus Podlech & I.Deml	Afghanistan, Kataghan: Rechinger 37517 (TARI)	AB052034
A. multijugus DC.	Markazi, Arak: Mozaffarian and Maassoumi 47957 (TARI)	AB051956
A. vulcanicus Bornm.	Mazandaran, Polur: Maassoumi 55134 (TARI)	AB051960
A. urmiensis Bunge	Qazvin: Maassoumi 55137 (TARI)	AB051958

Table 2. Morphological comparison between two subspecies of *A. macropelmatus*.

Taxa/Morphological Feature	Leaflet Shape	Leaflet size (mm)	peduncle	Calyx length (mm)	Standard length (mm)	Wing auricle (mm)	Pod length (mm)
- subsp. *macropelmatus* (= *A. macropelmatus*)	Narrow oblong, narrow ovate	4–10 × 1.5–3	subsessile	10–12	17–23	1.5–2.5	15–22
- subsp. *pseudobuchtormensis* (= *A. pseudobuchtormensis*)	Ovate, wide elliptic or orbicular	2–5 × 2–3.5	pedunculated 0.5–2 (-5)	13–16	22–29	3–4	20-32

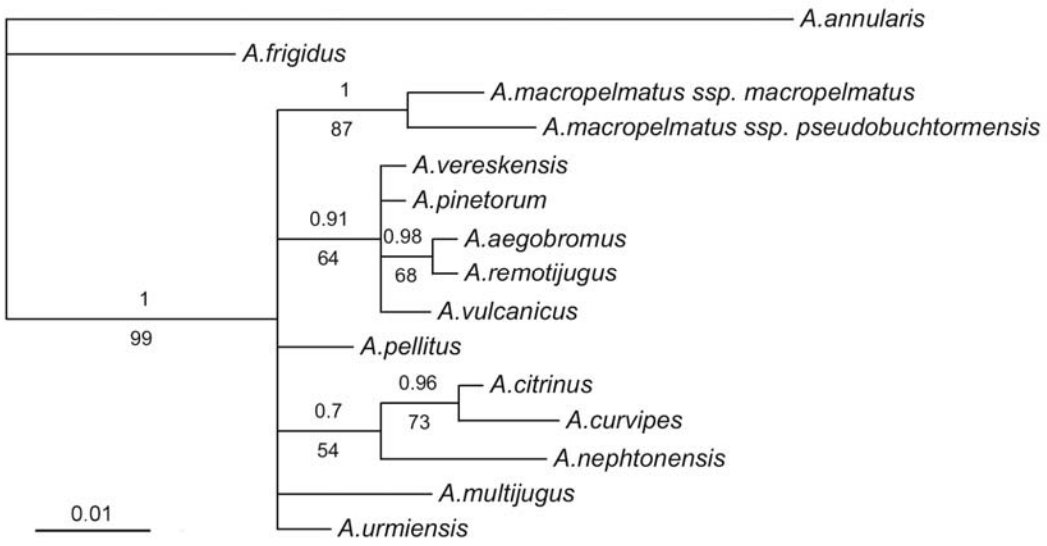

Fig. 1. Fifty percent majority-rule consensus tree derived from analysis of the nrDNA ITS sequences of studied taxa, using Bayesian method. The numbers above and below branches show posterior probability and bootstrap value, respectively.

Table 3. Nucleotide pair frequencies and discrepancies between two subspecies studied of *A. macropelmatus*.

Taxa\Domain	ii*	si	sv	R	TT	TC	TA	TG	CC	CA	CG	AA	AG	GG	Total
A. macropelmatus	597	5	1	5	153	3	0	0	148	0	1	130	2	166	603

*ii = Identical Pairs, si = Transitional Pairs, sv = Transversional Pairs, R = si/sv

DNA sequences analyzed here, revealed some differences between two subspecies of *A. macropelmatus* (Table 3).

Širjaev and Rechinger introduced *A. pseudobuchtormensis*, as a distinct species, in 1953. Later on, Parsa (1966) reduced this species to the variety level of *A. buchtormensis* Pall. as *A. buchtormensis* var. *pseudobuchtormensis* (Širj. and Rech. f.) Parsa. Eventually, Podlech (1988) described *A. pseudobuchtormensis* as a subspecies under *A. macropelmatus*. Based on present molecular analysis, disparity of sequences observed between two subspecies of *A. macropelmatus*, could be defined as five transitional plus one transversional nucleotide substitutions (Table 3). These differences from a molecular view along with various morphological discrepancies (Table 2) persuaded us to return *A. macropelmatus* subsp. *pseudobuchtormensis* to its previous specific rank. From the geographical distribution viewpoint, -subsp. *macropelmatus* is confined to West and Central Iran and -subsp. *pseudobuchtormensis*is restricted to the Eastern part of Iran.

Taxonomic treatment

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Lectotype: Persia borealis: In mont. Derbend, Th. Kotschy 660. *A. macropelmatus* subsp. *macropelmatus* Podlech, Mitt. Bot. Staatss. Munchen 25: 735 (1988).

A. pseudobuchtormensis Širj. and Rech. f., Anz. Math.-Nat. Kl. Österr. Akad. Wiss. 90: 183 (1953). *A. turbat-haidaiensis* Širj. and Rech. f., l. c.: 162 (1953).*A. Aitchisonii* Širj. and Rech. f., Dan. Biol. Skr., 9 (3): 67 (1958) non Baker. *A. subconduplicatus* Ali, Kew Bull. 13: 315 (1958).

A. macropelmatus subsp. *pseudobuchtormensis* (Širj. and Rech. f.) Podlech, Mitt. Bot. Staatss. Munchen 25: 735 (1988). **Syn. Nov.**

Holotype: Persia: Khorasan, inter Birjand et Kain, K. H. Rechinger fil. P. Aellen and E. Esfandiari 4181 (W).

Acknowledgments

We would like to thank to the Director and Curator of National Central Herbarium of Iran (TARI) for giving opportunity to study required specimens. Also we wish to thank Professor Shahrokh, Kazempour Osaloo for his helpful comments.

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(Manuscript received 5 March 2017; revised on 26 August 2017)