Introduction of a Multipurpose Palm, Phoenix pusilla, in Kuwait

C. SUDHERSAN Biotechnology Department, Food Resources and Marine Sciences Division, Kuwait Institute for Scientific Research, P.O. Box 24885 Safat 13109, Kuwait schellan@safat.kisr.edu.kw



1. Two-year old male palm of *Phoenix pusilla* Gaertn. with inflorescence.

Dwarf date palm (*Phoenix pusilla*) has been successfully introduced in Kuwait through seeds collected in India. These palms are well adapted to the climatic conditions of Kuwait. Growth and development is normal, and flowering and fruiting occurs from February to August. Studies confirm the feasibility of utilization of this species for food, fuel, medicinal, landscape beautification and ornamental purposes. Phoenix pusilla Gaertn., a multipurpose palm species closely related to the date palm, is commonly known as the small date palm in India, as it only grows to 100 cm tall (Barrow 1998). It is a beautiful and shrubby suckering palm with a very short stem enveloped in persistent leaf sheaths. A crown of about 15-17 leaves is produced every year. Just like the true date palm, P. dactylifera, it is dioecious (Gosh et al. 1987), producing male and female flowers on separate trees. It grows wild in dry areas in India at low elevations (Gamble 1967). Its flowering season starts in November and runs through January. Clusters of edible orange-red fruits turn into black drupes in the months of July and August (Mayuranathan 1994). Propagation of this species is only through seeds. In its natural habitat, this palm produces a mat of fibrous roots that anchors the palm firmly to the substratum, and a crown of leaves that touches the soil surface. In undisturbed areas in southern India, several areas often show pure stands of this palm that protect the soil from erosion. At one time in India, this beautiful palm occupied vast areas of scrub jungle. Recently, its natural habitat has been disturbed due to its overexploitation as a fuel for lime kilns and its tender shoots as food and leaves for brooms. This palm, along with some other species

2. Female palm (two years old) with parthinocarpic fruit.



such as *Phoenix loureiroi, Bentinckia condapanna,* and *Borassus flabellifer* have been destroyed by broom industries, lime kilns and brick kilns (Padmanabhan & Sudhersan 1988, Davis 1985) and are facing the threat of extinction.

Phoenix pusilla is a low shrub growing to 100 cm tall. The stems are clothed completely with persistent leaf bases. The leaves are pinnate, 65–140 cm long; the leaflets are linear, fascicled, more or less in four ranks, rigid, and shining with an orange-red pulvinus at the junction with the rachis. The lower leaflets are transformed into stout, flat spines that are 5–7 cm in length. Male and female inflorescences develop from the axils of the leaves in separate palms. Each inflorescence is covered by a coriaceous protective sheath called a prophyll. The flowers are unisexual and trimerous. The male flower has a cupular calyx, three valvately arranged petals and six stamens. The female flower has three carpels, each containing one ovule and sessile stigmas. The fruit is 20–22 mm long, oblong, terete and fleshy. It is initially green, red at maturity, and ripening black. The seeds are oblong and ventrally grooved (Gamble 1967).

The pulp of the fruit is fleshy, sweet and mealy. The tender part of the palm is often eaten by the poorer people as a meal called *kanji*. The leaflets are woven into mats and the split petioles into baskets. Brooms were also made out of the leaves of this palm. Its fruit is used in herbal medicines, as it is sweet, sour, cooling and laxative, cardiotonic, aphrodisiac, carminative and roborant. The fruit is also used for hyperdipsia, burning sensation, fevers, consumption, cardiac debility, seminal weakness, gasteropathy and general debility (Varier 1995).

While travelling from Kanyakumari to Chennai in India in the month of July 2000, the author found a few small palms growing wild along the roadside in between the Madurai and Trichy areas. Most of the palms had bunches of fruit at the ripening stage and produced a sight along the roadside. Due to curiosity and an interest in palms, the author collected a bunch of fruit and a leaf for identification. The small palm was latter identified as *Phoenix pusilla* Gaertn.

In order to conserve and study the possible utilization of this multipurpose palm species in landscape beautification and soil conservation, the author collected seeds and brought them to Kuwait. A few seeds (50) from the collection were brought to the Biotechnology Department of the Kuwait Institute for Scientific Research (KISR) in Kuwait in the year 2000. The seeds were washed in a soap solution, and the clean seeds were soaked



3. Female palm with normal green fruit.

4. Female palm showing ripening fruit.

for 24 hours in freshwater. Of the 50 water-soaked seeds, 40 were planted in 10 cm diameter plastic pots containing sand and peat moss mixed at a 1:1 ratio, and 10 seeds were planted in sterile culture media. The cultures were maintained in a temperature- and light-controlled growth room. These seed cultures were used for studies of seed germination, seedling growth and development. The 40 pots were irrigated with fresh water while being maintained in the temperature-controlled greenhouse. After two weeks, 100% of the seeds germinated into seedlings. The seedlings were maintained in the same pots for three months

and then carefully transferred to 15×15 cmdiameter pots without damaging the root system. During the germination, half of the cotyledon protruded out through the dorsal side of the seed opposite to the groove. The protruding cotyledon elongated 2.5–3 cm and formed a cotyledonary tube containing a radicle and plumule at its basal end. The other part of the cotyledon which remained inside the seed, developed into a haustorium that digested and absorbed the nutrients from the endosperm and supplied them to the growth point through the cotyledonary sheath. After the full growth of the cotyledonary tube, the radicle entered the soil, and the cotyledonary tube swelled. Thus, the seed germination was hypogeal and remote (Tomlinson 1961, Biradar & Mahabale 1969). After the complete growth of the cotyledonary tube and the establishment of the primary root system, the first sheathing leaf emerged through a crack in the cotyledonary tube. This scale leaf enclosed the first green leaf (eophyll). The eophyll was simple, lanceolate and with an acute apex. About six such simple leaves developed prior to the development of the first pinnately compound leaf.

All 40 seedlings were maintained in the greenhouse until they produced compound leaves.

They were planted in the open field at a spacing of 2×2 m in September 2001. Freshwater was used to irrigate the palms daily until field establishment. After the new leaf development in the field, the palms were irrigated once every 3 days during the summer months and once every 2 weeks in the winter months. Fertilizer, NPK 20:20:20, was added uniformly to all of the palms once a month regularly at a rate of 25 g/palm.

All of the palms planted in the field survived, and tolerated the cool winter (4–10°C) and hot summer (46–48°C) temperature conditions in Kuwait. Initially, it was difficult to identify the male and female palms from one another. During the second



5. A bunch of ripening fruit.

6. Isolated ripening fruit.



7. Blackcolored, fully ripened fruit.

8. Seeds of *Phoenix pusilla*.

year of field growth, most of the palms started producing inflorescences. Approximately 60% of the palms were males, and the remaining 40% were females. All of the newly introduced young palms were uniform in size, and flowering occurred from February to April. Male inflorescence (Fig. 1) was about 25–30 cm long and produced a large quantity of pollen grains. Female plants showed two types of fruit: one parthenocarpic, red in color (Fig. 2) and the other normal green in color (Fig. 3). At the maturity stage, the green-colored fruits turned red (Figs. 4–6) gradually from the upper end, to the lower end and finally, at the ripened (Fig. 7) stage, fruits were black in color. The ripened fruits were sweet and edible. The seed was surrounded by a thin membrane. The seeds (Fig. 8) were smaller in size than those of the date palm, but similar in shape. Each seed had a furrow at one side, with the embryo embedded within the endosperm marked

by a depression at the middle region opposite to the furrow.

The vegetative growth of this palm species during the past 3 years showed that they can tolerate low temperatures of 4°C to high temperatures of 48°C. They have the ability to grow on open desert land as well as in coastal regions. The very short clustering stem with a crown of leaves touching the soil surface could be used for the protection of soil from erosion.

Both male and female *Phoenix pusilla* palms were successfully introduced and established on the Kuwait Institute for Scientific Research (KISR) campus in Kuwait. The fruits were small, edible and attracted birds during the fruiting season. The growth and appearance of the beautiful multipurpose palm species will attract people due to its ornamental, medicinal and soil conservation usefulness. Since there is no offshoot production, tissue culture is the only way to produce a large number of both male and female dwarf date palms in a limited time. Experiments conducted by the author showed that the pollen from this palm can be used for pollinating date palms and vice versa (Sudhersan et al. 2003).

Since there are no reports or detailed studies about this species, the author has showed great interest in its propagation and conservation. Studies are also in progress on using this species for date palm crop improvement programs, landscape beautification and ornamental purposes in Kuwait.

Acknowledgments

The author gratefully acknowledges the support and encouragement provided by the management of the Kuwait Institute for Scientific Research (KISR) during the course of this study. This paper is KISR No. 6946.

LITERATURE CITED

- BARROW, S. 1998. A monograph of *Phoenix* L. (Palmae: Coryphoideae). Kew Bull. 53: 513–575.
- BIRADAR, N.V. AND T. S. MAHABALE. 1969. Studies on palms: Fruits, seeds, and seed germination in the genus *Phoenix* L. Proc. Indian Academy of Sciences 70: 55–65.
- DAVIS, T.A. 1985. Palmyra palm, the state tree of Tamil Nadu is on the verge of extinction: Save this very useful tree. Environmental Awareness 8: 95–106.
- GAMBLE, J.S. 1967. Flora of the presidency of Madras, 2nd reprinted edition. Botanical Survey of India, Calcutta, Vol.3: 1084–1094.
- GOSH, S.S., S.K. DE AND T.A. DAVIS. 1987. Morphology of juvenile palms of four species of *Phoenix*. Date Palm Jour. 5: 19–35.
- MAYURANATHAN, P.V. 1994. The flowering plants of Madras City and its immediate neighbourhood. Revised by C. Livingstone and A. N. Henry, Bulletin of the Madras Government Museum, New Series, Natural History Sec. Vol. 10. Madras.
- PADMANABHAN, D. AND C. SUDHERSAN. 1988. Mass destruction of *Phoenix lourerii* in South India. Principes 32: 118–123.
- SUDHERSAN, C., M. ABOEL-NIL AND K. JIBI MANUEL. 2003. Seedless date fruits through pollination by dwarf date palm. Submitted.
- TOMLINSON, P.B. 1961. Anatomy of Monocotyledons. Clarendon Press, Oxford.
- VARIER, P.S. 1995. Indian Medicinal Plants, Vol. 4. Orient Longman, Chennai.