

A SURVEY OF *ISOETES COROMANDELINA* L. F. POPULATIONS IN TIRUNELVELI DISTRICT**Sahaya Anthony Xavier, G*, S. Sundhari, P. Mariammal, M. Vaishnavi and T. Vanitha**

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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.



Fig. 1. Map of the study area

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 Karuthapillaioor 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.

S. No	Location	Latitude	Longitude	Altitude	Ecology
1	Cheranmahadevi railway gate	N 8. 40.580	E 77 33.570	202 ft	This is a small population of <i>Isoetes</i> 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.
2	Veeravanallur	N 8. 41. 026	E 77. 31.714	228ft	The <i>Isoetes</i> 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 <i>Marsilea</i> plants.

3	Veeravanallur Thadagam	N 8.40.8 30	E 77.29 520	259 ft	A small pool at the base of a hillock. The <i>Isoetes</i> 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	N8.40.252	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	N8.40.8 01	E77.28.039	255	Sand – red soil, stagnant pool, <i>Isoetes</i> –big population in an area 50 x 20 m, <i>Isoetes</i> plants at various stages forming a dense carpet at various places
6	Way to Ambur Esakkiamam Temple Pond	N8.44.523	E77.24.880	294	Sand-red soil, big pond covered with <i>Isoetes</i> , huge population area50 x 50m rimming the edges of the pond
7	Way to Ambur Kulam	N8.45.383	E77.24.354	332	Sand – red soil, a pit on a sloping hillside, small population, <i>Isoetes</i> suppressed by angiosperm weed
8	Puthuparaian kulam	N8.45.358	E77.23.645	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	E77.23.209	333	A big pond with sandy soil dominated by <i>Isoetes</i> at its eastern edges, <i>Isoetes</i> present as beds approx. 10 m in width from edge of the pond, length of the <i>Isoetes</i> beds>100m. <i>Isoetes</i> runs around the entire lake
10	Achan kulam Alwar kurichi	N8.47.276	E77.21.996	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	N8.47.605	E77.24.840	323	Base of excavated hill in pools of water- <i>Isoetes</i> 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	N8.45.533	E77.27.290	300	Big pond sloping to south- <i>Isoetes</i> present on edge of the pond –red soil-clear water.
13	Kakkan Nagar	N 8.408794	E 77.752503	-	On the Nanguneri – Uvari Road. Present as a lush green mat along the boundary of INS Vijayanarayanam base
14	South Vijayanarayanam	N 8.40466	E 77.763869	-	The <i>Isoetes</i> plants grow along the sides of a local pond. The <i>Isoetes</i> plants would cover a few acres atleast fringing the rims of the pond. Very abundant.
15	Tharuvai	N 8.671068	E 77.680560	-	A small population along the edges of the pond
16	Gopalamudram	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

18 Police Station
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.

Plate 1. *Isoetes coromandelina* 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.

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, Kakkan 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 Puthuparayankulam, 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 Sondergaard (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; Gacia 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.

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