A SURVEY OF *ISOETES COROMANDELINA* L. F. POPULATIONS IN TIRUNELVELI DISTRICT

Sahaya Anthony Xavier, G*, S. Sundhari, P. Mariammal, M. Vaishnavi and T. Vanitha

Department of Botany, St. Xavier’s College (Autonomous), Palayamkottai – 627002.

*E.mail: saxsxc@gmail.com*

**ABSTRACT**

The genus *Isoetes* is a cosmopolitan genus found around the world. The genus consists of aquatic or semi-aquatic plants needing water for survival. The distribution of *Isoetes coromandelina* L. f. in the freshwater ponds of Tirunelveli district was studied. The results of the survey show that the population of *Isoetes coromandelina* in Tirunelveli district are healthy and flourish wherever non-polluted, nutrient poor waters are available. Although there is no danger to the populations of *Isoetes* at present, water pollution could endanger the survival of the species.

**Keywords:** *Isoetes coromandelina*, survey, Tirunelveli, cosmopolitan genus.

1. **INTRODUCTION**

*Isoetes* L. is a cosmopolitan genus of heterosporous lycopsids comprising approximately 150 species found in lakes, wetlands (swamps, marshes), and terrestrial habitats (Taylor *et al.*, 1993) all over the world. 16 species of *Isoetes* have been reported from different geographical regions of India. Most of the populations are found growing along the margins of small ditches and ponds (Srivastava *et al.*, 1993).

Around the world, the genus *Isoetes* is facing a lot of issues that affect its survival due to loss of habitat, an increase in agricultural land use, and invasion of exotic species. *Isoetes* has been declared an endangered species in Korea (Changkyun *et al.*., 2008). In China all the four species present face extinction due to habitat loss, agricultural land use and invasion by exotic species (Fu and Jin, 1992). Local populations of *I. coreana* in Korea growing in marshy areas close to farmland face intense competition from other hydrophytes such as *Eriocaulon sieboldianum*, *Juncus effuses var. decipens* Buchen, and *Scirpus triangulates* Roxb. As a result, *I. coreana* plants are now isolated and endangered in South Korea.

* Isoetes is an aquatic / amphibious species. The requirement of a large amount of standing water is essential for the survival and reproduction of the species. Tirunelveli district falls in the rain shadow region of the southern Western Ghats. Consequently, while the western parts of the district may receive some rainfall and also some streams dot the countryside, as one moves to the eastern part of the district, the availability of freshwater decreases. The ponds near and east of Tirunelveli/ Palayamkottai depend on the water released from the dams. When the north-east monsoon fails, the ponds in the eastern parts of the district have been observed to be dry and without water for years together.

Though *Isoetes* cannot live without water, it has been observed to regrow vigorously once water is made available either through rain or by release from the dam. Could the survival of *Isoetes* during the rainfall deficient years be due to the perennating structures present in the soil? Could these also account for the rapid growth and colonization of large stretches of a pond’s area once water is available?

This survey of *Isoetes* populations in Tirunelveli district aims to answer these questions. The study of the population, population distribution, population structure and genetic diversity of the populations is important to have an idea of the extent of the spread of the population and its genetic health. It will also help us to analyze and understand how the species is coping in the wild to environmental challenges and changes. Such knowledge can give us critical insights and knowledge into the adaptive response of the species and the population as a whole to the stresses facing the populations. It would also help us to understand the long term risks facing the species and the steps needed to be taken to conserve the species. Therefore, this study was undertaken to survey and document the areas in Tirunelveli district where there are *Isoetes coromandelina* L. f. populations.
2. MATERIALS AND METHODS

2.1. Area of the study

Tirunelveli District was taken as the area for the study. The *Isoetes* populations at the different sites were studied. The location of the study sites along with their latitude, longitude, altitude and ecological characteristics are given in Table 1.

2.2. Plant material

*Isoetes coromandelina* L. f. was taken for study.

2.3. Methods

The study sites were inspected and the ecological characteristics noted. The plants were collected in the field. The GPS data was collected a Garmin 12XL device. Studies on the distribution of the *Isoetes* populations were conducted and noted. The study period was between November 2014 to March 2015.

3. RESULTS AND DISCUSSION

The characteristics of the different populations surveyed in Tirunelveli District are given in Table 1. Plate 1 shows the different habitats where *Isoetes* coromandelina grows in Tirunelveli District. The map of Tirunelveli District is given in Figure 1. A wide area with St. Xavier’s College, Palayamkottai as the base has been surveyed. To the west, the plant populations along the Palayamkottai – Papanasam road up to Ambur railway gate have been surveyed. Along Ambur gate the populations have been surveyed up to Karuthapillaiyaor and then on to Alwarkurichi and further to Edaikal and then on to Palayamkottai. To the east, the Nanguneri - Uvari road up to Uvari has been surveyed. A total of 18 populations have been surveyed. Due to constraints of time, some taluks in Tirunelveli district i.e. Kadayanallur, Vasudevanallur, Sankarankovil, Kuruvikulam, Shencottah and Melaneelithanallur could not be surveyed.

Table 1. List of *Isoetes* populations in Tirunelveli district surveyed in the current study.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Location</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Altitude</th>
<th>Ecology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cheranmahadevi</td>
<td>N 8.40.580</td>
<td>E 77.33.570</td>
<td>202 ft</td>
<td>This is a small population of <em>Isoetes</em> found in a natural ditch near the railway gate. The soil is a rich loamy reddish clay and the plants are growing in a semi-amphibious state. The growth of the plants is not very vigorous and they are very well spread out in the depression. The <em>Isoetes</em> plants were found to be growing in an irrigation channel filled with rainwater in a semi-amphibious and some plants were submerged in the water. The plants in this area showed vigorous growth. This may be because of the soil which was clay soil with a lot of humus present in it. The plants grew very tall and formed a thick mat on the floor. The population was intertwined with many <em>Marsilea</em> plants.</td>
</tr>
<tr>
<td>2</td>
<td>Veeravanallur</td>
<td>N 8.41.026</td>
<td>E 77.31.714</td>
<td>228 ft</td>
<td></td>
</tr>
</tbody>
</table>
3 Veeravanallur
Thadagam

N 8.40.8 30  E 77.29 520  259 ft
A small pool at the base of a hillock. The
Isoetes are fringing the pool. Plants are
separated and present like a fairies ring.
Plants not clumped or dense in growth.

4 South
Pappankulam –
Kallidaikurichi –
Manimuthar Road

N 8.40.252  E 77.27.808
Small population at the base of a hilling
two small clumps. One clump has 40-50
plants and the second one has 7-10 plants.

5 Kallidaikurichi
Railway Station

N 8.40.8 01  E 77.28.039  255
Sand – red soil, stagnant pool, Isoetes –big
population in an area 50 x 20 m, Isoetes
plants at various stages forming a dense
carpet at various places

6 Way to Ambur
Esakkiamam
Temple Pond

N 8.44.523  E 77.24.880  294
Sand-red soil, big pond covered with
Isoetes, huge population area 50 x 50m
rimming the edges of the pond

7 Way to Ambur
Kulam

N 8.45.383  E 77.24.354  332
Sand – red soil, a pit on a sloping hillside,
small population, Isoetes suppressed by
angiosperm weed

8 Puthuparaian
kulam

N 8.45.358  E 77.23.645  342
Big pond – small population seen near
northern canal, population size 3 x 5ft,
phenotypic differentiation in populations,
population growing in water with tall
individuals, population growing in soil
with short individuals

9 Kaveri
konthankulam

N 8.45.425  E 77.23.209  333
A big pond with sandy soil dominated by
Isoetes at its eastern edges, Isoetes present
as beds approx. 10 m in width from edge
of the pond, length of the Isoetes
beds>100m. Isoetes runs around the
entire lake

10 Achan kulam
Alwar kurichi

N 8.47.276  E 77.21.996  409
Base of hill, gentle slope, red soil, tank is
dry now, 15m wide x 50m, present as a
lush green mat in the process of drying.

11 Vellikulam
pottalputhur

N 8.47.605  E 77.24.840  323
Base of excavated hill in pools of water-
Isoetes found growing in water and all
around the water’s edge-plenty of algae
for a thick mat on water-water has huge
amount of humic content

12 Idaikal kulam –
Adaichani

N 8.45.533  E 77.27.290  300
Big pond sloping to south- Isoetes present
on edge of the pond – red soil-clear water.
On the Nanguneri – Uvari Road. Present as
a lush green mat along the boundary of
INS Vijayanarayanan base

13 Kakkan Nagar

N 8.408794  E 77.752503
The Isoetes plants grow along the sides of
a local pond. The Isoetes plants would
cover a few acres atleast fringing the rims
of the pond. Very abundant.

14 South
Vijayanarayanan

N 8.40466  E 77.763869
A small population along the edges of the
pond

16 Gopalasamudram

N 8.683392  E 77.644780
A good population present near the local
pond

17 Veeravanallur

N 8.686786  E 77.524472
A randomly dispersed population near the
Plate 1. *Isoetes coromandeliana* in different environments of Tirunelveli District.

- Along side of a hillock.
- In a irrigation channel.
- Growing among rocks.
- Growing along the edges of the pond.
- Growing on land and submerged.
- Growing in the irrigation channel.
- Growing along a hill side.
- Growing in a stagnant pool of water.

Police Station
18 Veeravanallur
Petrol Bunk
N 8.687382  E 77.521569  -  police station
Sand red soil rich with humus. Stagnant water present in a natural depression. A small population present.
18 populations of *Isoetes* have been surveyed in this study. This study establishes that at the sites investigated i.e. fresh water ponds with an abundant supply of water, there are thriving populations of *Isoetes*. It also seems to suggest that a clean environment with oligotrophic waters is essential for the continued growth and survival of *Isoetes*.

At many sites such as Veeravanallur, Kallidaikurichy Railway Station, Ambur Esakkiamman Temple Pond, Puthuparaiyankulam, Kaverikoonthankulam, Achan Kulam, Vellikulam, Kakkkan Nagar, South Vijayanarayanam the populations of *Isoetes* were well established and covered a huge area. At Pappankulam and Veeravanallur Thadagam the populations were very small. In fact, it seems that the population at Pappankulam could be either a newly established population or an old population which was on its way to disappearance locally. At Puthuparaiyankulam, the lush growth of *Isoetes* was seen. Further, it was seen that some of the *Isoetes* grew in the water while some grew away from the water on higher ground.

It has been reported by Sand – Jensen and Søndergaard (1979) that the quillwort *I. lacustris*, a submerged evergreen perennial, inhabits mainly nutrient - poor lakes. This is confirmed by Boston and Adams (1987) in their study of *Isoetes*. Quillworts have evolved various adaptations to infertile habitats, including CAM metabolism (Keeley and Busch, 1984), high root biomass and slow leaf turnover (Boston and Adams, 1987; Garcia and Ballesteros, 1994). The adaptation to infertile habitats could explain the abundance of *Isoetes* in nutrient poor freshwater lakes.

**4. CONCLUSION**

A survey of the populations of *Isoetes coromandelina* in Tirunelveli district has been undertaken. The district received copious rain during 2014 – 15 due to which the ponds were full to the brim either with the rainwater or the water released from the dams. This has helped the growth of *Isoetes*. The growth of *Isoetes* was observed in ponds that had been dry for many years.

Though *Isoetes* cannot survive without water, the species has demonstrated its ability to recover and establish itself when water is available. Vigorous growth of *Isoetes* was observed in many ponds.

Luxuriant growth of *Isoetes* was observed only in environments with stagnant or standing water. However, *Isoetes* is also observed to along the gentle slope of hillock (Achankulam) where there is no chance for the water to stagnate.

The survival and reestablishment of *Isoetes* could be to the perennating structures present in the soil or to the spores present in the soil. The uniform growth of *Isoetes* observed at almost all the ponds at the same time seems to suggest that the growth of *Isoetes* in each pond could have been due to the perennating structures present there. If this is true, then *Isoetes* demonstrates a remarkable ability to overcome drought for long periods of time.

This study is a preliminary study aimed at studying the distribution of *Isoetes* in Tirunelveli district. Further studies on the population structure, population dispersal and genetic relationships of the different populations will give a clearer picture of the nature of *Isoetes* in Tirunelveli district.

**REFERENCES**


