

ECOLOGY AND DISTRIBUTION OF THE GENUS *TAMARIX* L. (TAMARICALES: TAMARICACEAE) ON THE ISLAND OF GRAN CANARIA

By A.R. BARRY * & A. LUQUE *

With 1 plate

ABSTRACT. The genus *Tamarix* L. (Tamaricaceae) presents a complex taxonomy due to the polymorphic characteristics and that even the smallest morphological differences are used in its classification.

The aim of this work is to study the present distribution in Gran Canaria of the different species of the *Tamarix* L. in relation to the characteristics of their habitat (i.e. altitude, temperature, soil, humidity, etc.) and to investigate their ancient distribution to best aid the taxonomy of their species and know the abundance and the ecologic interest in appointment to their level of protection.

INTRODUCTION

The species

Currently, there are two recognized non-endemic species of the *Tamarix* LINNE, 1753, genus in the Canary Islands, *Tamarix canariensis* Willdenow, 1816, and *Tamarix africana* POIRET, 1789.

T. canariensis Willd. has been mentioned for all the islands, while *T. africana* Poir. is only found in Lanzarote, Fuerteventura, Gran Canaria and Tenerife (HANSEN & SUNDING, 1993). Both species have also been recorded as existing in the other islands of the Macaronesia. *T. canariensis* Willd. also grows on some of the Cape Verde Islands, *T. africana* Poir. in some of islands of the Azores and on the Madeira island only *Tamarix gallica* LINNE, 1753, is found (HANSEN & SUNDING, 1993). *T. gallica* L. is not found living on Madeira island because they are confounded with *T. canariensis* WILLD. (BAUM 1978), and *T. canariensis* WILLD. From Cape Verde islands is possibly confounded with *T. senegalensis* DE CONDOLLE, 1828.

* Grupo de Ecología Litoral. Departamento de Biología, Universidad de Las Palmas de Gran Canaria. 35017, Las Palmas, Islas Canarias, España

The world distribution of *T. canariensis* Willd. is also distributed to north Africa, south Spain, Corsica and Sardinia while *T. africana* Poir. it is in the same locations and also at the south France and Italy (BAUM, 1978).

On a systematic level, the wild Canarian species represent two Sections and two Series in the islands (BAUM, 1978).

Gen. *Tamarix* L.

Sec. *Tamarix*

Ser. *Leptostachyae* (Bge.) Baum

Sp. *T. canariensis* Willd.

Sec. *Oligadenia* (Ehremb.) Endl.

Ser. *Anisandrae* Bge.

Sp. *T. africana* Poir.

According to some authors (RIVAS CEMBELLIN et al., 1990), there are some specimens which are difficult to determine at a specific level as they possess intermediate characteristics between *T. gallica* L. and *T. canariensis* Willd., and which have for now been included as *Tamarix* grex *gallica*, without excluding the possible presence of *T. gallica* L., all to be subject to future investigations. We for now at present us will remit to the two recognized species.

Both species of *Tamarix* L. in the Canary Islands are protected under the Law of 20th February, 1991, on the "Protection of Species of Wild Vascular Flora" (BOC, nº 35, 18th March 1991). This fact has been the cause of controversy due to differing opinions about of their ecologic and environmental value on the part of the farmers and the scientific community respectively.

Therefore the principal objective of this study is to clarify the degree of interest that these species arouse by studying:

- The possible naturalization of the species.
- The degree of abundance of the species.
- Areas and ways of distribution.
- Determining factors influencing the distribution.
- Localization in protected areas.

Another specie found cultivated in gardens on the Gran Canaria island is *Tamarix ramosissima* Ledebour, 1829, (BAUM 1978) legitim name of *Tamarix pentandra* Pallas, 1788, mentioned by some authors as BRANWELL & BRANWELL, 1985.

This representation of the genus is thus sparse in the Canary Islands, since the total world number of species from the genus is fifty- four (BAUM, 1978).

Identification of the species

The different characteristics used in the determination of both species are very selected

due to the high incidence of polymorphy exhibited by individual specimens, with seasonal and sometimes local variations (OZENDA, 1983), and there may even be variations in the flower clusters in the same individual specimen.

One of the key characteristics for the identification of the taxons present in the islands is the presence or absence of a pinnacle on the anthers (RIVAS CEMPELLIN et al, 1990). While *T. canariensis* Willd. has the pinnacle, it is not present in *T. africana* Poir.

KUNKEL (1968) pointed out what the main differences are the colour of the cortex, the size of the racime and the kind of sepals and petals.

In general, the two species show very few morphological variations.

Antiquity in the Islands

Without doubt, at least one of the species of *Tamarix* L. has appeared in abundance and spontaneously in the lower areas of the Canarian Archipelago, or at least in the eastern islands, since it is reflected in many place names. Always, these names are referring to "tarajal" or "tarahal" since in this manner popularly known the *Tamarix* L. genus in the Canary islands.

The oldest records of this can be found in the "Le Canarien", written from the year 1404, in which the chronicle relates how in the area of Betancuria (Fuerteventura) "Gadifer de la Salle's men had constructed the tower of Valtarajal", a name which seems to refer to the "Tarajales Valley" (HERNANDEZ RUBIO, 1991).

We can find real evidence of ancient places with the presence of "tarajales" in the toponymy in old maps. TORRIANI (1590) places the beach or port of Taraalejo in the island of Fuerteventura. Furthermore, he presents us with a curious map representing the extreme south of Gran Canaria, from Arguineguín to Maspalomas, which shows groups of trees at the entrance of and along the course of both of these ravines; from their situation, they could be the predecessors of the small woods of "tarajales" which currently exist in these areas of Gran Canaria.

Later on, the existing cartography continues to indicate several similar examples, all of them situated along the east coast of Fuerteventura: Taratalo (SANSON, 1734) Tarajalejo and Gran Tarajal (MACHADO FIESCO, 1762), Gran Tarajalero (TRINIDAD DE HERRERA, 1786), with this type of toponymy continuing growing in number until the present day (LOPEZ, 1986 and TOUS, 1994, 1995).

In his "Diccionario de Historia Natural de las Islas Canarias", VIERA Y CLAVIJO (1869) states, "They are numerous in Canaria and Fuerteventura where due to the lack of mountain trees, not only the old inhabitants of Fuerteventura, but also the primitive settlers who came from Europe, made use of them".

According to CACERES & SALAS (1992) in "Nombres de Plantas Canarias", the word "tarahal" is arabic in origin and could have come directly from the north of Africa, where it is called "tara'al", or from the Spanish Mainland with the name "taray", which also comes from Arabic and has been consolidated as "tarahal" and "tarajal" in the islands.

A observation which stands out in their plants is the popular tendency of the farmers in the north to call them mostly by the name of “tarahal”, while “tarajal” seems more common in the south, and this fact coincides with the oldest place names of the islands and could be related to *T. canariensis* Willd. and *T. africana* Poir. respectively. Or it could merely open up possibilities about the semantic origin of the word which could in later investigations reflect the origin of these species.

Uses and exploitation

Apparently, the aborigines in Fuerteventura used to use “tarajal” wood in the building of their huts as beams superimposed on top of other stronger and sturdier wood. In the same way, the first settlers of the same island also used this wood for beams in their primitive houses (HERNANDEZ RUBIO, 1991).

Medicinally speaking, both species possess astringent properties. Its skin is appetizing and diuretic (VIERA Y CLAVIJO, 1869). It is a hepatic tonic, especially useful in cases of opilations and obstructions in the liver and spleen (JAEN, 1984). It is also effective against dropsy (PEREZ DE PAZ, 1988).

Its seeds or pips possess coloring substances which were used by the ancient dyers as black dye instead of oak apples (VIERA Y CLAVIJO, 1869).

Many *Tamarix* L. possess a sickly sweet substance which has come to be interpreted in many instances as the “manna” of the Jews described in the Bible (MOLDENKE, 1952, in BAUM, 1978). LEONCIO RODRIGUEZ (1942) said “in the Canary Islands the tarhais or tarajales distilled a gum as salt, white and beautiful”, since they possess glands in the leaves, rachis, bracts and calyx which secrete a sticky substance, causing the unpleasant feel they have to the touch and the impregnation in the soil as well as its salty nature. However, these nectar-like substances in the flowers are very appetizing for insects.

The lexivial salt which is extracted from the ashes of the “tarajal” is of the same type as the well-known salt called “glauber”, belonging to *Pentandra triginia* (VIERA Y CLAVIJO, 1869).

The “tarajal” is also very effective in the fixing of soil, due to its capacity for taking root in loose ground thus avoiding erosion. It has been used to fix land in the “sorribas” or remove of land carried out along the length and the sides of ravines, avoiding the eroding away of walls and land by rushing water down the ravines.

They have been planted since the beginning of the century along the edges of roads built by the Ministry of Public Works, due to their ground-fixing character, and later they were introduced as ornamental plants, serving in addition as wind-breaks.

A final use which is of great interest and which is fairly widespread so much inside as outside the islands is its use as wood for ribs in the building of small boats, due to its high resistance to salt (SANTOS, 1979).

Habitat of the species

Both species are halophytic plants which tolerate salt spray very well, absorbing it during the day in order to excrete it at night and especially at dawn in the form of dew, as confirmed by certain farmers in the north of the island of Gran Canaria. Several shepherds in the south of the island commented that when the "tarajales" weep at sunset during certain summer months (June-July) it is because we are going to have a rainy winter.

They can lead to the desalinization of the deeper layers of the soil and increase the salinity of the surface layers (BAUM, 1978). The soil's surface is covered every year by a litter or layer of discarded and saline twigs (BAUM, 1978).

The "tarajal" posed grand capacity for taking root in loose ground. They are very good for fixing soil in sandy, desert conditions and good for holding dunes in sandy, coastal areas as to The Maspalomas Dunes where they are spreading widely after an official protection policy came into force.

MATERIALS AND METHOD

The zone of study

Gran Canaria is an island situated approximately between 27° 44' and 28° 11' latitude North and 15° 22' and 15° 50' longitude West.

It is more or less conical in shape and has a maximum diameter of 48 km, reaching its maximum height above sea level of 1949 m in the central area (Pico de las Nieves). The surface area above sea level is 1532 km².

The island has been greatly excavated due to a dense arterial drainage network. A line which goes from the north-west (Agaete) to the south-east (Juan Grande) divides the island into two clear geological halves: the "Paleocanarian" south-west which is of a fundamentally sialic nature and the "Neocanarian" north-east, where the most recent volcanic material of the most basic composition appears on the surface (SANTANA & NARANJO, 1992).

The differences caused by the altitude and orientation make up a mountainous environment of marked contrasts. The altitude which the island reaches creates a facade effect with a slope which is directly exposed to the almost constant influence of the trade winds, called "Alisiocanaria", and another sheltered by it called "Xerocanaria". This dichotomy creates a marked contrast in the distribution of rainfall with a north-eastern half where the rainfall is greater than the annual average of 1,000 mm and the other southwestern half which hardly reaches 600 mm. On the other hand, we find the appearance of the "sea of clouds" produced by the thermal reversal of the trade wind frequently affected by an altitudinal ridge which goes from 600 m to 1500 m, situated between the ravines of Agaete and Telde, generating an additional contribution of water and an increase in relative humidity by means

of the phenomenon of “horizontal precipitation”. Consequently, we end up with a subhumid facade and a semiarid one.

The island has a population of 750,000 inhabitants spread among numerous population nuclei. The rest of the island’s surface is principally used for crops, which are found up to 300 m. with tomatoes, bananas, tobacco and garden vegetables out of season, irrigated crops and ornamental plants in greenhouses. Mediterranean dry crops can be found between 300 m. and 900 m. and above 900 m forest exploitation and livestock raising is carried out.

Cartography

The work plan consisted of drawing up maps of the units of vegetation on a scale of 1:25,000 using maps edited by the Army Geographical Service corresponding to different years (1976 to 1993). The UTM (Universal Transverse Mercator) coordinates of projection and the level curves for altitude were used as a starting point. The degree of abundance of the species in ravines was studied on quadrilled divided into square kilometers.

On drawing up the maps two types of graphs were made: on the one hand, graphs referring to the existing species in the ravines, which were then transferred to the map both the isolated ones and those found in communities, and on the other hand, graphs showing those situated outside the ravines (generally cultivated), only registering those communities with more than five individuals, discounting isolated species, unless they were large specimens, which were then also charted. Simultaneously, descriptions were recorded in a notebook of the plant landscape along with a floral inventory and other information of interest.

Once all the information had been compiled, it was reworked, specifying the limits, completing altitude data, highlighting the orientation, the situation of meanders and so on.

We have not taken into account oral statements in the drawing up of the map, but they have been of great help in the search for communities as well as for finding other information about the species.

Expeditions

The prior data which we had at our disposition for the localization of the species was the maximum height above sea level of 400 m. (KUNKEL, 1977), and the preference of the species for coastal areas and ravines. Therefore, we decided to make an exhaustive study of all the ravines by penetrating them from the coast up to 400 m., or on occasions more if we were able to observe some indication of a continuing of the species.

Daily expeditions were made during a period of three months using the hours of daylight to a maximum. Sometimes it was necessary to spend the night in those more remote areas which were key centers on the route, like for example Maspalomas (the south), Veneguera (south-west), Tejada (the basin and ravine of La Aldea) and Los Berrazales (the

north-west). The rest was carried out from the city of Las Palmas. The coastal zones which are inaccessible by land were reached by sea (Güi-Güi).

For the determination of the species we used a lens count-threads, observing the presence of the pinnacle on the anthers of *T. canariensis* WILLD.

RESULTS

The maximum limit of altitude found for the naturalized species of *T. canariensis* Willd. is 200 m, although the best specimens are found below that at an altitude of around 100 m. The occasional ascent found above this level in some ravines is related to forced plantations and in the same way the relatively abundant presence of his species towards the interior of the island is linked exclusively to plantations, generally on the edges of farms and roads. In low areas out of ravines they also were planted.

The maximum altitude found for the naturalized species of *T. africana* Poir. was observed to be around 350 m (basin of Tejeda and ravine of La Aldea), with possibilities of being found up to 400 m following the banks of the ravines as far as the reservoirs situated on these altitude levels. The optimum of this species is observed to be between 150 m and 250 m in altitude.

With regard to the ecological characteristics observed, we can say that the two species of *Tamarix* L. studied are highly conditioned by edafic factors, with a clear difference between *T. canariensis* Willd., which prefers loose, salines or sandy soil, especially that which is well turned over and impoverished, and *T. africana* Poir, which exclusively seeks detrital-sedimentary alluvial soil on the ravine banks and without too much salt.

Another decisive factor is temperature, although it has more influence in the general geographical distribution than in the local distribution, since we find *T. africana* Poir. towards the south and the west in semi-arid areas of high sunshine, unlike *T. canariensis* Willd. which is best localized in the north up to a height of 200 m or in the coastal regions of the south, but with a clear influence of the temperate zones.

A well-known important factor is the degree of resistance to salt, which is observed to be more marked in *T. canariensis* Willd than in *T. africana* Poir., with the former being found much more developed in estuary areas while the latter is rarely observed in these areas, since generally it is localized up the ravine banks.

The search for aquiferous zones is another important factor, but it is greatly conditioned by temperature and altitude. In this case, while *T. canariensis* Willd. prefers salt and residual water, settling in river beds, meanders, low-lying reservoirs etc., which have briny filtration, irrigation waters etc., *T. africana* Poir. seeks purer waters up the ravine, even getting as far as reservoirs at a higher altitude on an alluvial bank water table.

The distribution of *T. canariensis* is widely localized in many ravines on the north slope, and less in the south, not being found much from the ravine of Moya to the ravine of

Agaete (except in a small water-bed near Agaete), although it is observed planted in adjoining land. In the south and west it can be seen in ravines which were intensely cultivated like Maspalomas, Arguineguín, Mogán, La Aldea, El Risco, etc., but only in estuary areas or near them, being widespread in the protected area of the Nature Reserve of the Dunes of Maspalomas. One must think that *T. canariensis* Willd. seems to have an invading character and can turn out to be harmful or disturbing for other plants in the area, as it competes for their habitats and above all it can cause impoverishing of springs and reserves of water.

T. africana Poir., is localized exclusively in the south and west of the island, in alluvial soil on the banks of ravines like Fataga, Chamoriscán, Ayagaures, Arguineguín, Mogán, La Aldea (as far as the basin of Tejada), El Risco (below Tirma) and Guayedra, strictly following the banks,. This species, apart from the natural determining factors of its situation, seems to be situated in those ravines where there were aboriginal settlements.

The most natural appearance of the communities of “tarajales” seems to be found on the banks of ravines following the course of the water near drains, irrigation channels, wells or reservoirs etc. but with a low altitude.

The spontaneous distribution of the species offers clear differences between both. *T. africana* Poir. does not seem to offer any doubt to its natural manner, and can be defined as a native species. *T. canariensis* Willd., however, shows very natural features in areas around the mouths of ravines, but it offers large doubts in the rest. The coastal areas like the Nature Reserve of the Maspalomas Dunes, the ravines of Veneguera and El Risco, the beach of La Aldea etc, according to the data compiled from the area in relation to the existing crops there seem to point to their introduction by man, although rather long ago. Undoubtedly, the Nature Reserve of “Las Dunas de Maspalomas” offers an ecosystem of great beauty which deserves its name, and it may perhaps be the site of the natural introduction of the species, but we must not forget the plantations which existed on the hill of the “Morro de Maspalomas”, the “Campo de Golf” and “Campo International” zones, etc.

In the north, the most spontaneous species of *T. canariensis* WILLD. are located in the ravines of Tenoya, El Cardón, Pagador, Cabo Verde etc, but like the rest, they are situated near the crops and appear as large communities lined up in chain formation, bordering the banana plants along the ravine bank, which scarcely leaves any doubt to their anthropic origins.

This non-spontaneous appearance is very heightened in *T. canariensis* Willd. which also seems to have more of an invading nature than *T. africana* Poir, which appears to be wilder and less abundant.

One must detach that *T. canariensis* Willd. is the invading character with a good cutting reproduction, like by power to aid to confirm the before sketch. On the other hand, many ravines have a total absence of both species, although they still have crop plantations nearby on their edges, a fact which could be attributed to the volcanic nature of the soil, to the non-anthropogenic action of the area and the considerable impoverishing of many of them.

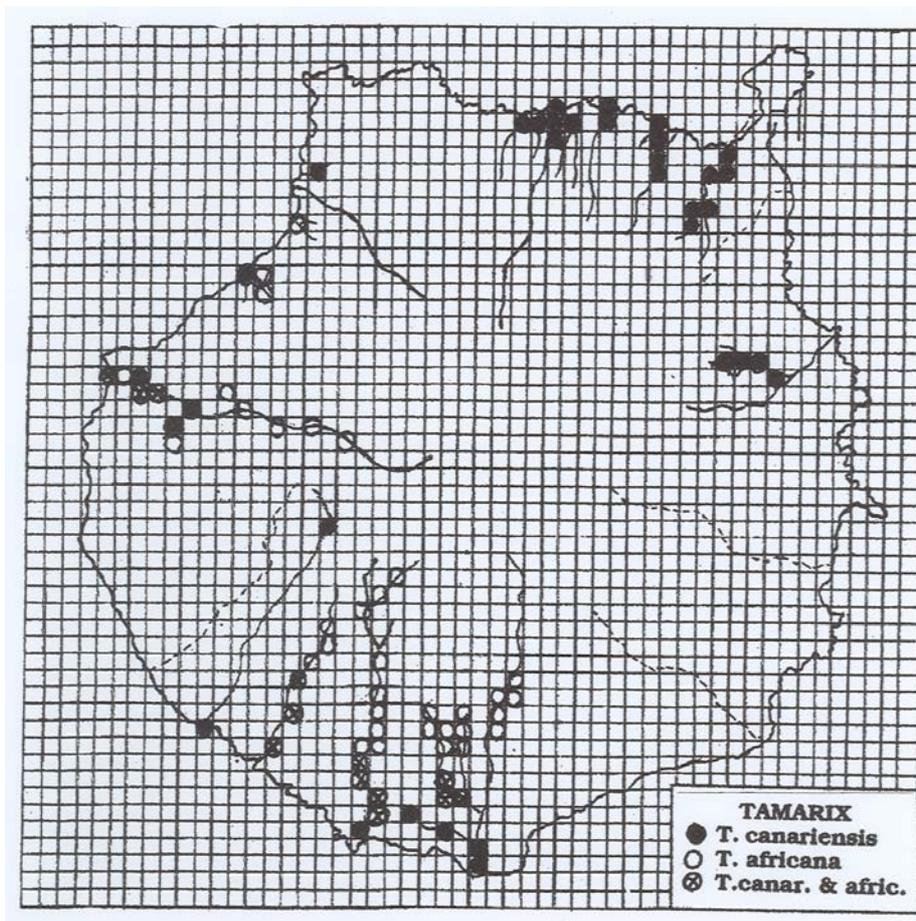
The naturalization of *T. canariensis* Willd. in the ravines seems to be relatively

recent, since it shows itself to be strongly linked to the presence of crop plantations, where there are species planted along the edges or to fix ground remove of "sorribas" on the sides and banks of ravines so they are not swept away. Possibly *T. canariensis* Willd. brought about as a result of old, destroyed "tarajales" (CEBALLOS & ORTUÑO, 1976). This is not the case with *T. africana* Poir., which is more localized and less widespread, and which could be the real "tarajal" of the guanche aborigines.

So much as we have previously mentioned, the naturalization of the species may not be only due to introductions but to re-introductions of our own species which try to recover the ground that was snatched away from them.

The species *T. ramossima* Ledeb. which is found in some gardens and farm vegetable gardens does not seem to grow wild, at least in the areas under study. This latter species together with the possible group *Tamarix grex gallica* is pending future investigation.

Distribution of the naturalized species of *Tamarix* L. genus in Gran Canaria island



* The symbols of the two species, and both together, have been represented over square of 1 km².

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