



NDF WORKSHOP CASE STUDIES
WG 3 – Succulents and Cycads
CASE STUDY 5

Cycas circinalis

Country – INDIA

Original language – English

CYCAS CIRCINALIS L. IN INDIA

AUTHORS:

Anita Varghese and Tamara Ticktin

Keystone Foundation (www.keystone-foundation.com) in collaboration with People and Plants International (www.peopleandplants.org) and University of Hawaii (www.botany.hawaii.edu/faculty/ticktin).

I. BACKGROUND INFORMATION ON THE TAXA

1. BIOLOGICAL DATA

1.1. Scientific and common names:

Cycas circinalis L. Vernacular names: Hindi-Jangli madan must ka phul; Kannada-Mund isalu, Goddu eechalu; Malayalam-Eentha panna; Marathi-Malabari supari; Sanskrit-Hintalah; Tamil-Madana kama raja, Salaparai, Eentha panai; Telugu-Rana guvva, Per ita, Madana Kamakshi.

1.2. Distribution

C. circinalis is an endemic restricted to the Western Ghats (Fig.1) and hilly regions of the southern peninsula, in the states of Kerala, Karnataka, Tamil Nadu, and the south of Maharashtra (Hill 1995). *C. circinalis* is usually found in fairly dense, seasonally dry scrubby woodlands in hilly areas.

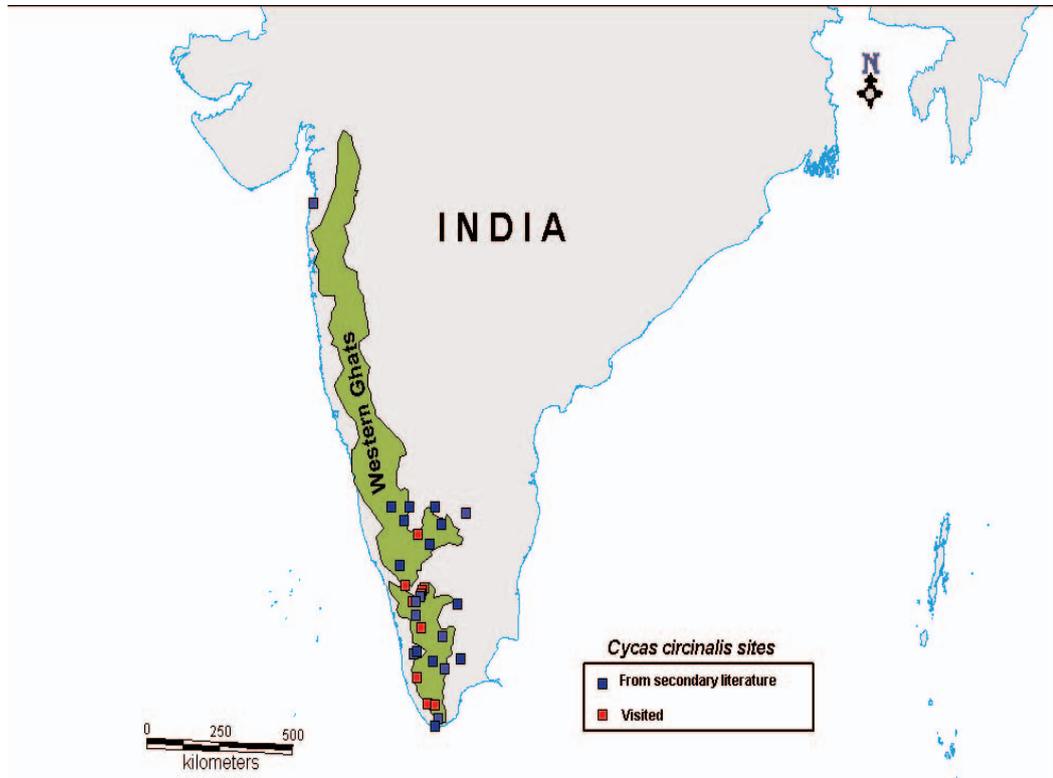


Fig.1 – Locations of *C.circinalis* populations along the Western Ghats, India.

1.3. Biological characteristics

1.3.1. General biological and life history characteristics of the species

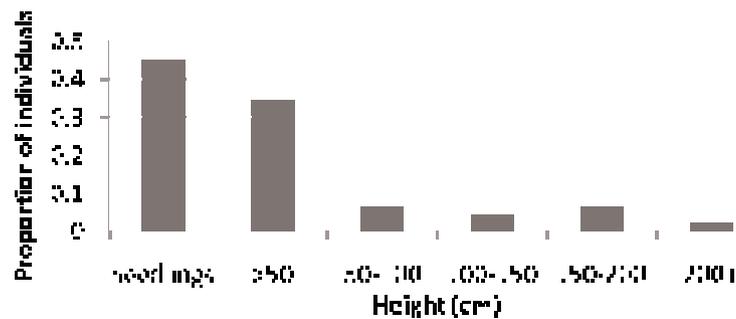
Very little is known to date about *C. circinalis* rates of reproduction, recruitment, survival, or sex ratios although this information is currently being gathered. There is some information available on population structure, impacts of harvest, and rates of leaf production. In a study of the population structure of *C.circinalis* in the Nilgiri Biosphere Reserve (Varghese & Ticktin 2006), it was found that populations that were harvested only for seeds showed a reverse J curve, with many individuals in the smaller size classes. This suggests good levels of regeneration despite seed harvest.

Populations subject to seed and leaf harvest showed a much lower proportion of seedlings and saplings. This may indicate lower rates of regeneration as compared to those populations that are not harvested for their leaves. In addition there were no individuals in the 150-200 cm height size class. The very high rates of leaf harvest (92% of all individuals > 20 cm high were harvested for their leaves, and $91.3 \pm 15\%$ of all leaves per tree were harvested) reported above suggest that the lack of individuals in this size-class could be a result of repeated over-harvest of leaves.

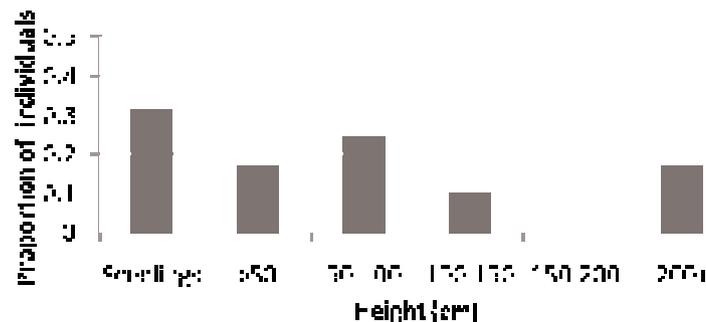
The structure of the populations subject to seed, leaf, stem and male cone harvest consisted almost entirely of individuals in the smallest size classes. There were no individuals larger than 100 cm in height. The one exception was one very large individual (> 200 cm height), but this was found among rocks and highly inaccessible. The lack of adult individuals points to high levels of stem harvest and depletion of the adult population.

Fig 2. Population structure of *C. circinalis* is dependent on harvest type ($\chi^2 = 25.02$ $p < 0.001$)

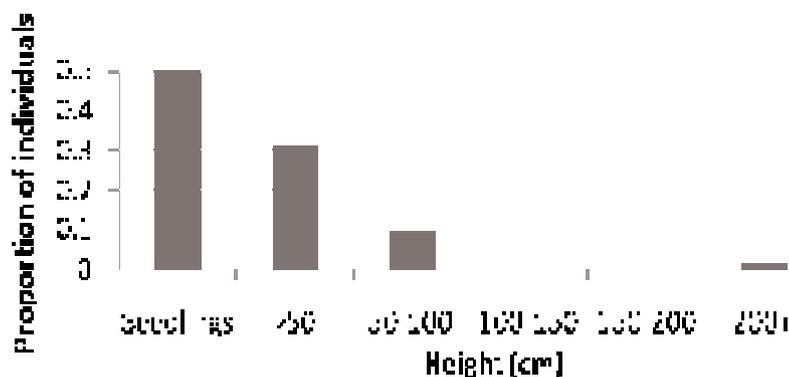
a. Seed harvest only, N= 63



b. Seed and leaf harvest, N=33



c. Seed, leaf and stem harvest, N=69.



Rates of leaf production are greatly variable, with larger individuals producing more leaves per year and individuals in areas of higher precipitation producing a greater number of leaves per year. Individuals in mid elevation dry deciduous forests appear to produce a flush of leaves only once per year, even when harvested, whereas as harvested individuals in low elevation wetter forests produce leaves throughout the year.

Branching appears to be a response to heavy leaf harvest. None of the *C. circinalis* individuals in populations that were not harvested for their leaves showed any branching. However, 21.3 % of the individuals in leaf harvested populations were branched, with the main apical meristem not producing leaves anymore.

1.3.2. *Habitat types:*

Found from the coast up to 1200m in the hills. Mostly in the mid elevation deciduous tracts of the hills, low elevation moist deciduous forests and along the low elevation riverine vegetation. Also found in the low elevation teak plantations of Kerala. Appears to grow profusely in fire prone areas. The regeneration levels were observed to be very high. One of the populations along the hills in the Nilgiris were observed on steep slopes that were prone to land slips.

1.3.3. *Role of the species in its ecosystem*

BUTTERFLY – Plains cupid butterfly was observed laying eggs on the immature leaves. The larvae rested at the base of leaf and in a period of 7-9 days emerged.

SPIDER – One species of Signature Spider was observed weaving its web on the leaves.

BATS – The juices of the seed coat are ingested by bats and the seed is dispersed. Rates of regeneration from partially eaten seeds are being recorded at the nursery.

Indian Sambar Deer-The Sambar deer found throughout Asia feeds on the acrid tasting fibrous seed with little flesh.

BEES – Dammer bees were observed collecting resinous sap from the tender leaves of the plant.

Ants – Two species of ants were also observed on *Cycas circinalis* trees, collecting the resinous sap from the young unfurling leaves of the cycad and collecting secretions from the bodies of plains cupid butterfly larva.

An article with regard to these observations was published in the newsletter of the Cycad society and can be accessed at <http://www.cycadsg.org/publications/TCS-December2007-Varghese.pdf>

1.4. Population:

1.4.1. Global Population size:

Table 1 – Populations of *Cycas circinalis* observed in various locations along the Western Ghats, India.

Locations	Altitude (msl)	Habitat	Estimated # of adults
Site 1 Tamil Nadu	1000	Dry deciduous and Savanna woodland type	>300
Site 2 Tamil Nadu	300-500	Riparian forests	>300
Site 3 Tamil Nadu	500-800	Dry deciduous, Savanna woodland, Riparian	<200
Site 1 Kerala	300-500	Semi evergreen, Moist deciduous, Teak plantations	>500
Site 2 Kerala	300-800	Riparian, Teak plantations, Moist deciduous	>200
Site 3 Kerala	Not visited	Not visited	Not visited
Site 4 Kerala	300-500	Semi evergreen, Moist deciduous, Teak plantations	>300
Site 5 Kerala	300-500	Semi evergreen, Moist deciduous, Areca plantations	>100
Site 4 Tamil Nadu	300-500	Moist deciduous, Teak plantations	>200
Site 5 Tamil Nadu		Savanna woodland, Teak plantations, Semi evergreen	>200
Site 1 Karnataka		Scrub woodland	800
Site 2 Karnataka		Scrub woodland	100

1.4.2. Current global population trends:

increasing decreasing stable unknown

1.5. Conservation status:

1.5.1. Global conservation status (according to IUCN Red List):

Critically endangered Near Threatened
 Endangered Least concern
 Vulnerable Data deficient

1.5.2. National conservation status for the case study country

Cycas circinalis is included in the negative list of exports notified by the GOI Notification 2 (RE-98) dt. 13-04-1998, 1997-2002 (Ravikumar and Ved 2000). The plant is also listed as an RET species.

1.5.3. *Main threats within the case study country*

- No Threats
- Habitat Loss/Degradation (human induced)
- Invasive alien species (directly affecting the species)
- Harvesting [hunting/gathering]
- Accidental mortality (e.g. Bycatch)
- Persecution (e.g. Pest control)
- Pollution (affecting habitat and/or species)
- Other _____
- Unknown

2. **SPECIES MANAGEMENT WITHIN THE COUNTRY FOR WHICH CASE STUDY IS BEING PRESENTED**

2.1. **Management measures**

There have been no specific management plans so far put forth for the management of this species in India.

2.2. **Monitoring system**

2.2.1. *Methods used to monitor harvest*

There is no formal monitoring program in place to monitor *C. circinalis* harvest throughout its range. However, Keystone Foundation has established a monitoring program throughout the NBR (including populations in Tamil Nadu and Kerala states) to monitor harvest. This involved establishing permanent plots with tagged individuals, and monthly monitoring of the number of leaves, seeds, cones or stems harvested. This monitoring was carried out over a period of one year.

2.2.2. *Confidence in the use of monitoring*

The indigenous communities living closest to the *Cycas* populations are being involved in a community monitoring program. For now the program has started with an interpretation center and a nursery in the village. The *cycas* areas are being mapped with people's participation. The threats to the populations will be identified and a permanent plot will be set up in consultation with the harvesters that will be monitored seasonally. This involves measures of growth, survival, reproduction, regeneration and a calculation of sex ratios.

2.3. **Legal framework and law enforcement:**

Listed in Appendix II of the CITES, the species is included in the negative list of exports notified by the Government of India (Notification 2 (RE-98) dt 13.04. 1998, 1997-2002) (Ravikumar and Ved 2000).

3. UTILIZATION AND TRADE FOR RANGE STATE FOR WHICH CASE STUDY IS BEING PRESENTED.

3.1. Type of use (origin) and destinations (purposes)

In Kerala and Tamil Nadu indigenous communities harvest mainly the seed and the young leaves of *C. circinalis*. These are considered delicacies and are highly valued. In Tamil Nadu, some villagers relish the young leaves and steamed seed. Although in Tamil Nadu *C. circinalis* seed is harvested for home consumption, in Kerala there is also local demand for the dried seed. The harvest is heavy here as the harvesters harvest the seed and sell it after some processing and drying to the market. The ripe seed is picked (about 25 kg per day) and smoked on a bamboo mat and then dehusked and dried. Harvesters report that 25 kg of seed would yield only up to two kg of dried seed. In a harvest village 20 tonnes of fresh seed were collected in 2008.

Harvesters in Tamil Nadu and Kerala harvest the mature leaves of *C. circinalis* yearly for making the shelters for special rituals. The mature leaves are also heavily harvested for the floriculture industry and the pith from Tamil Nadu is sold in medicinal markets. The price per kg of dried pith is 20 rupees per kg, if it is milky white. A traditional trader at Virudhanagar market in Tamil Nadu estimated that from Tamil Nadu itself about 200-300 tons of the pith is being traded annually. He reported that the bulk of it was coming from Kerala. The pith is sent to traders in North India to supply to the herbal medicine industry. An extract of the pith is used to increase milk production in lactating mothers. He also reported that the male cone is very important for the production of a male aphrodisiac and much in demand but difficult to get.

The vendor emphasized that *C. circinalis* trees were very abundant about 10 years ago and even found in gardens, but now they are gone so that pith is now brought from homesteads in Kerala, where the whole tree is purchased for Rs. 50 -60. When gatherers harvest in the monsoons it is difficult to dry the produce properly making it brown in color. When the color is brown the price also drops and the traders are not able to sell the produce then.

In Kerala, there is a demand for *C. circinalis* male cones by local farmers. Most paddy farmers place the cone in the middle of their paddy fields to drive away a particular insect which attacks the young paddy. The insect is drawn to the cone because of the smell and leaves the paddy alone.

Table 2. Use, harvest patterns and demand for *C. circinalis* products in Tamil Nadu and Kerala portions of the NBR.

Part harvested	Harvest Status	Use	Harvest patterns	Demand		
Young leaves	Yes	Food	Tamil Nadu Men and women involved, but mostly older people. Harvest once per year Oct/Nov or mid April. Hill communities	Kerala Men and women involved, young and old people. Harvest once per year.	Tamil Nadu Indigenous villages	Kerala Indigenous villages
Mature leaves	Yes	Floriculture, Thatching	For cultural events and small traders who pay up to 2 rupees per leaf. Mostly men involved. Heavy harvest for market.	For religious and cultural events. Men go for collection. Not sold.	Indigenous villages and local markets within the district	Indigenous villages
Seed	Yes	Food and medicine	Men and women involved, collection rates of about 80% per individual	Men and women involved, collection rates of about 80% per individual. Observed in August.	Indigenous villages	Indigenous villages and markets within the district due to local demand for the dried kernel to
Pith	Yes	Medicine	Traders bring their own set of harvesters. Clandestine operations with no local people involved. High harvest rates. Exhaustion of populations in Tamil Nadu resulted in move to homesteads in Kerala.	Traders from Tamil Nadu come to collect the whole plant from the homesteads where it grows abundantly	be used in medicinal preparations. South Tamil Nadu	South Tamil Nadu
Male cone	No	Medicine,	Insect repellent	Local farmers	None come in to harvest this for use in their paddy fields	Local farmers within the district

3.2. Harvest:

3.2.1. Harvesting regime

Harvest of young leaves:

The young leaves are collected around October to November and in mid April. All new leaves from an individual are harvested. This harvest is only for home consumption and not frequent.

Harvest of seed:

Harvesters report that the seeds are not available for harvest every year. The seed is collected during the months of July and August in the Nilambur area and between February and March in the Nilgiris area.

Harvest of mature leaf and pith:

Harvest of mature leaf and pith continues today in the Nilgiri Biosphere Reserve area. Since the harvest of pith is not permitted by the Forest Department the harvests happen secretly and are usually from distant areas. Occasionally the indigenous peoples are paid a per-leaf rate and harvest the mature leaves for the floriculture industry.

There are many small time contractors operating from the base of the forested slopes of the Nilgiris. One forest contractor reported that he used to contract harvesters to extract *C. circinalis* leaves and pith. One rupee is paid per mature leaf. Leaf is in most demand around January-February and October to November. He confirmed that pith harvesters look for the younger trees around 5 ft. tall and it is the pith found at the lower end of the trunk that is used. Bigger trees have more fibrous piths and are not favorable.

3.2.2. Harvest management/ control

No permits are issued for collection of *Cycas* parts.

3.3. Legal and illegal trade levels

Since there is no clarity on the legislation regarding this species, levels of trade are difficult to assess. The only trade is the illegal trade. 200-300 tonnes of the dried pith was one of the estimates given by a trader who was located near the coast in Tamil Nadu. In Kerala a trader came asking for the male cones and one village harvested 350 kgs of the cone for him.

A recent study on methods to identify authenticity of raw material cites the use of dried pith of *Cycas* sp. as an adulterant for tuber of *Peuraria tuberosa* (Devaiah & Venkatasubramanian, 2008).

II. NON-DETRIMENT FINDING PROCEDURE (NDFS)

ii. Non-detrimental finding procedure (NDFS)

1. IS THE METHODOLOGY USED BASED ON THE IUCN CHECKLIST FOR NDFS?

yes no

2. CRITERIA, PARAMETERS AND/OR INDICATORS USED

- 1) Part of plant that is harvested. Harvest of pith and male cones appears to be unsustainable. Harvest of seeds and leaves may be sustainable at some levels depending on at least some of the following:
- 2) Quantity that is harvested as determined by amount of leaves or seeds harvested/individual and proportion of individuals in a population that remain unharvested. Preliminary research (Varghese & Ticktin 2006) suggests that repeated heavy leaf harvest of *C. circinalis* may decrease growth and reproductive output, leading to lowered regeneration. Very heavy seed harvest could also lead to lowered regeneration.
- 3) Time for recovery after harvest and timing of harvest, as determined by frequency and seasonal timing of harvest of leaves. For example, the harvest of leaves once a year, soon before they are (naturally) shed, may have little impact on the individual.
- 4) Local management for regeneration: Harvest of seeds and/or leaves can be sustainable in communities that are actively growing *Cycas* in nurseries, maintaining their homestead populations and planting them out to increase populations.
- 5) Size of population: It would probably not be sustainable to harvest from very small populations especially if it is an isolated population.
- 6) Region harvested: *C. circinalis* populations have been observed in many different habitats with very different environmental conditions and these appear to significantly affect vital rates. For example, individuals in wetter regions have significantly greater rates of growth and reproduction than those in drier regions. It is possible that some populations may withstand higher levels of harvest because of the more favourable growing conditions.

3. MAIN SOURCES OF DATA, INCLUDING FIELD EVALUATION OR SAMPLING METHODOLOGIES AND ANALYSIS USED

1. Part of plant harvested: easily identified.
2. Quantity that is harvested: This would have to be provided by the seller, along with location of harvest. It could also be verified

through field evaluation because both leaf harvest rates (through evidence of harvested leaves) and the proportion of individuals harvested can be quantified. Since seeds and leaves are not sold through organised markets or government mechanisms actual data on volume could only be gathered through a community based monitoring where possible. Visits to local markets can also provide some of this information.

3. Frequency and timing of leaf harvest: This would also have to be provided by the seller and/or through community-based monitoring where possible. In the case of protected areas like National Parks and Sanctuaries collections are technically not permitted.
4. Local management for regeneration: Evidence in community nurseries, out planted populations in home gardens and/or forests.
5. Population size: Documented through field evaluation.

4. EVALUATION OF DATA QUANTITY AND QUALITY FOR THE ASSESSMENT

1. Plant of part harvested: easily determined accurately.
2. Quantity that is harvested. This can be determined fairly accurately through field surveys. The limitation is that it is not practical to do regularly, especially given that many populations are in remote locations. Community-based monitoring programs can obtain the information accurately, documenting harvest that could include both local people and outsiders. The limitation is number of communities where programs can be established, right now these programs are just in initiation in a very small number of communities.
3. Frequency and timing of harvest. This can only be determined accurately by fairly regular monitoring and so may only be a possibility in communities with community- monitoring programs. This is because *C. circinalis* appear to flush at different times of the year depending on their location, so it is difficult to identify a time of year when harvest is optimal across all regions. For the same reason, annual monitoring cannot accurately determine when/how frequent harvest was.
4. Local management for regeneration: easily generated by assessment of nurseries and out plantings
5. Population size: can be determined fairly accurately in the field. Limitation is localizing the existing populations.

5. MAIN PROBLEMS, CHALLENGES OR DIFFICULTIES FOUND ON THE ELABORATION OF NDF

Right now there is not enough data to develop specific guidelines on harvest practices that are sustainable (especially with respect to quantity and frequency). We have ongoing studies specifically aimed at addressing this and expect to have this information within the next few years.

There is also no clarity on the species in each location, this needs to be determined and we need to develop a good field guide to the Cycads of India. When the species itself is not clearly defined then framing management practises for it become even more tricky.

Another problem is the lack of transparency on the uses of the cycad parts that find themselves in the trade, especially of pith and male cones. There is still very little information available on trade (quantities traded, demand for different plant parts, trade routes etc) of *C. circinalis* (and other *Cycas* species).

There also needs to be a complete ban on destructive harvests that involve stems and piths.

6. RECOMMENDATIONS

Identify sustainable management practices/plans (quantity, frequency, timing of harvest) that can be promoted at the community level and maintained through community-monitoring programs. This will entail further research on the ecology of this species, its uses/harvest by communities across its range and their impacts.

Strengthen and further promote the community-based *Cycas* monitoring programs that have been initiated.

Improve identification of the cycad species in India, with an easy to read Field Guide that would help to identify species in the wild and potentially from parts in markets. This would help to clarify which populations are actually *C. circinalis* or other species.

Carry out a survey of the market for *Cycas* (including both South and North India). This has not yet been done and could throw more light on quantity of trade and demand (including timing of demand) for different parts of the plant.

Develop a *Cycas* database which could be held with the Biodiversity Board to disseminate and enhance information on species/populations in the wild.

Dialogue with the Medicinal Plant Board to identify the threats to the species and work with them to come up with criteria for procurement of raw material.

REFERENCES:

- 1.RAVIKUMAR, K. & D.K.Ved. (2000). Illustrated Field Guide-100 Red Listed Medicinal Plants of conservation concern in Southern India. FRLHT, Bangalore, India
- 2.HILL KD (1995) The genus *Cycas* (Cycadaceae) in the Indian region, with notes on the application and typification of the name *Cycas circinalis*. *Taxon* 44: 23–31.
- 3.HILL, K.D. 2003. *Cycas circinalis*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. Myers, N., Mittermeier, R. A., Mittermeier, C. G., Da Fonseca, G. A.B. & Kent, J. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403, 853.
- 4.VARGHESE, A. & Ticktin, T. 2006. Harvest, Trade, and Conservation of the Endemic Multi-use Cycad, *Cycas circinalis* L., in the Nilgiri Biosphere Reserve, South India. <http://cycadsg.org/publications/Cycas-circinalis-case-study.pdf>
- 5.DEVAIAH, K.M. and Venkatasubramanian, P. 2008. Development of SCAR marker for authentication of *Pueraria tuberosa* (Roxb. ex. Willd.) DC. *Current Science*, Vol. 94, No.10.