*Javier López Martínez-Fortún, Carlos Machado Carvajal and Eliecer Pérez Robaina*

# *Sonchus leptacaulis*: A New Species Settlement in Gran Canaria

*In March of 1998, an unknown plant was discovered in Gran Canaria (Canary Islands – Spain). During the academic year 1999-2000, the authors discovered two populations between 20 and 40 specimens, each one with similar characteristics, and started to compare them with the existing bibliography. In the bibliographical study the terminology used by Boulos (1974), Aldridge (1976) and Bramwell (2002) is clarified. Three herbariums were checked searching for similar plants.*

*For four years, all floral aspects of the new species were analyzed, and two DNA analyzes were carried out in the Royal Botanic Garden of Madrid, as well as a short study of the pollen. The seed fertility of some specimens was checked twice (in the years 2001 and 2004). The genus assigned is Sonchus, confirmed by the DNA sequences. The proposed name is Sonchus leptacaulis.*

*As a result of all the preformed measures, a possible origin of both populations is proposed, as well as the characteristics of the new species, leaving the scientist community to study it. The origin of both populations could be a determinate hybridization and stabilization of that hybridization which made fertile hybrids and kept up the morphological aspects of the new species.*

*The new species is located only in two places of Gran Canaria, which should demand a special protection by competent authority. An analysis of speciation mechanisms is also recommended because it could explain a usual apparition of new species in the Island.*

*Javier López Martínez-Fortún*

*Carlos Machado Carvajal*

*Eliecer Pérez Robaina*

*Coordinator: José Luis Barba Gutiérrez*

*Institution: Colegio Garoé. Las Palmas de Gran Canaria. España*

## Introduction

In the academic year 1999-2000, during the course of a trip done by some partners of our school, a strange population of plants was discovered in Fataga (Gran Canaria) by coincidence. It was studied by a group of students for one year. Due to the quality of their work, the XIII Young Researchers Congress granted them a 15-day-stay in a Spanish investigation centre (CSIC), which facilitated the DNA sequence and the compilation of the whole existing bibliography from *Sonchus* gender until 2001 and many references of other authors. Then, they decided to give up working so they let us carry on with the investigation.

## Objetives

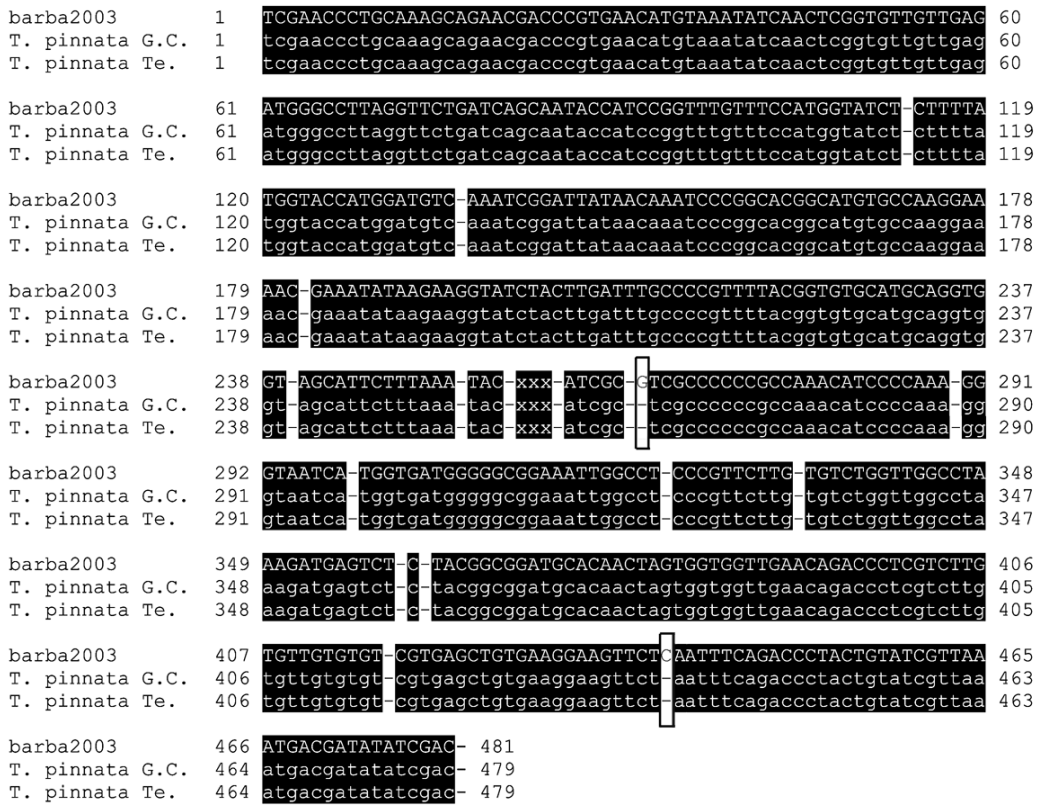
Our group tried out a first hypothesis to certify that it was not an already discovered species which had germinated for human negligence or had been moved by some animal to a different place from the original one. To confirm this, we had to analyze all the existent bibliographical quotations to look for places where other or similar species to ours had been discovered. The authors that had studied the gender with more detail were: Boulos (1974), Aldridge (1976), Kunkel (1980) and Bramwell (2002). We also analysed any current reference of the gender *Sonchus* in the Canaries and in the Macaronesic region (Pitard, 1909; Cabrera Pérez, 1999; Santos, 1983), in the north of Africa (Museo Real de Africa Central, 1985) and in the South of Spain (Vables, B *et al*; 1987). The references that appeared in different articles were gathered and studied. At the present time, we have photocopies of all those articles in the Garoé School.

As a consequence of the bibliographical study, we reached the conclusion that no resemblance existed between our strange discovered species and the ones mentioned in the important articles, not even in the ones that have been discovered recently (Reifenberger Ursula and Adam, 1966). As we were confirming this hypotheses, new ones were elaborated: Would the new specimens found belong to a new species? Were we at the beginning of a specific differentiation proccess?

We intended to answer those questions. If they turned out to be true, we had to propose an origin mechanism, to analyze thoroughly the opposing specimens, to track down the populations and to propose a new species with a new name.

## Researching progress

In the years 1996 and 1999, Kim and their team carried out a genetic analysis of the gender and related species (Kim *et al*, 1996). The previous group brought the sequence of a ribosomal gene from one of our specimens from Madrid. This gene is sequenced for many species, it is of public domain and is easily accessible in the Gen-Banks web page. As Kim had sequenced all *Sonchus* species to carry out the phylogenetical tree, we decided, on the one hand, to request the articles he had published, which he sent to us by e-mail, and, on the other hand, to request a second sequence of our specimens from the Royal Botanic Garden of Madrid. Approximately three months later we got both things. The sequences of the ITS enzymatic meaning showed us the evolutionary mutations, which are necessary to propose differentiation mechanisms and genetic distances among the diverse species (Kim *et al*, 1996 and 1999).



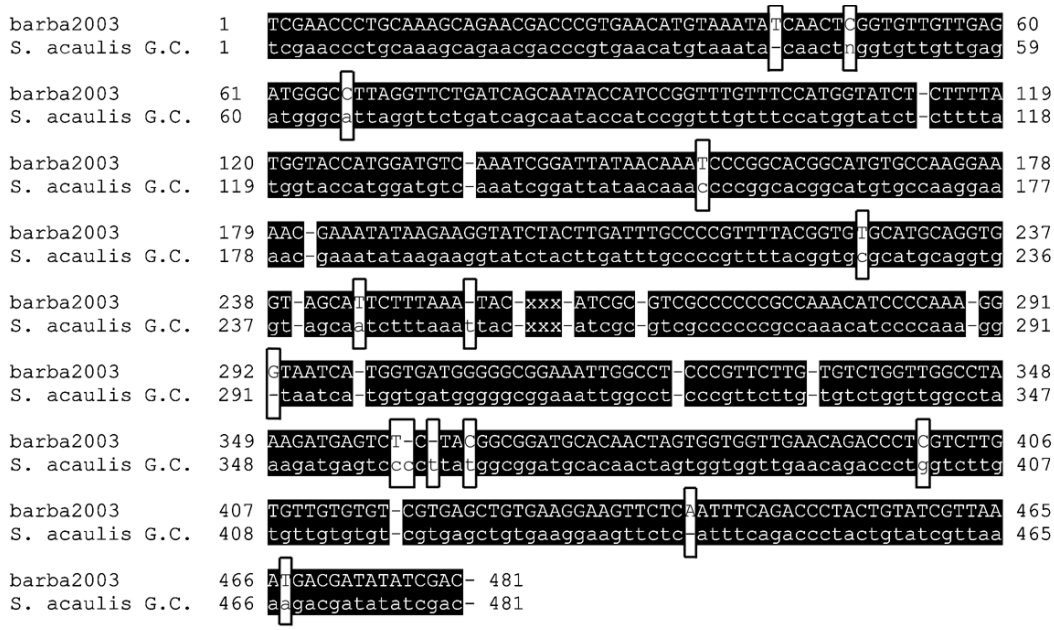

*Barba2003*, *Taekholmia pinnata* Gran Canaria TAKITS1A and *T. pinnata* Tenerife TAKITS1B

During the summer of 2003, we compared them using the Bioedit (a freeware software) that enables the comparisons of sequences. All the sequences are compared in our essay but only the most interesting ones are shown here. It is necessary to say that two different species can only differ in one or a pair of nucleotides. Our species differs from *S. leptocephalus (Taekholmia pinnata)* in two nucleotides. The name of the last sequence of our species is "*Barba2003"* because it is our teacher's surname.

In this triple comparison, we can observe that "*Barba2003*" has two more nucleotides than the other two sequences, but the guanine of the 264 nucleotide exists in the other 18 sequences of the 31 in which we were working and they all have cytosine in the 439 nucleotide except *T. pinnata* and *T. pinnata microcarpa*.

It is odd that *S. acaulis* from Tenerife has fewer different nucleotides than *S. acaulis* from Gran Canaria.

We were lucky since in the year 2003 the listing of existent species was published by the Database of Biodiversity of Canarias (Botanical Department from the University of La Laguna, 2001). No reference is made about our species, neither in that listing nor in the Red Book of Threatened




*Barba2003* and *S. acaulis* Gran Canaria SOKITS1P

Species, published one year before. This listing coincides basically with the one done by Sommerfeltia (1993) which was sent to us by Per Sunding from Oslo.

We also had the possibility to compare our plants with the dried plants collection of the Herbarium of Gran Canaria, as well as with those that are in the Royal Botanic Garden of Madrid and in the herbarium of Arid Zone Centre of Almeria. This analysis was very important because in some occasions we found bibliographical appointments about dried specimens that were not classified. We proceeded to look for both current terms and old synonymies (*Atalantus, Taeckholmia, Babckockia*, etc). The only references found were two preserved specimens, not well conserved, gathered by Sventenius (n. ref: 14812-1972; List of herbarium Jardín Viera y Calvijo, 2001) in Viera Clavijo Herbarium in Gran Canaria. Both were proposed as a hybrid between *S. platylepis* and *S. leptocephalus*. The specimens did not present either seed or flowers. The area where Sventenius found those plants was examined several times during three years, not finding any trace of similar plants. We have thought that, in case of belonging to our species, the origin proposed by Sventenius should be corrected.

To be able to determine whether this is an already existent species, we proceeded to work in two ways. The first one was to carry out a chart where all the floral data picked up by the more involved authors in the study were presented (Bramwell, 2001; Kunkel, 1972, 1973, 1974, 1977, 1978, 1991; Aldridge, 1976, 1976, 1978, 1979; Boulos, 1968, 1974, 1996).

During this work, we took the widest intervals. If an author granted the seed size between 2 and 2.8 mm and another author between 1.8 and 2.5 mm, we chose the interval between 1.8 and 2.8 mm. With this, a more reduced chart was built to facilitate the comparison of different species.

The second purpose of the work was to get our own measures. Because of that, during three years we got samples of the different floral elements of the plant and measured them in the laboratory, and at the same time we described them. We also carried out a study about the cypselas of our species and other similar ones: *S. congestus, S. leptocephalus, S. canariensis* and *S. acaulis*. We thought that it would be interesting to compare the seeds that could be connected with our species.

We believe that it could be very interesting to describe the different characteristics of the *Sonchus* gender in the Canaries before making the comparison of the data. Although Bramwell has correctly collected all the species into only one genus, the different authors since Boulos have understood that there were two subgenus, *Sonchus* and *Taeckholmia*. One difference between the two was the shrubby character and the number of flowers by capitulum. The mixture of characteristics is high, but according to Kim the origin is unique (Kim *et al*, 1996). Shrubby character appears in evolutionary processes where the climate is dry and the isolation is clear, as on our island. The flowers of *Taeckholmia* are all together for lower apex giving the capitula a triangular shape, but the other species present a basement in the capitulum where the different flowers lean, giving the capitulum a plane shape in its base.

The conclusions were obvious.

Although it is not easy to determine it with data, the general outlook it presents is very different from the aspects of other species because of the character of the pendant leaves and the property of being shrubby with a rarely branched stem. The leaves are big and terminal and give a large aspect to the specimens.

The leaves of our species present a considerable size at the appropriate conditions. Only *S. acaulis* has that length. But the leaves of *S. acaulis* are lobulated or pinnatalobulated whereas our specimen always presents pinnatisect ones. The extremes of the lobes in our specie are between 12 or 13. This looks like *S. leptocephalus* but the broad of the lobes is much bigger (the lobes of *S. leptocephalus* do not reach 5 mm and our lobes have several cm). The other species never exceed 4 or 5 cm of length. Moreover, the lobes present a direction through the apex of the leaf, a detail which is not present in any of the similar species of *Sonchus*. That direction of the lobes is also in *S. leptocephalus*. For this reason, we considered it to be a detail inherited from this specie.

Another detail that we used for classification is the presence of prickly appendixes and hair in the edge of the leaves. The size and the number is variable, although it has not been studied carefully. Any of the old *Taeckhomia* presents it, and this is a characteristic of *S. acaulis* and *S. congestus* but the flowers and the leaves are different. Moreover, it has two hair lines that our species doesn't have.

We were surprised because the plant preserved the leaves of the latest years, a characteristic which is very evident in *S. acaulis*.

The other characteristic that is very different is the floral system is a very distinctive number of flowers in each capitulum. The flower belongs to the genus *Taeckholmia* (the old genus) with the flowers grouped by the lower apex to the capitulum, which is different from the old genus *Sonchus*, to which *S. acaulis belongs*, that presents a horizontal basement where the flowers are. But the number of flowers of *Taeckholmia* is smaller than the number of our species. This number is a feature inherited from *S. acaulis*. *S. leptocephalus* doesn't have more than 20 flowers, whereas our capitula have around 100. It could be very similar to *S. canariensis*, as we thought at the beginning. When we compared the sizes of the cypselas, the sizes of the leaves, the lobes and the shape of ramify, we discovered that the hypothesis in which we have been working during 5 or 6 months wasn't correct. We even got seeds of all specimens from Andén Verde, Moya, Valleseco, Caldera de los Marteles and from the specimens cultivated in the Canary Garden of Viera y Clavijo. A curious detail is that in *S. leptocephalus* the flowers appear before the new leaves, which does not happen in our specie.

We thought that the number of flowers took us to *S. ustulatus* or *S. pinnatus*, but the size of the seeds, the pollen and the leaves were very different from our plant. Moreover there is no specimen in the vicinity of our populations.

We think that it could be a good idea to analyse all details to see the similarity between the species. It is logical that, if there was a common genetic origin, we should find that characteristic. When we studied the DNA we checked if it could be related to *S. leptocephalus*, although mysteriously the nucleotides that are different are common to those in *S. acaulis*. This detail might mean an exchange of information between the chromosomes of those genes. If it were a hybridizing, we thought that the analysis of DNA would only appear in the sequence of one of the two species. The presence of these nucleotides means later changes in the hybridizing of the genes of the chromosomes from *S. acaulis*.

The data of our species and the data of the DNA led us to the conclusion that we had found specimens with their own characteristics, and after that we decided to complete the study in other lines of work.

One of them was to carry out a map about the distribution of the specimens of the zone and a location of all specimens of the area. We found specimens each time farther from the first specimen that was found in 1999. We also found a second population in Inagua (on the West side of Fataga).

To get the data correctly we thought of making a classification of the plants and to enumerate them in a map of the area, because it would help the study. We had to make it twice because the first time we didn't use an effective method. When we analysed the zone, we discovered that the specie needs specific climatic conditions. We observed that the specimens lived in dry zones and in the shade. This could be because of the high temperatures, but not because of the sunstroke. In one of the populations the shade is given by the pines (*Pinus canariensis*), and in the other by the isolated almond tree and by *Chamaecitysus proliferus*.

We thought that it could be very useful to locate other species. The coincidences in the areas of the two populations certified the need of specific climatic conditions. Some species are: *Lavandula canariensis, Chamaecytisus poliferus, Asparagus* sp., *Cistus monspeliensis, Prunus* sp., *Kleinia neirifolia, Asphodelus microcarpus, Pinus canarienesis, Echium onosmifolium, Lobularia* sp., *micromeria benthami, Descurainia preauxiana, Euphorbia Regis-jubae*, etc. We also found *S. leptocephalus* and *S. acaulis*. Only in one case we found a specimen of *S. platylepis* quite far of the population.

We needed to know if our specimens were just a result of a hybridizing process or if they were really a new species. To be sure, we checked seed fertility. In January 2001 and in December 2003 plantations were done in Petri disk close to seeds of similar species. We got an 80% germination of the whole group. Our seeds showed a sawed edge at the beginning, but this feature was less clear as they grew up. It is possible that this feature is inherited from *Sonchus acaulis*.

We had to confirm that the new plants had similar characteristics. We took a young specimen to the school where it was observed for two years. In fact, we tried to get an auto-pollinated specimen but we did not choose a very good method: we covered flowers with plastic bags, which did not allow air to go out or in and the flowers got dried. We counted and measured all details of the specimens that were in the school and which were collected in the field.

During last year we were lucky. Julia Pérez de Paz, Head of Researching Centre of Viera y Clavijo Garden of Las Palmas de Gran Canaria, let us make a pollen analysis using EBM. In summer of 2003 we learnt some palinology concepts. At the end of 2003 we took some photos with EMB. The photos we got were of *Sonchus leptocephalus*, *Sonchus*

*acaulis* and the new species. We noticed that some details were specific for our plant and others were a mixture between *Sonchus acaulis* and *Sonchus leptocephalus*. This experience was very enjoyable.

## Conclusions

Every data we gathered in this article shows that our specimens belongs to a new species that has not been described yet. We have discovered two populations in Gran Canaria of a new endemic plant. Its relationship to *Sonchus leptocephalus* and *Sonchus acaulis* seems to be very clear. We have proposed *Sonchus leptacaulis* as its name. We thought its origin could be a hybridization between those two species and some later mutations which made the new species more stable. This is obvious because if it was just an hybridization DNA should be the same as the parental DNA without any variations. Besides, the phenological features are very different.

These process are very common in nature, some of them in the Canary Islands are described (Pérez de Paz, 1976), and they have produced many species in our planet. Nowadays we are looking at new species stabilization. We have two populations with at least 30 individuals, each one breeding out new specimens.

We were lucky for discovering a new species. We have asked ourselves during the whole time why nobody had found it. The two populations are very small and maybe the process is very new.

Finally we want to encourage local authorities to establish some kind of law to protect those areas. One of the populations is in a kind of Environmental protection due to the presence of an endemic bird of Gran Canaria. The other one is more sensitive. It is surrounded by agriculture area, although very hidden. It is possible that it will be eliminated by humans if we do not protect it as quickly as possible.

It could be a very good idea to make a genetic analysis of the whole population. If the results are compared, they can help us understand that type of evolutionary process. It will be necessary to store seeds to preserve this new species. This study could contribute to the comprehension of evolutionary processes in oceanic islands.

Before describing our species *S. leptacaulis* we would like to thank every one who helped us. First of all, José Luis Barba, as our coordinator; Manolo Rodríguez, as the one who discovered a first specimen; Julia Pérez de Paz, head of Viera y Clavijo Research Centre, who taught us and allowed us to obtain some photographs from pollen grains; Javier Fuertes, for getting DNA sequences; Garoé School, our school, because it enabled us to use the things we needed in these years of work and many relatives who have helped us to translate some articles, encouraged us to go on till

the end, and finally, Miguel Angel López, Miguel Francés and David Vega who started this researching job five years ago and let us continue and believed in us. They thought we would not be able to reach the end.

## *Sonchus leptacaulis*. Description

**Summary**. The species is located in the south of the island, a bit far away from sea, in sunny areas.

**Introduction**. This species has not been published, as we have not found any quotations in specific bibliography. Although Sventenius previously discovered it in the "Caldera de los Marteles", he did not begin the study of the plant because he did not find flowers or more specimens.

**Description of the plant**. It is a woody shrub of between 50 and 100 cm height. Its trunk has between 1.5 and 6 cm in diameter. Its aspect is dense due to its hanging leaves, mainly when they are old. The first ramification does not take place until they reach at least 30 cm from the level of the ground. The number of leaves is abundant and they stay throughout the year. Sometimes previous year leaves can be found underneath the new ones if precipitations were not abundant.

The shoot of new leaves slowly begins in the month of October, with the possibility of being accelerated by precipitations to adopt the adult aspect before complimenting.

The leaves arrange in terminal rosettes at the top of the stem. The ramifications are little, they usually present one or few plumes. Their leaves are between 20 and 60 cm long and from 10 to 20 cm wide. Leaf colour is sensitive to insulation degree. Leaves, almost pinnatisect, have up to 12 pairs of lobes of between 5 to 12 cm length and from 0.3 to 1.8 cm wide, finishing in a terminal lobe in the end. The direction of these lobes is towards the apex of the leaf.

Peduncles are between 3.5 and 6 cm long and 0.2 cm wide. The section is cylindrical, and it grows as it approaches the capitulum. This transition takes place slowly. The capitula form is conical at the beginning. In the middle of them there is a narrowing at the first external row of bracts.

There are different levels of bracts. The following levels were found, with a total of between 44 and 26 bracts. The measures between the bracts are not taxonomically useful because of the existence of similar intervals in *Sonchus* genus, and therefore they present just an orienting character.

- External bracts: 12 to 15 with measures 4-7 × 1-1.8 mm. They have so large minor and they are in the outside of the flower. They also have an intermediate a pointed and triangular form.
- Intermediate bracts: 11 to 15 and has a rounder and extended form and they are transparent with respect to the external ones. With a measurement of between 10-13 × 1.5-2 mm length.

– Internal bracts: 13 to 15. These bracts are more near the capitula and measure 16-18 × 2-2.5 mm They are longer and more transparent than others.

The size of the capitula is between 0.25 and 1 cm wide and 2.2 cm long. It has between 63 and 127 flowers by chapter, its diameter oscillates between 0.6 and 1 cm. Inflorescences have from 53 to 90 capitula in a branching way as *Sonchus leptacephalus*.

Achenes are in the base of the corolla, and pappus is present. Achene is between dark brown and black colour. Its appendix is truncated. Achenes are from 2.5 to 3 mm long and 0.75 to 1.2 mm wide. They present longitudinal grooves as in the whole genus. Grains of pollen have a diameter of 21.48-30 m without counting the crests.

Flowering time of *Sonchus leptacaulis* is from December to February.

**Ecology**. Surroundings plants are usually: *Sonchus acaulis, Sonchus leptocephalus, Lavandula canariensis (*lavanda*), Chamaecytisus poliferus (*Escobón*), Asparagus* sp., *Cistus monspeliensis (*Jara*), Prunus* sp. *(*almendros*), Kleinia neirifolia (*verode*), Asphodelus microcarpus (*gamona*), Pinus canariensis (pinos canarios), Echium onosmifolium (*tajinaste negro*), Lobularia* sp., *Micromeria benthami (*tomillo*), Descurainia preauxiana* and *Euphorbia regis-jubae* (tabaiba).

**Taxonomy**. There are two large populations: Fataga and Inagua. They have around 30 specimens of different ages. *Sonchus leptacaulis* has been proposed as the name as its origin may be a hybridization between *S. leptocephalus* and *S. acaulis*.

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