

sampling of reared crabs. The "water crabs" of 150-500 gm can attain a final weight of 250-650 gm during 3-4 weeks (CIBA, 2000).

Maintenance of water quality

For the maintenance of water quality suitable for crab culture temperature should be maintained in between 28-32°C, dissolved O₂ 5-7 ppm, pH 7.5-8.5 and depth 0.5-1.0 m of water bodies. Cleaning of screen and maintenance of regular water supply flow are also taken as the measures of water management.

Harvesting

Table sized (mature) crabs can be caught with the help of a scoop net. The crabs can also be harvested by baited lift net and bamboo cages/traps.

Socio-economic condition of Fisherman

The plight of the fisher folk of North Bihar are most backward in respect of social, economic as well as educational background and regarded as the marginal farmers. Their

life is a woeful tale of continuous struggle for survival against various socio-economic odds and handicaps. They are poorest of the poor population of this area and are exploited by the middleman and money lenders. They do fishing with simple, indigenous and age-old implements.

Aquaculture, as an economic activity, is gaining gradual popularity in the rural areas of North Bihar. Still it is taken up mainly as a subsidiary occupation by different socio-economic groups. The potentiality of the crab production, propagation, conservation and management offers employment and jobs to a considerable population of this agro-aquacultural area of Bihar.

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Soil-borne Fungi of Cultivated Lands of Biratnagar, Morang District, Nepal

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Several microorganisms may associate in the different layers of soil. The disease caused by microorganisms that live in the

soil is referred to as soil borne disease and pathogen as soil borne pathogen. The fungi (pathogenic and non pathogenic) that are

associated in the soil are known as soil borne fungi.

Soil is the source of organic and inorganic nutrients providing the energy for fungi, bacteria and actinomycetes. The decomposition process of organic matter contributes to the maintenance of the nutrient status of soil providing an environment suitable for different types of fungi. The analysis of soil shows diverse types of fungi both pathogenic and non pathogenic.

The occurrence of fungi varies with the depth of soil (Baruah, 1982). *Mucor*, *Aspergillus*, *Rhizopus*, *Trichosporium*, *Cladosporium* and *Helminthosporium* are generally found on the superficial layer of soil. *Penicillium*, *Alternaria*, *Trichoderma*, *Trichothecium*, *Fusarium* and *Mycelia sterilla* are found in soil from 5.08 cm-15.24 cm depth where as at a depth of 30.48 cm there are only two isolates of *Penicillium* and *Trichoderma* and in 60.96 cm depth there are no fungi at all.

Biratnagar (26°29'N and 87°16'E, 72 msl) is the second largest town and largest industrial town of Nepal. This region is a part of the alluvial plain of the northern Indian subcontinent. Soil of the area is made up of materials transported and deposited in relatively recent times by the tributaries of the Ganga. Being immature, soil has no profile. The general soil texture is sand 40%, silt 40%, clay 20% and phosphorus 0.004-0.464 (Bhatta, 1977). The climate of Biratnagar is sub-tropical monotonous and humid type. Herbaceous plants are the dominant components of the vegetation of Biratnagar bearing 73% of dominance value in terms of floristic composition (Jha and Siwakoti, 1987). Except a few thin patches of natural forests here and there, most of the

trees present in this region are planted. Lack of natural trees and shrubs is due to the biotic pressure. Alluvial soil, high temperature and adequate rain irrigation and comparatively easy availability of agricultural inputs favour cultivation of two or more crops in a year in this area. The principal crops are paddy, wheat, maize, potato, oil seed, lentil and pigeon pea while sugarcane and jute are cultivated as cash crops. About 59% of total land of Biratnagar is utilized for agriculture. The farmers of this region are suffering from heavy losses caused by various types of plant pathogens. Among them soil borne pathogens are very destructive and cannot be controlled easily.

The soil mycoflora of Nepal has not been adequately investigated so far. In Biratnagar, no earlier work was done in this field and this work tried to explore the soil borne fungi of Biratnagar and to prepare list and description of the observed fungi.

Soil samples were collected from different crop fields in Jamungachhi, Avivadan tole, Campus field, Janapath tole and Mills area of Biratnagar. Soils of different depths viz. 0 cm, 0-10 cm, 10-20 cm and 20-30 cm were taken aseptically with the help of sterilized steel tube. Five or more such cores of soil samples were collected randomly in the spots. The soil of each different depth was mixed with the soil of same depth of different cores of a spot to make composite samples. Then the soil samples were dried in room temperature and stored in refrigerator at 4°C. These samples were used for studying soil pH and soil texture. The soil pH was determined by using digital pH meter (model 153 R, Toshon, India) and the texture was determined by sieving and weighting method (Piper, 1944).

Table 1. Soil pH at different depths of different spots.

S.N.	Depth (cm.)	Areas (pH)				
		Jg	At	Cf	Jt	Ma
1	0	8.1	7.4	7.2	7.8	7.3
2	0-10	7.7	7.1	7.1	7.6	7.3
3	10-20	7.1	7.1	6.8	7.6	7.1
4	20-30	7.1	6.8	6.6	7.2	7.2

Jg= Jamungachhi, At= Abivadan tole, Cf= Campus field, Jt= Janapath tole, Ma= Mills area

Table 2. Soil borne fungi obtained from different spots by War-cup plate method.

S.N.	Name of fungi	Family	JG	AT	CF	JT	MA
1	<i>Acrostalagmus sp.</i>	Moniliaceae	+	-	-	-	-
2	<i>Alternaria brassicola</i>	Dematiaceae	-	+	-	-	-
3	<i>Alternaria tenuis</i>	Dematiaceae	-	-	+	-	-
4	<i>Aspergillus flavus</i>	Aspergillaceae	+	-	-	-	-
5	<i>A. niger</i>	Aspergillaceae	-	-	+	-	+
6	<i>A. fumigatus</i>	Aspergillaceae	-	-	-	+	-
7	<i>Choenophora sp.</i>	Cherophoraceae	-	-	+	-	-
8	<i>Cladosporium sp.</i>	Dematiaceae	-	+	-	-	-
9	<i>Cunninghamella sp.</i>	Cunninghamellaceae	-	-	+	+	-
10	<i>Curvularia sp.</i>	Dematiaceae	-	+	-	-	-
11	<i>Fusarium sp.</i>	Tuberculariaceae	+	-	+	+	+
12	<i>Fusarium sp. (ii)</i>	Tuberculariaceae	-	+	-	-	-
13	<i>Gliocladium sp.</i>	Moniliaceae	-	-	-	+	-
14	<i>Gongronella butleri</i>	Mucoraceae	-	+	-	-	-
15	<i>Helminthosporium sp.</i>	Dematiaceae	-	-	-	+	-
16	<i>Mucor racemosus</i>	Mucoraceae	-	+	-	-	-
17	<i>Penicillium citrinum</i>	Aspergillaceae	-	-	+	-	-
18	<i>P. granulatum</i>	Aspergillaceae	+	-	-	-	+
19	<i>P. purpurogenum</i>	Aspergillaceae	-	-	-	+	-
20	<i>Rhizoctonia sp.</i>	Mycelia Sterelia	-	-	-	-	+
21	<i>Rhizopus sp.</i>	Mucoraceae	+	+	+	+	+
22	<i>Stysanus sp.</i>	Stilbellaceae	-	+	-	-	-
23	<i>Verticillium sp.</i>	Moniliaceae	-	-	+	-	-

The media used for the cultivation of micro-organism was sterilized by means of autoclave (Aneja, 1993). Soil was incubated by War-cup method. About 0.15 g air dried soil sample was kept each in five sterile petridishes and 20 ml of melted, cooled medium was added with the help of transfer loop. Soil particles were dispensed throughout the medium by gentle rotation of the petridishes. The plates were allowed to solidify and incubated at 25°C in an inverted

position for 15 days. The fungi grown were observed carefully. Finally, they were isolated by direct inoculation method, slides were made, photographs were taken and identification of fungi was done following Barnett (1960), Barron (1966), Gilman (1957) and Ellis (1971).

In the present investigation the relation of soil borne fungi with soil depth, soil pH and soil texture of the cultivated lands at Biratnagar was studied. The soil pH affects

the distribution pattern of soil fungi. There was a high variation in the value of soil pH for different spots of Biratnagar area. The soils of all investigated spots were slightly alkaline in nature. The soil PH ranged from 6.6-8.1. With the increase of soil depth, pH value decreased. The soil fungi obtained were more or less in the same ratio from each site. However, more fungi were obtained from campus field and Avivadan tole soil. According to Ranjan and Sigh (1973), the population of fungi was lower in alkaline soil. The present result showed a little peculiar relationship between soil fungi and soil pH in comparison with above mentioned fact.

Soil texture is also one of the factors that affect the distribution pattern of soil fungi. The soil textures of the research spots of Biratnagar area were loam and sandy loam. There was a slight variation in the percentage of sand, silt and clay for different horizon of the same site. However, it did not affect the soil texture. There was no variation in texture for five sites. There were only two types of texture. So in this work we could not get significant result on taking account of relationship of soil fungi and with soil texture.

The present research work showed that various factors play important role in the distribution and growth of soil fungi. Greater numbers of species are present near the surface layer than deeper in the soil profile. Growth and population of fungi are governed by various factors like temperature, O₂ concentration, CO₂ concentration, light, moisture, organic and inorganic nutrients present high percentage on the superficial layer. Those factors favour in the development and sporulation of soil fungi as a result of which more fungi

are found near the surface layer than deeper in the soil profile.

The total numbers of fungi obtained were above 30, out of which 23 fungi belonging to 17 genera were identified. The most dominant species were *Aspergillus*, *Fusarium*, *Penicillium* and *Rhizopus*.

From the present investigation, it can be concluded that microorganisms are neither uniformly distributed throughout the soil profile nor throughout a single soil horizon. The various factors (soil, soil texture, soil depth, pH, organic and inorganic nutrients) play important role in the distribution and growth of soil borne fungi. Greater numbers of species are found at surface layer than deeper in the soil profile.

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