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The *Tamaricetea arceuthoidis*: a new class for the continental riparian thickets of the Middle East, Central Asia and the subarid regions of the Lower Volga valley

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Abstract: Akhani, H. & Mucina, L. *The Tamaricetea arceuthoidis*: *a new class for the continental riparian thickets of the Middle East, Central Asia and the subarid regions of the Lower Volga valley. Lazaroa 36: 61-66. (2015).*

The new class, the *Tamaricetea arceuthoidis*, is described covering riparian and intermittent shrubby vegetation of the Irano-Turanian Region in the SW and Central Asia and the Lower Volga valley. The dominating species are species of the genus *Tamarix* that refer high water table in arid and semi-arid habitats with high to moderate salinity. This new class is an ecological analogon of the *Nerio-Tamaricetea* occurring in the Mediterranean Basin.

Keywords: halophilous vegetation, Irano-Turanian Region, *Nerio-Tamaricetea,* nomenclature, *Populetea euphraticae*, riparian thickets, syntaxonomy, *Tamarix.*

Resumen: Akhani, H. & Mucina, L. *Tamaricetea arceuthoidis: una nueva clase para la vegetación arbustiva riparia continental de Oriente medio, Asia central y regiones subáridas del valle del bajo Volga. Lazaroa 36: 61-66. (2015).*

La nueva clase *Tamaricetea arceuthoidis* incluye todas las comunidades vegetales arbustivas riparia y de cauces intermitentes de la región Irano-Turaniana en el suroeste y centro de Asia y en el valle del bajo Volga. Las especies dominantes son del género *Tamarix* que colonizan ramblas en zonas áridas y semi-áridas con salinidad de alta a moderada. Esta nueva clase es un análogo ecológico de la *Nerio-Tamaricetea* de la cuenca Mediterránea.

Palabras clave: vegetación halófila, Región Irano-Turaniana, *Nerio-Tamaricetea*, nomenclatura, *Populetea euphraticae*, vegetación arbustiva riparia, sintaxonomía, *Tamarix*.

INTRODUCTION

Distribution and ecology of *Tamarix* thickets

Tamarix thickets are a typical vegetation feature of semi-arid (seasonally arid) and arid (desert-like) environments of Macaronesia, Southern Europe, North Africa, Middle East, Arabian Peninsula and Central Asia. They also occur in the semi-deserts of southern Africa (Mucina & *al.,* 2006) and as introduced plants they currently occupy large areas of riparian vegetation in the S and SW of N. America (Sher & Quigley, 2013).

In the Mediterranean Basin, the *Tamarix* species (typically together with *Nerium oleander* and *Vitex agnus-castus*) form riparian thickets on alluvia of intermittent rivers fed by winter and spring rains. These riparian thickets have been classified in the *Nerio-Tamaricetea* (Braun-Blanquet & de Bolòs, 1958) and become a subject of several syntaxonomic studies (e.g. Izco & *al.,* 1984, Fernández-González & *al.*, 1990, Asensi & Díez-Garretas, 2011) just to mention the most important ones. This class reaches as far east (and southeast) as Anatolia (Kamaömerioðlu, 2007) and the Levante (Eig,

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1946; Zohary, 1973). It also occurs in North Africa (e.g. Barbagallo & *al.,* 1990, Brullo & Furnari, 1994). The diagnostic species of this class include: *Tamarix africana, T. arborea, T. boveana, T. canariensis, T. dalmatica, T. gallica, T. hampeana, T. tetrandra, T. tetragyna, Nerium oleander* and *Vitex-agnus-castus.*

Further eastwards, towards the semi-arid regions of European Lower Volga and Ural River valleys, Central Asia, Middle East and the Arabian Peninsula, the *Tamarix* vegetation is quite common. Here the thickets dominated by *Tamarix* occupy different habitats from those known from the Mediterranean, the Balkans or the regions of the Ukrainian-Russian steppe zone. The *Tamarix* communities here fringe the intermittent and permanent river margins, estuaries and depressions in inundated plains, water runnels, wetlands margin and even on desert sand dunes with high underground water table; all these habitats show a notable levels of ambient salinity. They also may form phytogenic mounds (locally called 'nebka' both is sand dunes or around playas (inland saline intermittent lakes) (Maghsoudi & *al.,* 2012). The *Tamarix* communities occur in habitats with considerable water supply where the amount of water and its salinity change during the year (Akhani, 2004). Thanks to the unique salt excreting mechanism (Bosabalidis & Thomson, 1984) in *Tamarix* that allow them to adapt in such extreme and unstable environments. The excreting of salts by salt glands increases the ground salinity as a result of shedding of leaves and falling of excreted salt. The accumulation of which leads to an increase in surface salinity, eventually preventing germination of new plants in the absence of enough washing. Therefore the *Tamarix* communities are well adapted along rivers or depressions where there is fresh water flow at least in part of the annual life cycle. The salt glands do not only serve as machinery to remove extra salt from twigs, they also function as a hygroscopic solute to reduce duration of transpiration and finally proving an enriched environment for CO_2 (Waisel, 1991). These advantages help *Tamarix* shrubs with C_3 photosynthetic type to have fast growth under high temperature in desert environment.

There are ca. 65 species of *Tamarix* (cf. Baum, 1978; Qaiser, 1981) and many of them hybridize and/or form new hybrid swarms (Samadi & *al.,* 2013; Mayonde & *al.*, 2015; H. Akhani & T. Borsch, unpublished data). The genetic flow between the different species of *Tamarix* increases adaptability and genetic diversity of *Tamarix* species for successful occupation of new niches (Gaskin & Schaal, 2002). Vegetative reproduction and production of many seeds are additional advantages for *Tamarix* scrub to dominate suitable habitats. Diversity and species combination strongly depends on water supply, stability of habitat and salinity. In fresh and brackish water, *Tamarix* species associate with many non-halophilous and ruderal species. By increasing salinity, irregular interruption of water availability, decreasing altitude and higher temperature the associated species restricts to a number of highly tolerant halophytes which eventually may form poor scrub communities of only couple of *Tamarix* species. Other shrubby and small tree species may associate with *Tamarix* depending on surrounding vegetation types and geography. *Elaeagnus turcomanica* and *Halimodendron halodendron* co-occur with *Tamarix* communities in the European part of the class, Trans-Caucasus and sometimes even in northwestern edge of Iran. In the western Iran *Tamarix* associate with *Salix,* however as a consequence of drying of rivers, *Tamarix* would as a rule dominate.

In the center of the species diversity and the highest incidence of the occurrence of hybrids is found in Iranian playas and along rivers. *T. ramosissima* occurs mostly in higher altitudes or milder climates along fresh and brackish water river and wetlands. In NW of Iran *T. octandra*, *T. meyeri* and *T. ramosissima* are common. But in the central part *T. arceuthoides* s.l., *T. meyeri*, *T. kotschyi* and *T. androsowii* and in the southern part *T. mascatensis*, *T. kermanensis, T. kotschyi, T. meyeri* and *T. stricta* are common, the latter is a tree species and occurs in dry or moist valleys in SE Iran and adjacent Pakistan.

T. pycnocarpa (=*T. aucheriana*) is very common in the central and southern part of Iran and adjacent area in hypersaline moist habitats. Shrubby species include *Halostachys belangeriana*, *Caroxylon imbricatum*, *Salsola drummondii*, *S. rosmarinus*, *Suaeda fruticosa*, *S. physophora* and some *Lycium* species (*L. depressum*, *L. kopetdaghi*, *L. shawii*). In the warmer zone with high water table or permanent fresh water supply in most rivers running from Zagros Mountains and in the Mesopotamia *Populus euphratica* and *Nerium oleander* co-occur with *Tamarix* communities. The occurrence of *Nerium oleander* in SW Iran is in consensus with extension of the distribution of Mediterranean elements into western and southern Iran (Akhani & Deil, 2012).

The *Tamarix* thickets of the arid regions of the Central Asia and the Middle East (biogeographically falling within the Irano-Turanian Region, as defined by Zohary, 1973) have so far been largely syntaxonomically misunderstood and classified within the *Nerio-Tamaricetea* (typical for the Mediterranean Region). The works of M. Zohary and H. Akhani are notable exceptions as they have coined the terms *'Retamo-Tamaricetea fluviatila'*, '*Tamaricetea salina'* (Zohary, 1973) and '*Tamaricetea ramosissimae'* (Akhani, 2004).

Probably the first data-rich account of this vegetation from Central Asia is from the book by Bakhiev (1985) that used the Russian formation-approach to describe the vegetation unit. Bakhiev & *al.* (1994) later embraced the Braun-Blanquet approach and adopted the concepts of the Mediterranean order *Tamaricetalia* and *Nerio-Tamaricetea* (Braun-Blanquet & de Bolòs, 1958) and suggested 5 new alliances for the Amu Darya River valley (Central Asia). In the same year, Barmin & Golub (1995) published these alliances effectively. Crucial for the recognition of the *Tamaricetea arceuthoidis* as presented in our paper was the paper by Barmin (2001) who attempted to show (his synoptic Table 1) that the Eastern European and Central Asiatic *Tamarix*-dominated communities belong to the *Nerio-Tamaricetea*. In fact this synoptic table shows clearly that they have floristically hardly anything in common with the *Nerio-Tamaricetea*. Therefore we decided to rectify this situation and recognise those communities as a class in its own right.

DESCRIPTION OF NEW SYNTAXA

Tamaricetea arceuthoidis class. nov. hoc loco

Type: *Holotypus hoc loco: Tamaricetalia arceuthoidis* Akhani et Mucina 2015 (see below)
Synonyms: '*Retamo-Tamaricetea fluviatila'* Zohary 1973 (ICPN Arts. 2b, 8 & 34a); *Tamaricetea salina* Zohary 1973 (ICPN Arts. 2b, 8, 34a); *Tamaricetea ramosissimae* Akhani 2004 (ICPN Arts. 2b, 3b, 5 & 8)
Character taxa of the class: *Caroxylon imbricatum*, *Desmostachys bipinnata, Elaeagnos turcomanica, Nerium oleander* (in the Saharo-Sindian/Irano-Turanian Floristic Region), *Ochradenus aucheri* subsp. *rechingeri, Phragmites australis, P. karka, Prosopis koeltziana, Suaeda fruticosa, S. physophora, Tamarix aphylla, T. arceuthoides, T. aucheriana, T. dubia, T. hispida, T. kermanensis, T. kotschyi, T. mascatensis, T. ramosissima, T. rosea, T. stricta, Vitex pseudonegundo, Ziziphus spina-christi.*

The following grass and herb species can be considered as differential of the *Tamaricetea arceuthoidis* against the *Nerio-Tamaricetea*: *Aeluropus lagopoides, A. littoralis, Alhagi pseudalhagi, Calamagrostis dubia, Cynanchum acutum, Karelinia caspia, Suaeda arcuata*.

The new class (*Tamaricetea arceuthoidis*) comprises riparian scrub communities of saline and sub-saline alluvial habitats along mainly intermittent rivers of the Irano-Turanian Floristic Region (*sensu* Zohary, 1973) of the continental Central Asia and Middle East. Here it is confined to the semi-desert and desert vegetation zones. This vegetation type reaches eastwards as far as the deserts of Gobi (e.g. Kürschner, 2004; Liu Bing & *al.*, 2008) and Taklamakan (Thevs, 2005). Except for the significant exceptions of Zohary (1973) and

Akhani (2004), these communities has been treated as part of the *Nerio-Tamaricetea* Br.-Bl. et O. de Bolòs 1958, described for the Mediterranean Floristic Region and Macaronesia (e.g. Bakhiev & *al.*, 1994; Golub & *al.*, 1998; Barmin, 2001). However, as a re-analysis of these latter sources is showing, the *Nerio-Tamaricetea* and the new class – the *Tamaricetea arceuthoidis* floristically have hardly any significant group of species in common.

The *Tamarix ramosissima* communities described from the marginal steppe zone of the Eurosiberian Region (southern Russia, Ukraine and Moldova: Popescu & *al.*, 1984; Golub & *al.*, 1998; Chifu & *al.*, 2006) neither belong to the *Tamaricetea arcenthoidis*, nor to the *Nerio-Tamaricetea*, but are rather classified as part of the *Salicetea purpureae* Moor 1958 as an order in its own right – the *Tamaricetalia ramosissimae* Borza et Boşcaiu ex Dolţu et al. 1980). The Table 22 in Chifu & *al.* (2006: 403–413) supports this view very well.

Sometimes the vegetation classified here as the *Tamaricetea arceuthoidis* is considered as part of the *Populetea euphraticae* Zohary 1962 *nom. inval.* (e.g. Kürschner, 2004). The species typical of the *Tamaricetea arceuthoidis* are salt-tolerant and can survive changing of salinity over the year but *Populus euphratica* rarely occur in brackish water habitat or in places with high fresh water table or in riparian habitat.

The new class contains, at this stage, two orders – the *Tamaricetalia arceuthoidis* and the *Elaeagno turcomanicae-Tamaricetalia.*

Tamaricetalia arceuthoidis ordo nov. hoc loco

Type: *Holotypus hoc loco: Tamaricion arceuthoidis* Akhani et Mucina 2015 (see below)
Diagnostic species: identical with those of the *Tamaricion arceuthoidis* Akhani et Mucina 2015 (see below)

Tamaricion arceuthoidis all. nov. hoc loco

Type: *Holotypus hoc loco: Tamaricetum arceuthoidis* Léonard 1992
Diagnostic taxa: *Desmostachys bipinnata, Nerium oleander* (in Turcomanian Region), *Ochradenus aucheri* subsp. *rechingeri, Phragmites australis, P. karka, Prosopis koeltziana, Tamarix androssowii, T. aphylla, T. arceuthoides, T. dubia, T. kermanensis, T. kotschyi, T. mascatensis, T. meyeri, T. pycnocarpa, T. serotina, T. stricta, Vitex pseudonegundo, Ziziphus spina-christi.*

This alliance encompasses communities of the core distribution area of the class where salinity and strong continental climate are major environmental stresses for many other plant groups. These communities are composed of two main functional groups, typical for environments experiencing combined effect of prolonged drought and high salinity; (1) the C_4 halophytes occupying flat-terrain alluvia belonging mostly to Chenopodiaceae, and (2) the *Tamarix* shrubs occurring on the seasonally river margins, playa margins and the water runnels. *Tamarix arceuthoides* s.l. (including microspecies such as *T. mascatensis, T. karakalensis, T. aralensis*) and *T. androssowii* s.l. (including *T. litvinovii*) are very common. *Tamarix aucheriana* dominates on the hypersaline river and playa margins (see Alaei, 2001, Akhani, 2015 for more details).

We classify within the *Tamaricion arceuthoidis* the following validly described associations:
Tamaricetum arceuthoidis Léonard 1992
Tamaricetum aucherianae Léonard 1992

Elaeagno turcomanicae-Tamaricetalia ramosissimae ordo. nov. hoc loco

Type: *Agropyro fragilis-Tamaricion ramosissimae* Golub in Barmin 2001, *holotypus hoc loco* (see Barmin, 2011: 143)
Synonyms: *Tamaricetalia ramosissimae* Golub et Kuzmina in Kuzmina 1996 (ICPN Art. 1); *Tamaricetalia ramosissimae* Golub in Barmin 2001 (ICPN Arts. 2b, 5, 8 & 31)

This order has only one, validly described alliance – the *Agropyro fragilis-Tamaricion ramosissimae* Golub in Barmin 2001.

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