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ISOLATION IDENTIFICATION AND CONTROL OF EARLY BLIGHT OF POTATO

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ABSTRACT

Estimates that were correct as of July 2019 suggest that the overall number of people living on our planet is somewhere in the neighborhood of 7.7 billion (Worldometer, n.d.), and that number is fast increasing with each passing second. In terms of demographic data, India is currently the second most powerful nation in the world, and the great majority of people who live in the city consider the countryside to be their permanent residence. Every living creature is required to have a meal in the morning and another in the evening on a regular basis. Breakfast and dinner are the most important meals. As a consequence of this, the vast majority of people all over the globe depend on the staple food crops, such as rice, wheat, and maize, in order to meet their day-to-day needs for the intake of food and to prevent themselves from going hungry. (Hong et al., 2017 and Spooner, 2013) Potatoes, scientifically known as Solanum tuberosum and colloquially referred to as spuds, are the crop that are ranked as the world's fourth most significant and important staple food crop, after cereals. The word "staple" refers to a category of food that is included in the diets of the vast majority of individuals within a certain community. According to the Resource library that is kept up to date by National Geographic (n.d.), the foods that are considered to be "staples" are those that are eaten often and on a daily basis. When growing any sort of crop, having soil that is not only nutrient-dense but also in healthy shape is of the utmost significance.

keywords: Isolation, Identification, Control of Early, Blight of Potato

INTRODUCTION

According to estimates that were accurate as of July 2019, the total number of people living on our planet is around 7.7 billion (Worldometer, n.d.), and that number is rapidly growing with each passing second. India is now the second most powerful nation in the world.in terms of demographic figures, and the vast majority of the city's residents call the countryside their home. The consumption of a breakfast and an evening meal on a daily basis is obligatory for all living things. Because of this, the majority of people all over the world rely on the staple food crops, such as rice, wheat, and maize, in order to satisfy their daily requirements for food consumption and avoid going hungry. (Hong et al., 2017 and Spooner, 2013) After cereals, the potato (Solanum tuberosum), sometimes known as the spud, is the crop that is considered the fourth most significant and vital staple food crop globally. The term "staple" refers to a kind of food that is consumed by the majority of people in a population's diet. According to the Resource library maintained by National Geographic (n.d.), staple foods are defined as those that are consumed often and on a daily basis. When planting any kind of crop, having soil that is rich in nutrients and in good condition is of the highest importance. Soil is a mixture of many different components, including pulverized rocks, liquids, organic matter, bacteria, and minerals, to name a few. It is one of the most important natural resources.

SYMPTOMS OF SOIL-BORNE DISEASES

The soil, which is the basis of agriculture, is also the location of many of the challenges that crops must overcome. Diseases that are carried by the soil are one of them. The potato, which is the most important non-grain food product, is also susceptible to a variety of illnesses that are carried by the soil. A research found that potatoes are susceptible to more than 40 distinct illnesses and pests, including those caused by insects, nematodes, viruses, bacteria, and fungus (Fiers et. al., 2012). The symptoms of soil-borne diseases that affect potatoes fall into one of two broad categories, depending on the type of damage they cause to the tuber or other parts of the plant. These categories are referred to as I symptoms showing damage to tuber and (ii) symptoms showing damage to other parts of the plant (Gudmestad et. al., 2007 and Fiers et. al., 2012). Fungal infections are among the many factors that contribute to the problem, but they are the ones that result in the most economic damage to the potato

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business. The Late Blight of potato, Silver Scurf, Pink rot, and Dry Rot are the most common fungal infections that may affect potatoes.

According to Secor and Gudmestad (1999), three diseases that might affect potatoes include verticillium wilt, rhizoctonia, and early blight. The illness known as Early Blight is already fascinating just by its name. This illness does not manifest itself in the early stages of the potato's growth, despite the fact that its name suggests otherwise. Additionally, it takes place throughout the process of maturation (ElMougy andAbdel-Kader, 2009). Alternaria solani is the fungus that is responsible for Early Blight (Herriott et al., 1990 and Mamgain et al., 2013). [Citations needed] [Citation needed] Potatoes are susceptible to fungus infections, notably those caused by Alternaria solani, and this is the area of our research that we are concentrating on.

More than one hundred nations throughout the globe cultivate the species Solanum tuberosum, which is a member of the family Solanaceae and the order Solanales. It can be grown in temperate, subtropical, and tropical zones since they are the ones that have the best environmental conditions for doing so. Temperatures in the range of 18 to 20 degrees Celsius (64 to 68 degrees Fahrenheit) are ideal for the plant's development, since it is almost always grown by planting tubers. (FAO declared 2008 the International Year of the Potato, while the TNAU Agritech Portal dedicated 2013 to the potato).

WONDERFUL SOURCE OF ENERGY

Potatoes are a wonderful source of energy for those who want to eat a diet that is high in carbohydrate content since they are an abundant supply of vitamin C, some of the B vitamins, and potassium. Potatoes also contain very little protein and fat. Additionally, the antioxidant activity that has been shown in potato is of a very high quality. Potatoes are a highly lucrative investment from both a financial and a nutritional standpoint (Brown, 2005; Camire et al., 2009; and Kumar et al., 2012). Glutathione, ascorbic acid, quercetin, and chlorgenic acid are the four types of antioxidants that may be found in potatoes. These are water-soluble and function as free radicals in the body (Al-Saikhan et. al., 1995). Because of its high nutritious content, the "King of vegetables" is eaten by more than one billion people all over the globe.

AGRICULTURE PLAYS A SIGNIFICANT ROLE

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India's economy, which makes sense given that India is known as the "land of agriculture." The diversity of India's soil helps sustain many different kinds of plants and serves as the foundation for the country's agricultural industry. The ancient categorization of soils divided them into two primary categories: fertile (Urvara) and barren (Usara), with the former denoting rich soil and the latter denoting barren soil. (From the NCERT's Soils). After some time, the categorization underwent certain changes that were intended to be more specific. The solid phase, the liquid phase, and the gaseous phase are the three components that make up the soil's three-phase system. (da \sSilva).

The Indian soils have been classified by The National Bureau of soil survey and the Land Use Planning an Institute under the control of The Indian Council of Agriculture Research (ICAR), into the following types, which are comparable on an international level. This was accomplished after extensive research was conducted by scientists. According to the soil taxonomy established by the United States Department of Agriculture (USDA), soils are classified as Inceptisols, entisols, alfisols, vertisols, aridisols, ultisols, mollisols, and other types. Other types of soils are also recognized.

The names that are recognizable to us and the categories that we have a better understanding of characterize Indian soils on the basis of their texture, color, moisture content, climatic conditions, human activities (grazing, farming, etc.), disproportionate rainfall, and many other factors. These include alluvial soil, black soil, red and yellow soil, laterite soil, desert soil, salty soils, peaty soil, and forest soil. Other types of soil include alluvium, black soil, red and yellow soil, and peaty soil. (NCERT's Soil map of India for 2019, as well as Soils)

Alluvial soil, red soil, and laterite soil are examples of the types of soil that are beneficial to the development of potatoes. These soil types were addressed before in reference to the settings that are conducive to the growth of potatoes. The health of every crop may be traced back to the soil it was grown in. A serious damage of crops is possible if there is an imbalance in any of the parameters. The section of Malwa Plateau that is the focus of the present study has soil that is medium dark in color and gravelly in texture. This region also gets an adequate amount of rainfall and is very advantageous for the agricultural sector.

There is a large community of helpful microbial populations that interact with plants; these populations, which may be grouped into three groups, can be broken down as follows: These bacterial populations, along with the plants themselves, are responsible for the plant's

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nutrition as a result of an increase in the supply of mineral nutrients to the plant. In the first category, we can put those microorganisms that are capable of playing a crucial role during the nourishment of the plant. Even if certain microorganisms are incapable of directly interacting with the plant, they are nonetheless beneficial to the plant because they influence the biotic and abiotic parameters of the soil, which in turn have a favorable effect on the development of the plant.

In the second category, we can generally count those bacterial groups that are capable of defeating the pathogenic microorganisms. In this way, the microorganisms stimulate plant growth by protecting it from undesirable microflora. These kinds of microorganisms are referred to as biocontrol agents, and they are the ones that are used in biological control of the disease in plants. A third category consists of the microorganisms that are responsible for encouraging direct growth. For instance, some bacteria are responsible for the production of phytohormones (Welbaum et al., 2004).

OBJECTIVES

1. To study on the isolation identification and control of early blight of potato
2. To study on the challenges that crops must overcome.

REVIEW LITERATURE

Arora, et. al., 2014, Lesions on the tips and edges of the leaves, initially a light green color, eventually develop into patches that are necrotic and purple-black in color as a result of this illness. Lesions of a brown color may be detected on the stems.

Rich, 2013, Canker, commonly referred to as gangrene, is a fungal illness that is caused by Phoma spp. and is another name for gangrene. The majority of the time, the illness is caused by improper storage conditions and affects tubers. The most noticeable signs of this illness, which manifest themselves on tubers, are depressions that are dark in color. The dry rot of potato, which is caused by Fusarium spp., is another name for this plant that is widely mentioned in relation to it. It is possible to see a wet rot in tubers that have been kept after harvesting; however, this is only the case if the tubers were stored in an environment that was too humid (Rich, 2013).

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Odilbekov et al. (2014) conducted a more in-depth research to investigate the early blight resistance of a variety of potato cultivars in order to find out which ones were the most resistant. We were able to observe and analyze the phenotypic of the disease's progression as well as its occurrence. Experiments in both the greenhouse and the field were carried out in order to record the symptoms of the illness and investigate the possibility of a connection between them. The comparison of sickness symptoms was done based on the location of the leaves. The findings indicated that there was a correlation between the lower and middle leaflets as well as the middle and higher leaflets.

Researchers Abdullahi et al. (2016) conducted research on the management of the early blight disease and its treatment using bioagents such as Trichoderma viride, Pseudomonas fluorescens, and Bacillus thuringiensis. After inoculating the potato plants, the group of researchers discovered the growth characteristics of the potato plant. Following the early blight pathogen, treatment was carried out using bioagent formulations. On a weekly basis, the signs of the early blight illness and the development of the potato plant were observed.

RESEARCH METHODOLOGY

Collecting Soil Samples The collection of soil samples from the rhizosphere was carried out with the use of a soil corer that had a diameter of 3 centimeters at a depth of 0–20 centimeters (Riley and Barber., 1970), and rhizoplane components from plant roots were gathered. The potato fields in various villages located in the Depalpur, Indore, and Sanwer tehsils of the Indore district of Madhya Pradesh were sampled three times: once during the seedling stage, once at the peak of vegetative growth, and once when the fruit had formed. The sampling took place from October/November to February/March. A total of thirty samples of field soils, known as the rhizosphere, and thirty samples of plant root materials, known as the rhizoplane, were taken from a variety of sites. The samples that were gathered were cut in half, with each half receiving separate examinations: the first half was examined for bacterial growth, while the second half was examined for fungus identification and analysis.

DATA ANALYSIS

SOCIO-ECONOMIC STATUS OF FARMERS OF INDORE DISTRICT OF M.P.

For the purpose of this inquiry, the farmers who were questioned were chosen at random in

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order to ensure that reliable information was obtained. Using a questionnaire form with the appropriate level of structure, they were questioned about their ages, levels of education, levels of income, types of families, and occupations. The data that were obtained were then organized further in accordance with the requirements of the statistical test.

Age and education status:

The age of farmers is believed to be a highly essential biological and socio-demographic aspect. Age is seen to indicate both the mental capacity of a person as well as their past experience, both of which are directly related to the management of crops.

Table 1 Table Shows The Farmers Age Group Distribution, Engaged InAgriculture.

S. No.	Range of Age	Frequency	Percent
1	20- 25	7	5.147058824
2	26- 30	14	10.294116
3	31-35	20	14.70588
4	36-40	29	21.323526
5	41-45	25	18.38235
6	46-50	21	15.441174
7	51-55	12	8.823528
8	56-60	8	5.882352
Total		136	

The previous

The study provided information on the ages of potato farmers in the Indore district of

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Madhya Pradesh. These farmers are engaged in the cultivation of potatoes. During our study, we discovered that the majority of persons between the ages of 26 and 50 were active in potato farming. This age group accounts for more than 80 percent of the total. The gathered statistics suggest that young people aged 20 to 35 are losing interest in agriculture as a result of modernisation. This trend was also seen in a previous research conducted in India (Mikell., 2014). In the Indore district of Madhya Pradesh, the age group 41 to 45, followed by the age group 46 to 50, is the one that has the most significant contribution to the agricultural activity. The present figure makes this point even more evident.

Fig. 1 Figure Showing The Distribution Of Age Group Of Potato FarmersOf Indore District Of Madhya Pradesh.

Table 4. 2 Table Showing The Education Status Of Farmers.

S. No.	Education level	Frequency	Percent
1	Illiterate	47	34.55
2	Primary (5^{th} to 8^{th})	35	25.74
3	Secondary level (9^{th} to 12th level)	29	21.32

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4	Under graduate	20	14.71
5	Post graduate	5	3.68
		136	

Literacy is an important demographic indicator and a good indication of human growth. It is one of the demographic elements that is most important. It is necessary for the modernisation of society, the improvement of people's quality of life, and the planning of labor for accelerated economic growth. Education instills fresh perspectives that are essential to the evolution of a community and the growth of a country. A high literacy rate is a direct reflection of the social progress that is connected with economic growth. According to Table 4.3, the overall literacy rate among farmers was reported to be 65.44%. The proportion of illiterate farmers who were questioned was 34.56%, thus this indicates that the overall literacy rate among farmers was 65.44%. 25 percent of them acquired their education at the elementary level, followed by 21.32 percent who completed their education at the secondary level. This literacy rate was reported to be somewhat lower than what was recorded at the national level (Jhariya et al.,2014).

ISOLATION AND IDENTIFICATION OF BACTERIAL SPECIES

The collection of rhizoplane materials and soil samples from the rhizosphere were carried out. Rhizosphere samples were also taken. The sample of the soil and root materials was finished during the seedling stage, peak of vegetative development, and fruiting of potato from potato fields (Figure4.6) from various villages in the Indore district of Madhya Pradesh's Depalpur, Indore, and Sanwer tehsils. From a variety of potato fields that were chosen at random, a total of thirty field soil samples (called the rhizosphere) and thirty root material samples (called the rhizoplane) were obtained. The samples that were obtained were cut in half, and one half of each sample was examined for microbial contamination. Using the approach of serial dilution, many bacterial species were cultured on a medium consisting of nutritional agar.

Table 4. 3 Some Biochemical Characteristics Of Isolated Bacterial Species

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Isolate Test	**BS -1**	**BS -2**	**BS -3**	**BS -4**	**BS -5**	**BS -6**	**BS -7**	**BS -8**	**BS -9**	**BS - 10**	**BS - 11**	**BS - 12**
Cell shape	rod	rod	rod	rod	rod	rod	rod	Rod	rod	rod	rod	rod
Gram staining	-	-	-	+	-	+	+	-	+	-	-	+
Methyl Red (MR)	-	-	-	-	-	-	+	-	-	-	-	-
Citrate utilization	-	+	+	+	+	+	+	-	+	-	-	+
Voges–Proskauer (VP) test	-	+	-	+	-	-	-	-	-	-	-	+
Carbohydrate Fermentation			-					+				
Starch Hydrolysis			-			+	+		-			
Catalase Test	+	+	+	+	+	+	+	+	+	+	+	+
Motility	-	+	+	+	+	+	-	+	-	+	+	+

MOLECULAR INVESTIGATION OF ISOLATES

Recent years have seen an increase in the frequency with which 16S rRNA gene analysis is used for the purpose of identifying bacteria. This technique contributes to the phylogenetic and taxonomic research of bacteria. This molecular technique is chosen for a

number of reasons, one of which is the existence of a lengthy DNA sequence that is conserved and consists of 1,500 base pairs (1,500 bp) in all bacteria (Patel, J. B. 2001). Assigning close ties at the genus level (Clarridge JE., 2004) and in many instances at the species level is made possible by the molecular research of 16S rRNA thanks to these characteristics. Additionally, in 16S databases (Conlan et al., 2012; Fettweis et al., 2012 and Newton et al., 2012), which provide almost full length sequences for a variety of strains. Because of this, in the current work, in addition to morphological and biochemical analysis, we have also employed molecular analysis. The phenol chloroform technique was used to extract genomic DNA from the bacterial culture after it had been cultivated in LB broth and all of the separate bacterial pure cultures had been produced there.

PHYLOGENETIC ANALYSIS AMONG BACTERIAL ISOLATES, ISOLATED FROM DIFFERENT TEHSIL OF INDORE DISTRICT OF MADHYA PRADESH

Phylogenetic analysis of bacterial isolates was carried out with the assistance of online software (CLUSTAL 2.1) by using the bacterial isolates' respective DNA sequences, which were acquired by the DNA sequencing of the 16S RNA gene of bacterial isolates. The evolutionary relatedness was shown through phylogenetic analysis based on genetic similarities between the species. The phylogenetic tree that was based on the DNA sequence displayed two major clusters, which were labeled clusters I and cluster II. Cluster I displayed genetic homogeneity among the genera of Enterobacter and Providencia. Both of these genera also displayed genetic similarity with genera of Pseudomonas. Cluster II displayed genetic similarity with genera of Pseudomonas. There is a striking resemblance between all of these cluster and Rhizobium and Streptomyces. It was revealed that a few members of bacillus and Pseudomonas showed genetic variance from the rest of the cluster I members. This subcluster IA showed sequence similarity with other strains of bacillus genera (IB), and it was intriguing to note that these few members showed genetic variety. The following findings were accomplished with the help of CLUSTAL 2.1 software.

Table 4 The List Of Selected Bacterial Isolates Using Morphological,Biochemical, And Molecular Techniques Used For Antagonistic Activity.

S. No	Code	Bacteria
1	**BS-1**	Chryseobacterium indologenes

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2	**BS-2**	Pseudomonas fluorescens
3	**BS-3**	Pseudomonas aerogenosa
4	**BS-4**	Bacillus subtilis
5	**BS-5**	Pseudomonas putida
6	**BS-6**	Brevibacillus brevis
7	**BS-7**	Bacillus megaterium
8	**BS-8**	Rhizobium daejeonense
9	**BS-9**	Bacillus endophyticus
10	**BS-10**	Rhizobium sp. Strain
11	**BS-11**	Rhizobium sp.
12	**BS-12**	Bacillus subtilis

The microbial isolates that live in the environment around plant roots are referred to as rhizospheric microorganisms. Rhizospheric microorganisms may act as biocontrol agents. The influence that these bacteria have on the development of plants might be beneficial, neutral, or negative. Microbes in the rhizosphere that have beneficial properties can stimulate plant growth in two ways: directly, by increasing the plant's capacity to acquire water and minerals; indirectly, by inhibiting the development of phytopathogens. Rhizospheric microbes that have beneficial properties can produce phytohormones, increase plant accessibility to inorganic compounds, and solubilize them.

QUANTITATIVE STUDY OF MICROFLORA (BACTERIAL SPECIES) OF RHIZOSPHEREAND RHIZOPLANE

In the current research, we evaluated the microbial population (the species of bacteria) in soil samples obtained from the Depalpur, Indore, and Sanwer tehsils located within the Indore district in the state of Madhya Pradesh, India. These tehsils are located in India. The

standard dilution plating technique, which is used for the quantitative investigation of microflora (Atlas Ronald, 1984), was used to assess the total counts of bacteria that were isolated from the rhizospheric soils and the rhizoplane. The results of this analysis are displayed in Table 6.

We detected a range of 4.46 106 to 7.06 106 CFU gm-1of soil after conducting bacteria counts in the rhizosphere soils of potato farms across all of the examined tehsils in the Indore district of Madhya Pradesh. When we compared the bacterial distribution in soil samples from the different villages that make up the three tehsils that make up the Indore district, we were unable to report any significant variation. However, we were able to report monthly variations in the number of bacterial CFU that were found in soil samples collected during the various stages of growth of the potato plant. When soil samples were obtained at the seedling stage, it was found to have a low amount (4.46 106 CFU gm-1 of soil), but it was discovered to have a high amount (7.06 106 CFU gm-1 of soil) during the peak of vegetative development, which was then followed by the fruiting stage of the potato plant (table), Das and Dkhar (2011) likewise noticed monthly fluctuations in the bacterial population, and they reported data of inhabiting bacterial population occurrence that were similar to those recorded by Das and Dkhar (2011).

Rhizospheric bacteria compete with one another for nutrients, water, and space, and on occasion boost their competitiveness by developing a treasured link with the plant they are associated with (Hartmann et al., 2009). These specific strains of bacteria play important functions in the development of the plant and in determining its capacity to thrive in its environment. Plants also encourage the growth of microorganisms in their surroundings by secreting secondary metabolites, which are a fundamental requirement for the development of certain bacterial strains. Because of this, earlier studies supported the more dense colonization of bacteria in the rhizospheric area of soil than in the non-rhizospheric area (Ridder-Duine et al., 2005).

Table 4. 5 Bacterial Quantification Of Rhizospheric Soils Potato Fields Of Indore District Of Madhya Pradesh.

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S. No.	**Tehsil of Indore District**	**The seedling stage** (10 samples mean value given inthis table)	**The peak of vegetative growth** (10 samples mean value given inthis table)	**The fruiting of potato** (10 samples mean value given in this table)
1	Villages of Depalpur	4.33×10^6 CFU gm^{-1} of soil	7.33×10^6 CFU gm^{-1} of soil	6.33×10^6 CFU gm^{-1} of soil
2	Villages of Indore	5.12×10^6 CFU gm^{-1} of soil	7.53×10^6 CFU gm^{-1} of soil	6.25×10^6 CFU gm^{-1} of soil
3	Villages of Sanwer	3.92×10^6 CFU gm^{-1} of soil	6.32×10^6 CFU gm^{-1} of soil	5.73×10^6 CFU gm^{-1} of soil
Average values of all district in different stages		**4.46×10^6**	**7.06×10^6**	**6.10×10^6**
Quantification of rhizoplane soils Potato fields of Indore district of Madhya Pradesh				
S. No.	**Tehsil of Indore District**	**The seedling stage** (10 samples mean value given in this table)	**The peak of vegetative growth** (10 samples mean value given in this table)	**The fruiting of potato** (10 samples mean value given in CFU gm^{-1} of soil)
1	Villages of Depalpur	5.43×10^6 CFU gm^{-1} of soil	8.48×10^7 CFU gm^{-1} of soil	7.21×10^7 CFU gm^{-1} of soil
2	Villages of	6.82×10^6 CFU gm^{-1}	8.42×10^7 CFU gm^{-1}	7.92×10^7 CFU gm^{-1}

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	Indore	of soil	of soil	of soil
3	Villages of Sanwer	6.27×10^{6} CFU gm^{-1} of soil	8.12×10^{7} CFU gm^{-1} of soil	8.87×10^{7} CFU gm^{-1} of soil
Average values of all district in different stages		**6.17×10^{6}**	**8.67×10^{7}**	**8.00×10^{7}**

FUNGUS QUANTIFICATION

The various types of secondary metabolites that are secreted by a specific plant into the area surrounding its roots include carbohydrates, organic acids, enzymes, nucleotides, vitamins, flavonoids, and hormones, as well as some volatile compounds. These substances have the potential to affect the growth of the microbial population in either a positive or negative way, and as a result, every plant has its own rhizospheric microbial ecosystem (Prescott, Harley and Klein 1999). Along with the bacterial population, we quantified the occurrence of fungal strains at the rhizospheric region and surface of roots (rhizoplane) from the samples collected from potato field in the Depalpur, Indore, and Sanwer tehsils of the Indore district in Madhya Pradesh, India. These tehsils are located in the state of India. For the purpose of conducting a quantitative investigation of the microflora, the time-honored technique of dilution plating was used to count the total number of fungal colonies (Atlas Ronald, 1984).

During this quantification study of fungus from the rhizosphere region and rhizoplane samples of potato fields of all selected tehsils of Indore district of Madhya Pradesh, we reported the range from 2.77 103 to 4.94 104 CFU gm-1in rhizosphere soil. Rhizoplane samples were taken from potato fields of all selected tehsils. We have noticed a slight variation in the dispersal of fungal species in soil samples taken from different villages in three different tehsils within the Indore district. On the other hand, significant differences were reported in the fungus CFU count in soil samples taken from the rhizosphere region of potato plants at various stages of development. It was reported to be low (2.77 103 CFU gm-1 of soil sample) in soil samples collected during the seedling stage, but the count was reported to be on the higher side (4.94 104, 4.89 104) in both stages such as the peak of vegetative growth and the fruiting stage of the potato plant (table). Almost the same pattern

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of fungal species was previously documented by bu-Dieyeh et al., (2010), and they also observed monthly variations in

CONCLUSION

The present population of human beings on our world is roughly 7.7 billion, and it is increasing at a very rapid rate every second. India is the second most populous nation in the world, and the majority of its people live in rural areas. India is the second most populous country in the world. Every living thing has a fundamental need to consume food on a regular basis, and humans are no exception. Rice, wheat, and maize are examples of staple crops, and the majority of people around the globe rely on these foods to satisfy their daily requirements for food. After these grains, the potato becomes the fourth most significant crop and the fourth most important staple food crop across the globe. The term "staple" refers to a kind of food that is consumed by the majority of people in a population's diet.

The potato, which is the most important non-grain food product, is also susceptible to a variety of illnesses that are carried by the soil. A recent research found that potatoes are susceptible to more than 40 distinct illnesses and pests, including those caused by insects, nematodes, viruses, bacteria, and fungus. Potatoes are susceptible to a wide variety of fungal diseases, the most common of which are early blight of potato, late blight of potato, silver scurf, pink rot, dry rot, verticillium wilt, and rhizoctonia.

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