Phoenix in the Cape Verde Islands

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1. *Phoenix* at Algodeiro, Sal; one of Chevalier's syntype localities for *Phoenix atlantica*. This female specimen had more than ten mature stems and reached a height of over 20 m. Sally Henderson provides scale.

The taxonomic status of *Phoenix atlantica* A. Chev., the elusive date palm of the Cape Verde Islands, has been in doubt for some time. In 2002, field work was carried out on the islands as a first step towards unravelling the mystery of the Cape Verde date palm (Fig. 1).

The African Republic of Cape Verde consists of nine inhabited and several uninhabited volcanic islands set out in the Atlantic Ocean, about 500 km off the most westerly point of the African mainland and 1500 km south of the Canary Islands (Fig. 2). Most are rugged and mountainous; three (Sal, Maio, and Boavista) are flat, desert islands with sand beaches. Precipitation is meagre and very erratic; indeed Cape Verde can be seen as an island extension of the arid Sahel zone.

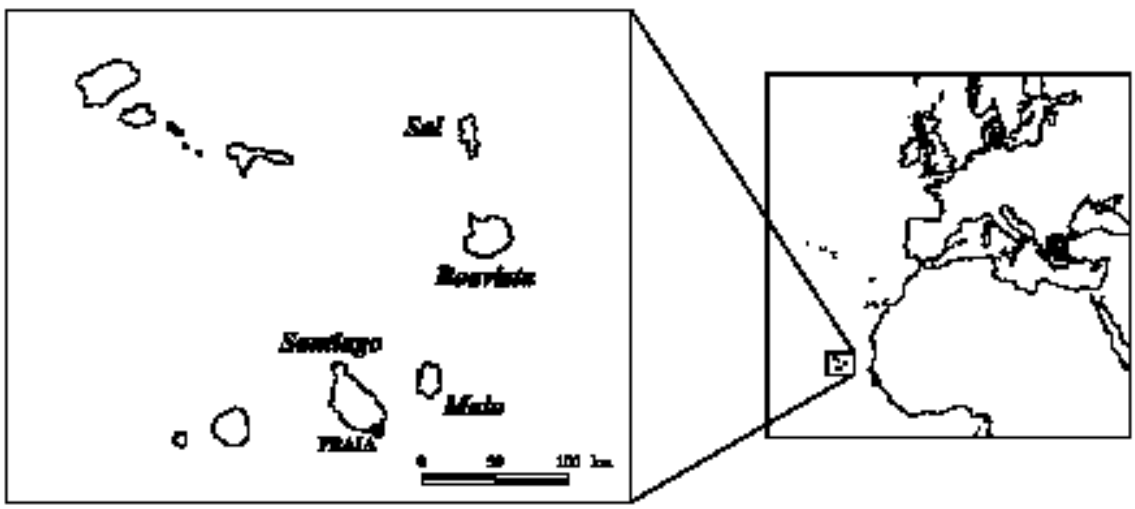
Three species of the genus *Phoenix* are recorded from the Cape Verde Islands, *P. dactylifera* L., *P. canariensis* Chabaud and *P. atlantica* A. Chev. While the former two species have almost certainly been introduced by man, the latter is said to be endemic to the islands. Perhaps because the Cape Verdes are a particularly isolated set of islands or because palms are notoriously awkward to collect, little is known about the taxonomy, origins and natural history of this species.

Phoenix atlantica was described by the French botanist Auguste Chevalier (1935a) following field exploration in the Cape Verdes in 1934 (Chevalier 1934: 1153). Chevalier provided limited diagnostic characters, defining the species as a clustering palm with 2–6 trunks, 5–15 m in height with dark green leaves 2–3 m in length. He considered it to be most similar in form to *P. dactylifera* and *P. canariensis*, possessing characters of both (Chevalier 1935a). Chevalier's description indicates that *Phoenix atlantica* can be distinguished easily from *P. canariensis* by its clustering growth form (*P. canariensis* always has a single, stout trunk) and its shorter, straighter leaves. However, the differences between *P. atlantica* and *P. dactylifera* appear much more subtle. For example, while *P. dactylifera* is usually observed as single-stemmed, when left undisturbed for a number of years it becomes clustering like the Cape Verde *Phoenix*, so this character on its own is unreliable. Further alleged distinctions include acuminate (*P. atlantica*) versus rounded (*P. dactylifera*) petals in the male flowers (Chevalier 1935a, b, Greuter 1967: 249, and Brochmann et al. 1997), fruit 2 cm long (*P. atlantica*) versus fruit more than 2.5 cm long (*P. dactylifera*) (Brochmann et al. 1997), leaves green (*P. atlantica*) versus leaves glaucous (*P. dactylifera*).

The somewhat ambiguous characters defined by Chevalier have raised suspicions that *Phoenix atlantica* is not a distinct species. Barrow (1998), in her monograph of *Phoenix*, suggested that it could be a feral form of the date palm (*P. dactylifera*) or a product of hybridisation and introgression between *P. dactylifera* and *P. canariensis*. However, she was unable to resolve the question because the material available to her was inadequate. The problem is intensified by a lack of knowledge of the full extent of morphological variation in *P. dactylifera*. Fortunately, genetic variation in *Phoenix* is being investigated more fully at CIRAD (Centre de Coopération Internationale en Recherche Agronomique pour le Développement) and IRD (Institut de Recherche pour le Développement) in Montpellier (see also, for example, Trifi, Rhouma & Marrakchi [2000] and references therein), providing an alternative basis for making comparisons with the Cape Verdean *Phoenix*.

With this in mind, a collaborative project was set up between The Natural History Museum, London and Instituto Nacional de Investigaçao e

2. Cape Verde Islands (named islands were visited by the authors).



Desenvolvimento Agrário (INIDA), Santiago, with the aim of clarifying the taxonomy of *Phoenix atlantica* using morphological and molecular tools. The initial phase of the project entailed collection of primary data – leaf material for DNA extraction, herbarium specimens, photographs and ecological notes. After consulting literature and herbarium specimens for collecting localities and flowering times, we arranged a field trip for May 2002. The four most easterly islands of Sal, Boavista, Maio and Santiago were visited.

The Islands

Santiago

> "The neighbourhood of Porto Praya, viewed from the sea, wears a desolate aspect. The volcanic fires of a past age, and the scorching heat of a tropical sun, have in most places rendered the soil unfit for vegetation. A single green leaf can scarcely be discovered over wide tracts of the lava plains; yet flocks of goats, together with a few cows, contrive to exist."
>
> Charles Darwin (1845)

Charles Darwin's first vision of Santiago in 1832 rings only too true today. The island's capital, Praia, has an undeniably West African feel – lively markets flanked by roadside kitchens selling rice and bean stew for breakfast, sweet sellers on the roadsides and shops in doorways.

Outside the city, heading up to the hills one travels through barren and desolate land dotted with planted *Prosopis juliflora* (Fabaceae) and the ubiquitous *Calotropis procera* (Asclepiadaceae). Near São Jorge dos Orgaõs the higher elevations bring somewhat lusher vegetation and a more tranquil atmosphere. Here, small numbers of *Phoenix* line the valleys next to settlements, suggestive of their being planted, but they are many-stemmed and at least superficially like *P. atlantica*.

Field work on Santiago centred around the area from which Chevalier's syntypes of *Phoenix atlantica* were collected, "around Praia and São Martinho, near to the shore, at the edge of the valleys..." (Chevalier 1935b, translation) to the south of the island. The sites visited by us (from west to east) were: Ribeira Grande, São Martinho (Pequeno and Grande), Praia Baixo and São Francisco.

Passing through Cidade Velha, where the 16th century ruins of the old capital of Santiago are found, we reached Ribeira Grande, a deep, lush valley brimming with mango trees, coconuts and date palms. Here, we observed numerous cultivated *Phoenix* including a striking individual, with large plumose, glossy leaves and bright orange leaf bases. Around São Martinho, the palms are mainly found in two spectacular, barren, dry river valleys (ribeiras) known as São Martinho Pequeno and São Martinho Grande. A handful of apparently untended *Phoenix* stand proud against the landscape of rock and dust (Figs. 3–5). The vast *Phoenix* populations at São Francisco extend from a dense, managed grove into a population with a more natural appearance on the shore. There is a striking morphological difference between the inland and the coastal palms; moving away from the tall, archetypal palms inland onto the dunes and the beach, we encountered remarkable stunted individuals, many-stemmed and with short, glaucous leaves (Front Cover). These palms are undoubtedly exposed to sea spray and some of those growing closest to the shore may even experience salt water at their roots at high tides. Whether or not they were originally natural, the *Phoenix* groves at Praia Baixo, as at Ribeira Grande, are now quite obviously managed with some clearly cultivated *Phoenix* seedlings, signs of irrigation, burning of *Prosopis* and further plantings of coconuts and mangoes reinforcing our convictions that these are agricultural systems, not natural populations. In São Francisco and Ribeira São Martinho, however, the distinction was far less obvious.

In Santiago began what we discovered to be extremely dusty work, often made less appealing by rubbish left under the palms; in these relatively populated areas the palm groves provide welcome shade for people and their livestock. *Phoenix* is important to the Cape Verdeans in other ways; leaves may be cut and used (sometimes sold) by villagers as thatch, fencing or fodder for livestock. At some localities (e.g. Praia Baixo) the fruit is apparently eaten by the locals while at others the fruit is fit only for the goats. The best fruit is said to be traded throughout the islands.

Brief respite from fieldwork was provided in Ribeira Grande in the form of locally produced *grogue*, a spirit made from sugar cane (grown in the fertile valleys). *Grogue* is figuratively and literally a way of life to many; not only is it an extremely popular drink on the islands, but it is also produced on a small-scale by many farmers. Oxen or mules are used to drive the *trapiche*, the machine which squashes the sugar cane. It is said that the pressing of the cane, with its steady rhythm, has been a strong source of inspiration for the famous Cape Verde music, although the *grogue* itself has probably proved to be equally stimulating! The hoteliers on the islands must have been surprised at our morning orders for

3 (top). Ribeira São Martinho Grande looking south, one of Chevalier's syntype localities for *Phoenix atlantica,* Santiago. A very similar photograph, taken by Chevalier in 1935 (looking north), indicates that little has changed since then in terms of landscape and vegetation (see Fig. 5). 4 (bottom). *Phoenix* in Ribeira Sao Martinho Grande, Santiago. This clustering male specimen had at least seven mature stems, which reached ca. 9 m.

5 (above). Chevalier's photograph of Ribeira São Martinho Grande in 1935 (1935b, pl. IX b) (looking north) The palms in this photo are still living and can be seen in Figs. 3 and 4. 6 (below, left). Moribund *Phoenix* plants growing next to the planted *Prosopis juliflora*, Sal Rei, Boavista. 7 (below, right). *Borassus aethiopum*, planted in front of *Phoenix* in a smallholding at Forte Vicente, Boavista. The fence is constructed from *Phoenix* leaves.

local *grogue* from the bar, but in fact we had found an alternative use for it – for preserving *Phoenix* flowers.

All our herbarium material was prepared using the Schweinfurth method, which involves pressing the specimens between newspaper before drenching them in 70% alcohol and sealing them in robust plastic bags. At the end of our fieldwork on Santiago, and indeed on the other islands, the bundles were packed in boxes and posted back to the UK. Palm specimens can take a long time to dry out, even using proper herbarium drying facilities, and if the material is not processed properly, the fruit, flowers and leaves will rot. Where drying facilities are not available, preservation in alcohol maintains the quality of the plant material until further processing can take place back in the herbarium. The processed collections have now been deposited in the herbaria at INIDA, The Natural History Museum, London and the Royal Botanic Gardens, Kew.

Maio

Our flight from Santiago to Maio lasted ten minutes, hardly worth the one and a half hour check-in time! We were met and given a warm welcome by Augusto Alves from the local office of the Ministério de Agricultura e Peixes (Ministry of Agriculture and Fisheries). Augusto drove us into Vila do Maio, the sleepy main town, flanked by a stunning beach of the whitest sand and the most turquoise of seas. Here, young boys played among the brightly painted fishing boats, crowding round to help the fishermen as they came onto shore with their catch. On the street above the beach sat two or three traders with trays of sweets or selling dark lumps of fresh tuna. Women came and went from the town's well, a place of great socialising, balancing buckets of water on their heads.

So we embarked on a tour of the island in the Ministry's 4WD vehicle. The flatter parts of the island's interior have been completely afforested with *Prosopis juliflora*, creating the biggest *Prosopis* plantation in the Cape Verde Islands. Plagues of locusts of near-biblical proportions occur in the plantation, although, according to Augusto, the infestation is not problematic. The new woodland is immensely important, although the success of the afforestation programme comes at a cost as *Prosopis* is notoriously water-greedy. The plantation was developed primarily to provide fodder to livestock in the highly degraded landscape. In addition, the timber from *Prosopis* is made into charcoal by the locals for use in cooking and is also sold to other islands.

On the dunes at Morrinho, we spotted our first example of date palms on Maio. Here, a handful of *Phoenix* grow in the blistering white sand dunes, impressive in their stature and isolation, accompanied by an occasional *Tamarix* bush and creeping *Cyperus maritimus*. The dunes are bordered on one side by Praia de Santana, a stunning, but desolate beach, and on the other by the salinãs (saltpans) of Terras Salgadas. The saltpan at Morrinho is one of the few relatively undisturbed ecosystems left on the Cape Verdes and is therefore under protection. The vegetation consists of an expanse of salt-tolerant plants such as *Arthrocnemum glaucum* (Chenopodiaceae), *Zygophyllum fontanesii*, the Cape Verde endemic *Asparagus squarrosus* (dead but recognisable) and the leafless, spiny *Launaea melanostigma*, resembling chicken-wire. Birds abound in the saltpan and on the adjacent savanna-like plains; zebra finches chirp en masse in *Prosopis* scrub and guinea-fowl scuttle around in great flocks.

At the village of Pedro Vaz, to the east of the island, we came across a large and ancient grove of *Phoenix*. The palms were majestic, despite some being so old they had lost their crowns. There was no sign of any *Phoenix* seedlings or juveniles here, an indication that the population is not regenerating, hardly surprising as the pressure from goat grazing is intense. One of the most striking palms at this site possessed around 15 stems and reached around 30 m in height, suggesting that it might be very old indeed. After making some collections, we drove through the village of Alcatraz towards Monte Penoso, a mountain, which, at 436 m, dominates the otherwise flat landscape. Monte Penoso is an eroded volcano that is green in the rainy season, hard to believe when the landscape appeared so infinitely barren at the time of our visit.

At Lagoa, to the south of the island, we clambered down the sides of the cultivated and relatively lush ribeira to sample a number of clustering *Phoenix*. Scattered everywhere were rocks encrusted with Gastropod fossils, evidence that Maio, while primarily volcanic, also has sedimentary uplifts. Our search for *Phoenix* continued along the coast by Praia da Lagoa, where we were presented with yet more stretches of sparkling seas and shimmering sands. This walk was not to be blessed with *Phoenix* discoveries, but we did make some other, serendipitous finds; a mass of bifurcating, hollow, stony tubes poking out of the dunes – later identified as fossil carbonate casts of tree roots – and remnants of a hammerhead shark, sea turtles and whales strewn around the high tide mark.

Boavista

We were greeted at the airport by an array of staff from the local Agricultural Ministry, two of whom, Sonia Ramos Barros and Mario Spencer, accompanied us on our fieldwork. Boavista is composed largely of immense dunes stretching endlessly along the coast and inland. As our Twin-Otter came in to land, we were treated with an astonishing early morning view of the epic white sand dunes at Praia de Chave. Most striking of all though was the glimpse of vast numbers of date palms extending throughout great inland dunes beyond Chave. Around Sal Rei, thousands of *Phoenix* form what appears to be a dynamic population of even age structure, with adults, juveniles and even seedlings popping up spontaneously. We realised that we had our work cut out here – a daunting prospect! In some areas, we noticed many moribund *Phoenix* plants growing near to *Prosopis* (Fig. 6), presumably because the latter competes more effectively for water.

Mario drove us south to the pretty village of Rabil where we collected yet more *Phoenix* from what appeared to be a plantation, and then off-road into the Sahara-like interior of the island (Fig. 8). The *Phoenix* "populations" in the desert oases have also been actively managed, sometimes growing with planted coconuts or tamarind trees. They also appear more static than those around Sal Rei and, as on the other islands, are composed of mature individuals only. We visited a small farm adjacent to a *Phoenix* grove where a deep well provided enough water for vegetables to be grown. On the edge of the smallholding, a few magnificent specimens of *Borassus aethiopum* (Fig. 7) were found. The farmer could tell us nothing of the origins of these undoubtedly ancient palms.

The monotony of the barren landscape was broken at intervals by hidden treasures – a remote beach near Praia Santa Monica covered in crab-prints and bordered by yet more *Phoenix*, the abandoned village of Curral Velho, where bread ovens sat ruined and old cooking pots and limpet shells lay scattered about the long-forgotten houses, the cracked salt crust of the salinãs at Curral Velho with date palms towering on high coastal dunes behind and frigate birds at Praia do Curral Velho (the only known breeding site on the eastern Atlantic being the tiny islet found off this beach). Beyond this, the rocky moonscape continued unabated, with blinding sun and sand-blast.

Sal

Sal is drab from the air and doesn't improve much on the ground. It has all the desolation, but few of the charms of the other islands. The land is entirely uncultivated; even the goats are few in number. It is the oldest, most eroded and most barren of all the islands. William Dampier, in 1683, arriving on the isle of Sal from Virginia wrote:

> "the land is very barren, producing no Tree that I could see, but some small shrubby Bushes by the Seaside. Nor could I discern any Grass, yet there are some poor Goats on it….There are no more than 5 or 6 Men on this Island of Sall [sic], and a poor Governor…who came aboard our Boat, and gave about 3 or 4 Goats for a Present to our Captain, telling him that they were the best that the Island afforded."
>
> William Dampier (1698)

Today, Sal's main source of income is from tourism, centred on the small town of Santa Maria. The seeds of tourism were sown in the 1960s when the first small guest house was built in Santa Maria by the six mile beach. Today, Santa Maria is a depressing contrast to the other places in which we had stayed, the streets lined with restaurants and shops pandering to European tastes, but the essence of Cape Verde culture still remains. Stray only a few metres from the tourist route at night, to the backstreets of Santa Maria, and the place becomes alive with countless hairdressers, tucked-away bars and grocers, and local people thronging the streets.

Sal may not be the most attractive of the islands visited, but it is critical in terms of *Phoenix*; two of Chevalier's *P. atlantica* syntype localities are found here. The palms are neither as numerous as in Boavista nor as majestic as in Maio. At the first syntype locality, Algodeiro, we collected in the small, dense grove (Fig. 1) adjacent to a beach with a remarkable salt-and-pepper blend of white shell sand and black volcanic dust. The second syntype locality, Palmeira, allegedly named for its abundance of palms, merely boasted a single stand in the middle of a run-down suburb of the town.

One of Chevalier's specimens from Sal (26 June 1934, *Chevalier s.n.*, P!) is annotated with the locality "Pedro Lime" – the most similar place-name today is Pedra de Lume, found about halfway up the eastern coastline. An exploration of the area for *Phoenix* proved fruitless, indeed we could see nowhere that even appeared to offer suitable habitat, but the trip was fascinating for other reasons. High above the village of Pedra de Lume is a salt lake inside the mouth of a long-extinct volcano from which salt has been extracted for many centuries. The architecture of the village serves as a reminder that this sleepy settlement was once a hive of industry; the terraced houses are

8. A clustering adult *Phoenix* growing in the interior of Boavista. Other individuals established in the dry stream-beds, can be seen in the background. *Tamarix canariensis* grows the foreground.

more reminiscent of 19th century industrial Britain than of anything we had seen so far on the other islands. The salinãs themselves are set within the adjacent crater, reached by a tunnel carved through the crater wall. The tunnel is found by following the cables and wooden pylons of the old tramway that was used at the peak of the production to transport salt from the crater to the port at the village. Today, one passes through the mountain to the salinãs to find a surprisingly silent and beautiful place, with regularly-spaced rectangular ponds of pink, blue and white. The rusting machinery and rotting buildings remain, the pulleys and tram-carts still visible, as if the whole industry was stopped short and abandoned suddenly before the end of a day's work.

Here in the salinãs we saw seven black-winged stilts, elegant, but absurd-looking birds which appear to have the body of a gull and the legs of a flamingo, and look altogether out of proportion. The redundant saltpans of Pedra de Lume are of great environmental importance as Sal is the only island in the Cape Verdes where these birds breed. Flamingos were also once prevalent here; Dampier wrote about flamingos on Sal's salinãs in 1698, saying "Their tongues are large, having a large Knob of Fat at the Root, which is an excellent Bit, a Dish of Flamingos' Tongues being fit for a Prince's Table." The bird of which he writes is the Rosy Flamingo which is now extinct on the islands; their demise was probably encouraged by Dampier's party shooting 14 of them in one go.

We explored the eastern coast of Sal by 4WD from Pedra de Lume, returning to the main road near Santa Maria. Finding yet more startlingly white sand dunes and wind-blasted beaches, we failed completely to locate any more *Phoenix* populations. A quest for another of Chevalier's sites on Sal, "Palha Verde," (*Chevalier 45840*, 1934, P!) also proved difficult, as it was not evident on any of the maps. After consulting a man selling salt crystals at Pedra de Lume we drove to Fontona, an old settlement in a dry ribeira just north of Palmeira, where we did indeed find a grove of around 200 *Phoenix* interspersed with a few coconut palms and *Terminalia catappa*. Again, nearly all the *Phoenix* palms were clustering adults. Towards the centre of the island, we identified a "new" locality for *Phoenix* (Fig. 9), where around seven individuals grew in a dry ribeira. At Fenjaol, we relocated another grove of around 150 *Phoenix* in a ribeira of blown sand and one of only two sites where naturally-established seedlings were observed. Perhaps the blown sand that covers the seed here and in the population at Sal Rei on Boavista encourages germination by protecting the seed from dessication?

Discussion and Conclusions

We observed some very striking populations of *Phoenix* in the Cape Verde Islands, but through the course of the field trip we began to appreciate how little the palms differed, if at all, from *P. dactylifera*. What is intriguing about Chevalier's

observations is that he was able to distinguish between *Phoenix atlantica* and *P. dactylifera* in the field. Furthermore, of the islands we visited, he recorded *P. dactylifera* from Santiago alone, from a palm grove near Praia (Chevalier 1935a, b), suggesting that all other palms that we saw would have been *P. atlantica* in Chevalier's eyes. Not only this, in addition to "pure" *P. dactylifera* and *P. atlantica*, he was able to identify hybrids of the two near Praia in Santiago (Chevalier 1935a, b). There is no indication as to how he determined these; certainly he made specimens neither of the putative hybrids nor of *P. dactylifera*. We were unable to distinguish the two species, let alone a hybrid.

Throughout the trip, we considered the distinguishing features specified by Chevalier and subsequent authors discussed above. Nearly all the date palms that we saw were multiple-stemmed, but this is a weak character, given that *P. dactylifera* is inclined to cluster if unmanaged. None of the *Phoenix* sampled bore fruit and therefore it was impossible to evaluate fruit characters, though anecodotal evidence suggests that Cape Verde *Phoenix* fruit is small, pink (to red) and often inedible. However, as *P. dactylifera* cultivars display a vast range of fruit in terms of colour, size, sweetness and shape (see for example Rhouma 1994), the distinction in fruit size outlined by Brochmann et al. (1997) is probably too simplistic. Any difference in leaf colour is also observed with difficulty; it even seems to vary within the same individual (the wax coating on leaves may vary with age). However, the new collections will make possible a more thorough investigation of the comparative leaf and floral morphologies in the herbarium.

Whilst all species of *Phoenix* intercross freely (Wrigley 1995), the suggestion that Cape Verde *Phoenix* may be a hybrid between *P. dactylifera* and *P. canariensis* (Barrow 1998) now seems unlikely. Chevalier (1935b) noted that *Phoenix canariensis* was occasionally planted on Cape Verde and recorded it from the island of Sao Vicente, to the west of the islands we visited. Despite our best efforts we failed to find this species on Maio, Boavista, Sal or Santiago; perhaps it is cultivated on some of the wetter islands to the west.

Until the taxonomy is resolved, the conservation status of this palm cannot be assessed; for this very reason, *Phoenix atlantica* was omitted from the most recent Cape Verde Red List (Leyens & Lobin 1996). This study is further complicated by the claim that the species has been said to exist further afield. Chevalier (1952) and Kunkel and Kunkel (1974) reported it from the Canaries and Madeira (but see also Morici 1998) and Chevalier (1952) described it from Senegal and Morocco (see also Munier 1973: 20). In the same paper, Chevalier also described *P. atlantica* var. *maroccana* A. Chev.

9. A number of clustering *Phoenix* specimens growing in a dry ribeira next to an abandoned settlement north of Murdeira, Sal. Most *Phoenix* populations in the Cape Verdes are found in close proximity to settlements; did the settlements grow up around the naturally occurring palms, or were the palms planted by the villagers?

which Barrow (1998) placed in synonymy with *P. dactylifera*. These records are not particularly important in solving the taxonomic conundrum of *Phoenix* in Cape Verde, but they do suggest that a detailed, broad-scale assessment of the morphological and genetic variation in *P. dactylifera* and its relatives across their range is long overdue.

The need for a clarification of the taxonomy and conservation status of *Phoenix atlantica* is obvious. Potentially, it is one of only two endemic tree species in the Cape Verde Islands and one of only four palm species native to Europe and Macaronesia. However, whether or not the Cape Verde *Phoenix* proves to be distinct from the date palm *P. dactylifera*, our observations suggest that it is of prime importance to the people of the islands in terms of providing shade, food for livestock and materials for building shelters. It also provides welcome relief for the eyes in an otherwise highly degraded and seemingly endless, barren landscape.

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