

SOME NEW RECORD SPECIES FOR THE FLORA OF IRAN AS WELL AS ECOLOGICAL AND PHYTOGEOGRAPHICAL NOTES

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Cardamine flexuosa With. (*Cruciferae*) and *Carex orbicularis* Boott subsp. *orbicularis* (*Cyperaceae*) are reported for the first time from Iran in Hyrcanian and Irano-Turanian phytoclimates respectively. Taxonomical problems, ecology and phytogeography of each species are discussed. Also a clearer picture of distribution and ecology of *Cardamine tenera* Gmel. in North of Iran is presented.

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گزارش‌های تازه و قابل توجه از فلور ایران به همراه نکاتی از اکولوژی و پراکنش
جغرافیایی آنها
علیرضا نقی نژاد، احمد قهرمان و مصطفی اسدی

Carex orbicularis Boott و *Cruciferae* از خانواده *Cardamine flexuosa* With. از *Cyperaceae* subsp. *orbicularis* برای اولین بار در ایران به ترتیب از مناطق هیرکانی (استان مازندران) و ایرانی-تورانی (استان کرمان) گزارش می‌شوند. اکولوژی، پراکنش جغرافیایی و مشکلات تاگزونومی هر یک از گونه‌های بالا بحث می‌شود. همچنین تصویر واضحتری از پراکنش و اکولوژی *Cardamine tenera* Gmel. در ایران ارائه می‌گردد.

INTRODUCTION

This article has been resulted from part of investigations of the first author on the flora and vegetation in North of Iran (Naqinezhad, 2003, Ghahreman, et al. 2003) as well as a specialized study on *Cyperaceae* family. Although some species of Iranian *Cardamine* is easily recognizable, but morphological resemblances are so strong that it is sometimes difficult to distinguish the annual species such as *C. hirsuta* and *C. flexuosa* (Ellis & Jones, 1969). The former species has been previously reported from Iran (Hedg, 1968) and the latter, *C. flexuosa* (*Cruciferae*), is reported now as an interesting record for the flora of Iran. Also we survey the complex of *Carex orbicularis* Boott. This is a variable species with two allopatric western and eastern subspecies (Shishkin, 1935; Davis, 1985, Kukkonen, 1998). *Carex orbicularis* subsp. *orbicularis* (*Cyperaceae*) as an eastern subspecies is reported as new record for the flora of Iran. Also we survey more specimens from *Cardamine tenera* Gmel. and show its geographical extension in northern Iran. This species had been reported from Iran only based on one specimen (Hedge, 1968).

MATERIALS AND METHODS

Specimens of *Cardamine* in Iranian herbaria, TUH, IRAN, TARI, (abbreviation according to Holmgren et al. 1990) were studied. Identification of *C. flexuosa* is relevant to comparison of several specimens of this species with *C. hirsuta*. Also with the study of specimens of *Cyperaceae* family in TUH, *C. orbicularis* subsp. *orbicularis* were determined.

RESULTS AND DISCUSSION

Cardamine flexuosa With.

Materials examined. Iran, Mazandaran province, Tunekabon, Nashtarud,

Khoshkedaran natural national monument, - 20 m, 15.5.2003, Naqinezhad, 30807-TUH; Namak-Abrud, Telekabin forest area, - 20 m, 14.7.2002, 30808-TUH

Despite of different position of *C. flexuosa* and *C. hirsuta* L. in the molecular based clades of Franzek, et al., 1998, these two taxa are morphologically similar. Although *C. hirsuta* had been previously reported from N, W, S of Iran, there is no reports of *Cardamine flexuosa* in Iran until now (Hedge, 1968; Akhani, 2003). Distinct morphological, phytogeographical differences between two species are presented in table 1.

Habitat. *Cardamine flexuosa* in contrast to *C. hirsuta* that is considered as a ruderal plant, is a forest species, confined to damp shady forests with high humus in Europe and newly founded places in wet alder (*Alnus glutinosa*) forests over Hyrcanian area. This plant is a pioneer characteristic species in Cardamino-Montion alliance and Cardaminetum flexuosae association in Europe (Hegi, 1986). In Japan, this species occurs as a weed in cultivated fields such as paddy fields, crop gardens and orchards (Kudoh et al. 1993). According to TARI's specimens, *C. hirsuta* grows on rocky limestone slopes with open *Quercus* forests (in Fars) or among the limestone rocks where forest recently has been cleared (in Mazandaran).

Phenology. *Cardamine flexuosa*, a winter-green or year-long annual, shows a facultative long-day requirement for flowering (Kudoh et al. 1995). This species completes its reproductive cycle in spring but fresh leaves and inflorescence can also be found in autumn and winter when it grows with *C. hirsuta*.

General distribution. Most of Europe widespread in Asia except for Siberia and the Central Asian republics of the Former Soviet Union, South and North of Africa, Macaronesia, North and South America, also



Fig. 1. *Cardamine flexuosa* ($\times 0.6$).

Table 1. Main morphological differences between *Cardamine flexuosa* and *C. hirsuta*.

| Species | Stem | Basal leaves | Petiole | Silique | Stamen |
|--------------------|---|---------------------------------|-------------|--|--------|
| <i>C. flexuosa</i> | Stem frequently flexuous, distally at least in the raceme | Few, not in a distinct rosette | Not ciliate | Erect-patent (or erect on ascending pedicels), scarcely overtopping unopened flowers | 6(-4) |
| <i>C. hirsuta</i> | Stem straight | Many, and in a distinct rosette | Ciliate | Erect (or pedicels and siliques ascending), much overtopping unopened flowers | 4(-6) |

naturalized in Australia. (Maire, 1967; Hilliard & Burtt, 1982; Hegi, 1986)

Taxonomical remarks. *Cardamine flexuosa* is a tetraploid ($2n=32$) which may have arisen by autoploidy or allopolyploidy. *Cardamine hirsuta* ($2n=16$) appears to have been closely concerned in the evolution of *C. flexuosa*. Morphological resemblances are so strong that it is sometimes difficult to distinguish the species, especially when only winter rosettes are available. Indeed, in the Floras of many European countries it is only in the present century that the species have been distinguished and as recently as 1943 they were recombined under *C. hirsuta* L (Ellis & Jones, 1969).

It seems that there is a high level of variations in *C. flexuosa* and *C. hirsuta* in Iran. Most of the herbarium specimens such as Chahrivar, Mirtae, 12119 (TUH), Gilan, Lahijan, - 25 m, Naqinezhad, 21378 (TUH), Gilan, Asalem to Khalkhal, 1500-1700 m, Termeh & Matin, 14430 (IRAN) and Mazandaran, west of Ramsar, 100-200 m, Wendelbo & Shirdelpur 15270 (TARI) seems to be intermediate states between two latter species. These specimens might be different intraspecific variation of each species or they can be likely considered as interspecific hybrids which is common in *Cardamine*. It is noteworthy that the hybrid *Cardamine flexuosa* x *hirsuta* (*C. zahlbrucknerana* O. E. Schulz) is known from the wild (Ellis & Jones, 1969). It

was reported by Schulz (1903) as occurring naturally in Austria. This hybrid taxon might be also present in Iran. This idea needs more studies to prove.

Carex orbicularis* Boott subsp. *orbicularis

Material examined. Iran: Kerman: Baft, Gugher, Bondar, 2880 m, Mirtadzedini, 31982-TUH.

Carex orbicularis is one of the two-stigmatic members of subgen. *Carex* that is splitted in two subspecies in Flora Iranica as named subsp. *orbicularis* and subsp. *kotschyana* (Boiss. & Hohen.) Kukkonen (Kukkonen, 1998). Subsp. *kotschyana* that has been considered as a separated species by Shishkin (1935) in Flora of USSR, has been previously reported from N, W, S, C Iran while subsp. *orbicularis* is reported for the first time from Iran. Major morphological differences between these two subspecies are presented in table 2.

Habitat. Members of *C. orbicularis* are mountainous and even alpine taxa that exclusively occur on wet or marshy meadows from 1500 m up to 4300 m.

Notes on the general distribution. *Carex orbicularis* extends within Irano-Turanian region that is divided into eastern part demonstrated with subspecies *orbicularis*. It distributes from C, E, NE Afghanistan and Pakistan eastward to Nepal and most of C.

Table 2. Major morphological and distributional differences between subsp. *kotschyana* and *C. orbicularis*. subsp. *orbicularis*.

| Subspecies | Spikes | Utricle | Utricles on the rachis | Global distribution |
|--------------------|--------|---|------------------------|---------------------|
| <i>kotschyana</i> | Lax | elongated (ellipsoid), gradually contracted to beak | spreading-erect | Western |
| <i>orbicularis</i> | Tight | orbicular, abruptly contracted to beak | spreading | Eastern |

Asian mountains to 4300 m (Kukkonen, 1998). Therefore new-founded place in Iran is westernmost record for this taxon up till now. In comparison, subspecies *kotschyana* is a rather isolated western taxon within *C. orbicularis* that is confined in NE Iraq, E Turkey, Transcaucasus, Iran (Shishkin, 1935; Hooper, 1985; Davis, 1985; Kukkonen, 1998). According to Kukkonen (1998), easternmost record for this subspecies has been reported in Shahvar mountains, Semnan (Iran). It seems that Iran (S & likely C & NE) is a point that these two subspecies meet each other. The existence of both taxa in one locality in Iran confirm this idea.

Taxonomical remarks. The morphological distinction between subsp. *kotschyana* and subsp. *orbicularis* is not always clear and transitional forms also occur (Davis, 1985; Kukkonen, 1998). For example plants with more or less tight spikes and orbicular utricles occur in Iran and plants with relative lax spikes and elongated utricles are found in Afghanistan (Kukkonen, 1998). This diversity is recognized even in one locality such as plants that has been collected in Dizin area (Tehran) by Mr. Dehshiri (pers. comm.) or some specimens collected by the first author in Mazandaran (Alam-Kuh, Naqinezhad- 34502-TUH). These specimens represent a wide morphological range from subsp. *kotschyana* to subsp. *orbicularis*. It is interesting that subsp. *kotschyana* itself, is rather variable in

Anatolia being represented on each of the different mountains on which it occurs by a more or less distinct variant, peculiar to that mountain (Davis, 1985).

A small note on *Cardamine tenera* Gmel.

C. tenera is a perennial *Cardamine* with large flowers, easily recognizable from *C. flexuosa* and *C. hirsuta*. Similar to *C. flexuosa*, this species is a humid forest plant. *Cardamine tenera* is a tertiary relict and confined as an Euxino-Hyrcanian element in Caucasus and North of Iran (Schishkin, 1935; Hedge, 1968). Hedge (1968) reported this species only from a no-numbered specimen from Gilan, Pir Bazar collected by Pichler. Personal investigation and studies on specimens of TUH & IRAN herbaria demonstrate that this species occurs in damp shady forests of *Alnus glutinosa* and *Buxus hyrcana* in lowlands and submountain regions. The materials examined: Mazandaran, Nowshahr, 12126 (TUH), Mazandaran, Tunekabon, Naqinezhad 30804 & 30805 (TUH), Mazandaran, Kelardasht to Abbasabad, 200 m, Termeh, Matin & Tehrani, 14478 (IRAN).

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Fig. 2. *Carex orbicularis* subsp. *orbicularis* (nat. size).

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