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A CASE STUDY

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Phytopathosys: determination of plant pathogenic organism and characterization by phytopatho information systems

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ABSTRACT

The Andaman and Nicobar islands comprise chain of more than 350 major islands in addition to a number of islets and rock outcrops in the Bay of Bengal lying between latitudes 6° and 14° N and longitudes 92° and 94° E. Phytopathology is the study of diseases in plants. The disease evolution may be due to the climatic condition, humidity level, temperature and the genetic character of the plant and the pathogen. Phytopathosys was developed by front end VB.net and back ends MS SQL. The valuable system to reveal the details regarding the routes of infection, the micro-organisms involved in the infection, from the host side the percentage and extent of damage, the treatment and control of disease through both chemically and biologically. This system also gives information on the plants and the pathogens prevalent in Andaman and Nicobar islands based on the research made. This paper focuses on the details of plant diseases, control of plant pathogens and increasing the crop production of Andaman and Nicobar Islands.

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INTRODUCTION

The total geographical area of Andaman and Nicobar islands is 8249 sq. km of which about 86 per cent of land is under forest and 14 per cent has been cleared for the habitation and agriculture. Out of total geographical area of 8249 sq. km area, the land available for agricultural activities is about 50000 ha. In the total cultivated area, around 22 per cent is utilized for rice cultivation, about 50 per cent of the area is covered by coconut, 9 per cent each by arecanut and fruit crops and the remaining area is covered by spices, root crops and vegetables.

The islands have tropical, humid climate with mean rainfall of about 3180 mm per annum. The average mean temperature varies from 23ºC to 30ºC with over 90 per cent humidity during the rainy season. The natural forests were cleared and replaced with plantations of arecanut, coconut and banana with the assistance given by the government. Vegetables like cowpea, cabbage, okra, cauliflower, bitter gourd, cucumber, ridge gourd, tomato and brinjal are grown in the areas immediately below the foothills, rice and summer vegetables are cultivated in the midlands and rice in the lowlands. The fruit crops are seen in homestead farms and spices are cultivated under plantations. Rice is grown mainly in the valley and plain lands with majority of the areas adjacent to sea. Rice is predominantly grown in Andaman districts and the plantation coconut and arecanut crops in Nicobar districts. Apart from this, the natural forests of Andaman has rich biodiversity of all kinds of crops and their wild relatives. The flora and fauna of these islands are unique having 2500

Fig. A : Pests and diseases of various plants

angiosperms out of which 243 (~10%) are said to be endemic. A valuable system to reveal the details regarding the routes of infection, the micro-organisms involved in the infection, from the host side the percentage and extent of damage (Jackson *et al*., 2009 and Stewart *et al*., 2000). The treatment and control of disease through both chemically and biologically. This system also gives information on the plants and the pathogens prevalent in Andaman and Nicobar Islands based on the research made.

Damage of field crops :

The field crops include rice, sorghum, sesamum, pulses and sugarcane. These crops are susceptible to the diseases like yellows and stem bores, gundhi bug, bacterial leaf blight, sheath blight, grain mould, charcoal rot, root rot, formation of mosaic, shoot bores, red rot etc. and these diseases are becoming a major challenge in the agricultural community (Richet *et al*., 2010; Choi and Han *et al*., 1990; Agrios, 1997).

Damage of vegetable crops :

The vegetable crops like tomato, brinjal, okra, chilli, cauliflower and cabbage, cucurbits, legume and amaranthus are susceptible to the diseases, fruit bores, bacterial wilt, damping off, Fusarium wilt, root knot nematodes, phomopsis knot blight, yellow vein mosaic, anthracnose and fruit rot, leaf curl, leaf spot, downy mildew, serpentine leaf miner, rust, white rust etc. (Dianese and Dristig, 1994 and Dristig and Dianese, 1990), which destroy the vegetable crops and reduce the economic value of those crops.

Damage of fruit crops :

The cultivable fruits are banana, mango, citrus (orange, lime), guava etc. which are strictly infected by rhizome weevil, pseudo stem weevil, banana bunchy, wilt, fruit borer, anthracnose, leaf miner, black fly, fruit piercing moth, citrus butterfly, canker, spiralling white fly, wilt etc. These destroy the crops at a maximum level and suppress the growth and production of fruit crops (Hara and Ono, 1983 and Mehan, 1995).

Damage of plantation crops :

The plantation crops include coconut and arecanut in Andaman and Nicobar group of islands. They are mainly damaged by Rhinocerous beetle, bud rot and root grub (Sarma *et al*., 1978).

Damage of spices crops :

The spices cultivation is carried out in Andaman basically with pepper, clove and ginger. These crops too subjected to damage by pollu beetle, top shoot borer, foot rot, stem borer, shoot borer, rhizome scale, soft rot etc. (Zehr, 1970).

MATERIAL AND METHODS

Phytopathosys was prepared using VB.net and MS SQL. VB.net is the advanced form VB6 and it gives the user a good working environment to know about the disease conditions and their preventive measures. The information system developed by Bioinformatics Centre, Central Agricultural Research Institute, Port Blair. The valuable system to reveal

the details regarding the routes of infection, the micro-organisms involved in the infection, from the host side the percentage and extent of damage, the treatment and control of disease through both chemically and biologically. This system also gives information on the plants and the pathogens prevalent in Andaman and Nicobar islands based on the research work carried out.

Data collection :

A survey was conducted in various places of Andaman and Nicobar group of islands, to get primary and secondary data about the infected plants and diseases. The information collected was crosschecked and authenticated. In this survey, all details were regarding various aspects of plants and diseases such as plant name, scientific name, family, habitat, characteristics, distributions, diseases, microbes, descriptions collected and documented from the surveyed areas. In addition to this, secondary data were also collected from institute / organization of these islands and mainland such as Botanical Survey of India (BSI), Department of Agriculture etc. Other information included various publications coming from these islands as well as mainland.

Database construction :

Visual Basic.Net :

This front end software was used by VB.Net 2005. Visualbasic.net is an object-oriented computer programming language that can be viewed as an evolution of Microsoft's visual basic (VB) which is generally implemented on the Microsoft.net framework. Microsoft currently supplies visual basic express edition free of charge (Sherriff, 2005; Taft, 2005 and Paul *et al.*, 2003).

Microsoft SQL server :

All data of plant disease informations were entered and maintained by MS SQL 2005. Microsoft SQL Server is a relational model database server produced by Microsoft. The main unit of data storage is a database, which is a collection of tables with typed columns. SQL Server supports different data types, including primary types such as integer, float, decimal, char, varchar, binary and text among others. In addition to tables, a database can also contain other objects including views, stored procedures, indexes and constraints, along with a transaction log. Storage space allocated to a database is divided into sequentially numbered *pages*, each 8 KB in size. A page is the basic unit of I/O for SQL Server operations. A page is marked with a 96-byte header which stores metadata about the page including the page number, page type, free space on the page and the ID of the object that owns it. Page type defines the data contained in the page - data stored in the database, index, allocation map which holds information about how pages are allocated to tables and indexes, change map which holds information about the changes made to other pages since last backup or logging, or contain large data types such as image or text (Kalen, 2009 and Kleinerman, 2008).

RESULTS AND DISCUSSION

The Phytopatho Information System was developed under VB.net consists of a loading screen at the beginning (Fig. 1). When the user the enter button the loading bar starts running. After loading, the page takes you to the home page which is built with a menu bar with the menus file, search by pathogen, search by host, practices, chemicals and about us. The file menu consists of open a file and close the file or exit the entire program. Under search by pathogen tab, we have given the user to select pathogen like bacteria, fungi, virus and pests (Fig. 2).

Under search by hosts tab, we gave user to select crops like field crops, vegetable crops, fruit crops, plantation crops, spices crops and tuber crops. Under practices tab, one can

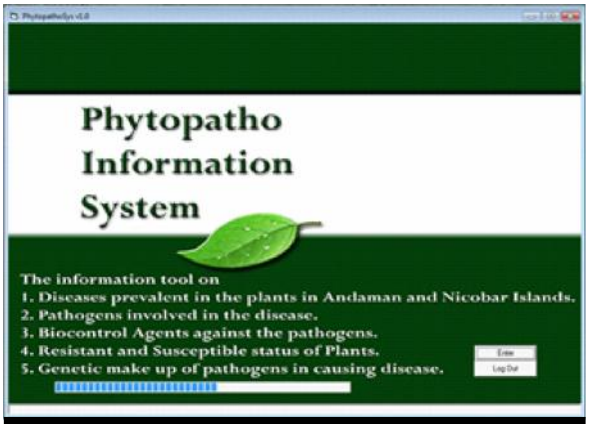

Fig. 1 : Startup loading window of the phytopatho information systems

Fig. 2 : Selection and execution page of phytopatho information systems

select the type of practices to know about the methodology of practices. Under chemicals tab, the type of chemicals used to control the pathogens and the disease. About us tab, takes the user to CARI website and contacts.

The user can also select the same from the check box in the homepage. Simple click the required check box and click 'go'. Click the checkbox corresponding to fungi and by clicking go will take the user to the information page where one can find the combo box with the list of fungi. By selecting the query organism, the information on fungi including the name of the fungi, disease caused by the organisms on plants, the target crop, the extent of damage and the remark of the damage throughout the area (Fig. 3). Around 150 plant disease informations were stored in this database. User can utilize this phytopatho system for agricultural fields and plant disease control.

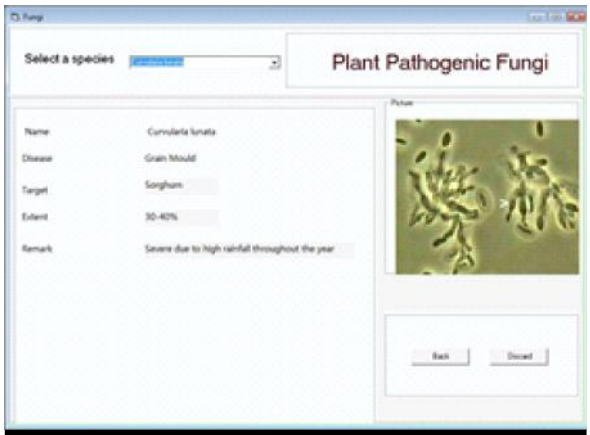

Fig. 3 : The microscopic picture of the organism is shown at the side of the window

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