Studies on the Diversity of the Fungi Symptoms in Some Local Vegetables (Solanaceae family) From Boko Area, District Kamrup, Assam.

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Abstract

Potato, Tomato, Brinjal and Bell Peppers are important vegetables with nutritional properties. These important vegetables are infected by various micro fungi, in the storage as well as in the market condition. The infection of the micro fungi on these important vegetables is responsible for decaying and there by the vegetable are becoming unhealthy and non consumable. This affect on the vegetables cause huge economic losses to the grower, whole sellers and the retailers.

This investigation encompasses the major causes of postharvest losses in vegetables (Potato, Tomato, Brinjal and Bell Peppers) due to fungal pathogen. Postharvest diseases vary each year and a wide range of air spores like fungal spore, pollen, bacteria, insects, etc cause diseases. The spores of fungi which cause diseases of vegetables after harvest is called post harvest disease of vegetables. The most frequently present fungi are Phytophthora sp., Alternaria sp. Fusarium, etc.

Postharvest disease of vegetable is influenced by the meteorological parameter i.e. rainfall, temperature, humidity and production area, cultivar, cultural practices and planting material. These factors may have a direct influence on the development of the disease by reducing the source of inoculums or by discouraging infection. Alternatively they may affect the physiology of the produce in a way that impacts on disease development after harvest.

From the investigation on postharvest disease of Potato, Major fungal diseases which affect the crop are late blight, early blight, black scurf, fusarium dry rot, wart, powdery scab and charcoal rot ,Tomato Gray mold and soft rot are the most important postharvest diseases of tomato worldwide ,Brinjal Common fungal pathogens are Alternaria (Black Mold Rot), Botrytis (Gray Mold Rot), Rhizopus (Hairy Rot), and Phomopsis Rot And Anthracnose, a postharvest disease caused by the fungus Colletotrichum capsici is the most devastating disease of bell pepper .

It was concluded that the environmental factors like temperature, humidity and rainfall are the main abiotic factors which are responsible for the cause of postharvest fungal disease of vegetable.

Keywords: Solanaceae, Fungi, Pathogens, vegetables, Symptoms

1. Introduction

Post harvest diseases are those that appear and develop after harvest, the diseases develop on harvested parts of the plants like seeds, fruits and also on vegetables are post harvested disease. Fungal diseases result in significant losses of fruits and vegetables during handling, transportation and storage. At present, post-production fungal spoilage is predominantly controlled by using synthetic fungicides

(Dukare A.S, et al.,2019). The harvested product may get infected on the way to storage or to the market or even before their final consumption. The plants may get infected in the field, but express of symptoms my take place later, at any stage before their final consumption. The quantity of plant products becomes reduced duo to the infection. The plant product may get infected by microorganisms and cause rotting or decaying partially or totally. The seed or grain may get damaged by accumulation of toxic substance, the mycotoxin produced by the infected microorganisms. The amount or extent of damage depends mainly on the pathogen involved on the condition of the product and the condition of storage.

Plant diseases caused by plant pathogenic fungi continuously threaten the sustainability of global crop production. An effective way to study the disease-causing mechanisms of these organisms is to disrupt their genes, in both a targeted and random manner, so as to isolate mutants exhibiting altered virulence. Although a number of techniques have been employed for such an analysis, those based on transformation are by far the most commonly used. In filamentous fungi, the introduction of DNA by transformation typically results in either the heterologous (illegitimate) integration or the homologous integration of the transforming DNA into the target genome. Homologous integration permits a targeted gene disruption by replacing the wild-type allele on the genome with a mutant allele on transforming DNA. This process has been widely used to determine the role of newly isolated fungal genes in pathogenicity. The heterologous integration of transforming DNA causes a random process of gene disruption (insertional mutagenesis) and has led to the isolation of many fungal mutants defective in pathogenicity. A huge advantage of insertional mutagenesis over the more traditional chemical or radiation mutagenesis procedures is that the mutated gene is tagged by transforming DNA and can subsequently be cloned using the transforming DNA. The application of various transformation-based techniques for fungal gene manipulation and how they have increased our understanding and appreciation of some of the most serious plant pathogenic fungi are discussed.

Potato tuber (Solanum tuberosum L.) is popularly known as the Vegetables' King", is the world's most productive vegetable and provides a major source of nutrition and income to many population and communities, and its content in dry matter, edible energy and edible protein makes it of good nutritional quality (Spooner,et al.,2006). Potato is considered as the most consumed vegetable in the world, particularly in many countries where the vegetable basket is considered incomplete without potato (Bradshawa ,et al.,2005).

The story of the potato began with wild potato species that look similar to the nowadays scultivated potato tuber. Wild potatoes are found in the Americas, however, the first cultivated potatoes probably were selected from populations in the central Andes of Peru and Bolivia between 6000 and 10,000 years ago. The first record of potato out of South America is from the Canary Islands in 1562, and the potato rapidly became cultivated in Europe and then worldwide (Jennings ,et al.,1977. Selection and breeding transformed the potato into a set of modern cultivars with more uniform colors and shapes and with improved agronomic qualities such as greater disease resistance and yield .

On the other hand, the controversy about the classification of potato as Linnean species treated under the International Code of Botanical Nomenclature (ICBN) or as Groups under the International Code of Nomenclature of Cultivated Plants (ICNCP) still exists, however, a recent Group classification proposes the first Group classification of the modern cultivars of potato, placing all under the single name (denomination class) of Solanum tuberosum)(Ugent ,et al.,1987) .

From the botanical point of view, potato tuber is a compressed stem, and the eyes correspond to apical and lateral auxiliary buds. Potato tubers are vegetative over-wintering organs and like many other similar dormant organs, such as seeds, corms, buds, exhibit varying degrees of dormancy (Okubo , et al.,2002).

Wild potato species, originating in modern-day Peru, can be found throughout the Americas, from Canada to southern. (Hijmans and RJ; Spooner,2001,) The potato was originally believed to have been domesticated by Native Americans independently in multiple locations,[4] but later genetic testing of the wide variety of cultivars and wild species traced a single origin for potatoes, in the area of present-day southern Peru and extreme northwestern Bolivia. Potatoes were domesticated approximately 7,000–10,000 years ago there, from a species in the Solanum brevicaule complex.(Spooner , et al.,2005)(.Office of International Affairs,1989)(John Michael Francis (2005) In the Andes region of South America, where the species is indigenous, some close relatives of the potato are cultivated .

Ames, et al., 2008 the importance of the potato as a food source and culinary ingredient varies by region and is still changing. It remains an essential crop in Europe, especially Northern and Eastern Europe, where per capita production is still the highest in the world, while the most rapid expansion in production over the past few decades has occurred in southern and eastern Asia, with China and India leading the world in overall production as of 2018.

Varieties cultivated in India :

While there are many different varieties of potato, the most common are:

BHURA ALOO
KUFRI CHIPSONA
KUFRI SINDHURI
KUFRI KHYATI
KUFRI KANCHAN

Raw potato is contain 79% water, 17% carbohydrates (88% is starch), 2% protein, and contains negligible fat (see table). In a 100-gram (3+1⁄2-ounce) portion, raw potato provides 322 kilojoules (77 kilocalories) of food energy and is a rich source of vitamin B6 and vitamin C (23% and 24% of the Daily Value, respectively), with no other vitamins or minerals in significant amount (see table). The potato is rarely eaten raw because raw potato starch is poorly digested by humans (Beazell , et al.,1939)

Table 1.1: Potato**, raw Nutritional value per 100 g :**

Energy	1533KJ(366.39 kcal)
Carbohydrates	81 g
Fat	0.4 g
Protein	9.5 g
Vitamin C	93.8mg
Calcium	57mg
Water	79%

Systematic Position:-

Kingdom: Plantae
Order: Solanales
Family: Solanaceae
Genus: Solanum
Species: S. tuberosum

The center of origin of tomatoes have been debated by many, some are suggesting the center to be the dry coastal desert of Peru (Jenkins, 1948, Preedy and Watson, 2008, Blanca et al., 2012), while others have suggested a dual center with one part in the coastal region between the Andes (Blanca et al., 2012) and the ocean and the second part from South Mexico to Guatemala (Bauchet and Mathilde, 2012). Wild relatives of tomato are distributed in the Andes from Ecuador, through Peru and to Chile (Peralta et al., 2005), growing between sea level and 3300 meters above sea level (Blanca et al., 2012) in diverse climatic conditions. The domestication is still unclear but linguistic evidence has postulated Peru and Mexico as the major regions of domestication (Peralta et al., 2006). Tomatoes are known to be used in cookingin Mexico by the Aztecs already 500 BC and were transferred to the rest of the worldby the conquistadors after the capture of the Aztecs territory (Bergougnoux, 2014).

Taxonomically, tomato belongs to the Solanaceae family. The cultivated tomato belongs to the species Solanum lycopersicum, while Solanum pimpinellifolium is the closest wild relative with a divergence of only 0.6% nucleotide base pairs (The Tomato Genome et al., 2012). A range of other wild tomato relatives are available,e.g. Solanum chmiewelskii, Solanum neorickii, Solanum chilense, Solanum habrochaites, Solanum pennilli, Solanum juglandifolium, Solanum ochranthum, Solanum lycopersicoides, Solanum sitiens, Solanum ecorneliomuelleri, Solanum arranum and Solanum galapagense (Peralta et al., 2006). Despite the fact that wild tomato relatives have contributed limitedly with desirable phenotypic traits to current cultivated tomatoes, interesting alleles for future tomato breeding may still be available in uninvestigated tomato collections (Rendón-Anaya and Herrera-Estrella, 2017)

A large variation has been ascribed to the tomatoes as related to differences in shape, color, flavor and other parameters. Wild tomato are generally small as compared with the domesticated ones (Bergougnoux, 2014), and the differences in size is regarded as a result of changes in a total of six quantitative traits loci (QTL) during the domestication process (Baiand Bergougnoux, 2014).

Cultivated varities of Tomato:

There are several cultivated varieties of Tomato,

Pusa Early Dwarf. A variety developed by Indian Agricultural Research Institute, New Delhi

Rashmi. It is a widely cultivated and determinate variety of tomatoes

Rupali

Sioux

Avishkar

Abhinav

Vaishali

Marglobe

Tomatoes are currently an important food component globally. The tomatoes are in fact the second largest vegetable both in terms of production and consumption (FAO, 2016). Reports from the United States show tomato as the second most consumed fresh vegetable with 6 kg/person in 2017 (USDA, 2016). Tomatoes are known as a source of vitamins and pro-vitamins (vitamin C, pro-vitamin A, β carotene, folate), minerals such as potassium, and secondary metabolites such as lycopene, flavonoids, phytosterols and polyphenols (Beecher, 1998, Luthria et al.,2006). Thus, 100 g of fresh tomato provides over 46%, 8% and 3.4% of the daily requirements of vitamin A (being 900 UE), vitamin C (being 82.5 mg) and potassium (being 3500 mg), respectively (Gebhardt and Thomas, 2002, Canene-Adams.et al., 2005). Furthermore, processed tomato such as soup, paste, concentrate, juice and ketchup (Bergougnoux, 2014) also contribute positively to human health by the content of the mentioned compounds in these products.

Table 1.2:Tomato, raw Nutritional value per 100 g :

Energy	74 KJ(18 kcal)
Carbohydrates	3.9 g
Fat	0.2 g
Protein	0.9 g
Vitamin C	14mg
Calcium	10 g
Potassium	237 mg
Water	94.5 g

Systematic Position:-

Kingdom: Plantae
Order: Solanales
Family: Solanaceae
Genus: Solanum
Species: S. lycopersicum

Cultivated varities of Brinjal :

The available indigenous varieties are Pusa purple oval, Sagalihingia, Pusa Bhairav, Arka Nidhi or BWR-12, Snowy, Kuchia, Bor bengena, White oval, Green oval, Long green, Pusa purple long, Pusa kranti, Khorua -3, Arka Neelkanth, Simran and Pusa purple cluster.

Brinjal or eggplant (Solanum melongena L.) is widely grown vegetable of tropical and subtropical parts of the world. Brinjal or eggplant (Solanum melongena L, 2n = 2x = 24) is an important solanaceous vegetable crop in many countries particularly India, Japan, Indonesia, China, Bulgaria, Italy, France, USA and several African countries. It is one of the most important vegetable crops in Africa, probably the fourth one after tomato, onion and okra. It is grown in almost all states, with an area of 679.4 thousand hectare under cultivation and production of 12438.7 thousand metric tons. The major brinjal growing states in India are Andhra Pradesh, Karnataka, West Bengal, Maharashtra, Orissa, Madhya Pradesh, Bihar, Gujarat and Chhattisgarh. As per FAOSTAT (2016) data, China is the top producer (61% of world output) while India ranks second (25%) in brinjal production. In India, brinjal is extensively grown under diverse agro-climatic conditions throughout the year (Nayak et al. 2014).

Brinjal is a hardy crop than other vegetables. Due to its hardiness, it can be grown successfully in dry areas with minimum irrigation facility. It is a moderate source of Vitamins and minerals .On the other hand, susceptibility of a host plant might be due to enrichment of essential and necessary food materials, especially carbohydrate and proteins have been reported by Sadasivam and Manickam (1992) and Dhaliwal and Dilawari (1993). The brinjal is attacked by 53 species of insect pests (Nayar et al., 1995). The production of brinjal has been seriously affected due to a steady increase in insect pest infestation, especially the fruit and shoot borer (BSFB), Leucinodes orbaonalisGuenn. (Pyralidae: Lepidoptera) which reduces the productivity as well as quality of the fruits. Various insects cause enormous losses to brinjal in all the seasons throughout year in Bangladesh (Alam, 1969). Among them the most serious and destructive one is the brinjal shoot and fruit borer, Leucinodes orbonalisGuenee, in Bangladesh (Alam and Sana, 1964; Alam, 1969) and India (Tewari and Sandana, 1990), (Jat and Pareek, 2003), (Rahman,2007) and in other countries of the world (Dhankar, 1988).

Eggplants are a rich source of abundant nutrients and their contents (mentioned in Table 1.3) which all desirable mainly for body growth, to overhaul of worn out materials and also provide shield. Eggplants are the complete set of minerals, vitamins, nutritional fiber, protein, anti-oxidants, along with some phyto-chemicals that having scavenging activities (Noda et al., 2000, Whitaker and Stommel. 2003). Major phytochemicals in brinjal, caffeic, chlorogenic (phenolic components) glucoside, delphinidin and nasunin (flavonoids) (Bhasker and Ramesh Kumar, 2015, Cassidy et al., 2013, Choudhury, 1976, Kwon et al., 2004, Matsubara et al., 2005)

Table 1.3:- Brinjal, raw Nutritional value per 100g

Energy	104 kJ (24.85 kcal)
Water	92 g
Carbohydrate	5.88g
Protein	0.98g
Fat	0.18g
Vitamin K	3.5 μg
Vitamin C	2.2 mg

Systematic position:

Kingdom: Plantae
Order: Solanales
Family: Solanaceae
Genus: Solanum
Species: S. melongena

Cultivated varities of Bell Pepper :

The available indigenous varieties are Capsicum annum (Jati Jolokia), Capsicum baccatum (Ohm Jolokia), Capsicum chinense (Bhut Jolokia), Capsicum frutescens (Dhan Jolokia, Maam Jolokia, Totta Bias) and Capsicum pubescens (Bhikue Jolokia)

The bell pepper (also known as sweet pepper, pepper, or capsicum) (Wells, et al.,2008) is the fruit of plants in the Grossed cultivar group of the species Capsicum annuum. Cultivars of the plant produce fruits in different colors, including red, yellow, orange, green, white, and purple. Bell peppers are sometimes grouped with less pungent pepper varieties as "sweet peppers". While they are fruits botanically classified as berries they are commonly used as a vegetable ingredient or side dish. The fruits of the Capsicum genus are categorized as chili peppers.

Bell peppers originated in Mexico, Central America, and South America. Peppers were named by Christopher Columbus and Spanish explorers who were searching for peppercorn plants to produce black pepper. Columbus took samples of a wide variety of peppers back to Europe where they became quite popular. Since then, peppers have also been introduced to Africa and Asia. Peppers are used as a food, condiment, and spice.

Today, most green bell peppers sold in the United States are grown in Florida. California, Texas, New Jersey, and North Carolina also provide a portion of peppers sold in stores. Wisconsin-grown bell peppers are available at farmers markets for a limited time during July, August, and September.
Indonesia is one tropical country that has a wealth of vegetables and fruits. Bell pepper is one of the many vegetable commodities cultivated in Indonesia. Bell pepper comes from Central and South America where many varieties of bell pepper have been cultivated (Padrón et al., 2015). Bell pepper contains nutrients such as carbohydrates, proteins, fats, minerals (potassium, calcium, phosphorus, and iron), and vitamins (vitamin A, vitamin B, and vitamin C) (Nadeem et al., 2011). Vitamin C is also known as ascorbic acid that can be found in nature almost in all plants, especially fresh vegetables, and fresh fruits, so called fresh food vitamins (Singh and Kumari, 2015).

Table 1.4 :- Capsicum, raw Nutritional value per 100g

Energy	84 KJ(20kcal)
Water	93.9g
Carbohydrates	04.64 g
Protein	00.86 g
Fat	00.17g
Vitamin C	84.4 mg
Zink	00.13mg

Scientific classification:

Kingdom: Plantae
Order: Solanales
Family: Solanaceae
Subfamily: Solanoideae
Genus: Capsicum

2. REVIEW OF LITERATURE

Abbas .et al.,2013 Proposed the major Potato diseases are Late blight, Early blight, Wart disease, and Stem canker and black scurf often can be managed successfully using a combination of cultural, biological, and chemical control measures. The cultural and biological methods are amenable to organic production systems. Management of Stem canker and black scurf remains more challenging. In the future, resistance to Rhizoctonia Solani kuhn and improved resistance to Stem canker and black scurf may be available in potato cultivars.
Tiwari, et al.,2020 Potato dry rot disease caused by Fusarium species is a major threat to global potato production. The soil and seed-borne diseases influence the crop stand by inhibiting the development of potato sprouts and cause severe rots in seed tubers, table and processing purpose potatoes in cold stores. The symptoms of the dry rot include sunken and wrinkled brown to black tissue patches on tubers having less dry matter and shriveled flesh. Fungal infection accompanied by toxin development in the rotten tubers raises more concern for consumer health. The widespread dry rot causing fungal species (Fusarium graminearum) is reported to have a hemibiotrophic lifestyle. A cascade of enzymes, toxins and small secreted proteins are involved in the pathogenesis of these hemibiotrophs. With the availability of the genome sequence of the most devastating species Fusarium sambucinum, it is

important to identify the potential pathogenicity factors and small secreted proteins that will help in designing management strategies. Limited resistant cultivars and the emergence of fungicide-resistant strains have made it more threatening for potato cultivation and trade. Several novel fungicide molecules (Azoxystrobin, chlorothalonil and fludioxonil), are found very effective as tuber treatment chemicals. Besides, many beneficial bioagents and safer chemicals have shown antibiosis and mycoparasitism against this pathogen. Germplasm screening for dry rot resistance is important to assist the resistance breeding program for the development of resistant cultivars. This review aims to draw attention to the symptomatology, infection process, pathogenomics, the role of toxins and management approaches for potato dry rot disease, which is very much critical in designing better management strategies.

Xue et al., 2019 The mechanism of induced resistance against Fusarium dry rot in potato tubers by the T-2 toxinT-2 toxin produced by Fusarium spp., induced resistance against postharvest diseases on potato tubers. Dry rot development of tubers was significantly reduced by T-2 toxin application The mechanism of induced resistance includes the activation of ROS and phenylpropanoid metabolism in potato tubers tissue .

Romberg et al., 2004, potato plants in three fields (cv. Desiree, Satina, Midas, and Mondial) in Lancaster, California exhibited symptoms and signs of powdery mildew. Disease symptoms were most severe on cvs. Desiree and Santina. Disease expression was greater along sprinkler lines and in localized areas from which the disease spread to surrounding plants. Severely affected plants began collapsing just prior to water cutoff. Early symptoms comprise small dark areas on the adaxial surface of leaves, along the veins, and at the petioles. Dark lesions consisting of mycelia and conidiophores were also visible on the main stems of affected plants. As the disease progressed, leaves were covered by a gray powdery fungal mass, and older leaves became necrotic. Conidial chains arising from the hyaline, epiphytic mycelia consisted of two to eight conidia. The cylindric to doliform conidia measured 16.8 to 22.8 µm wide (mean = 19.2, standard error = 0.36, N = 30) × 28.8 to 45.6 µm long (mean = 32.4, standard error = 0.75.

Paul et al.,2018 The Black rot disease was observed in sweet potato in Korea during a disease monitoring survey in 2017. The symptoms were black, small, circular, and slightly sunken lesions in the initial stages, leading to enlarged black spots and perithecia with long necks that appeared as dark bristles in the later stages. The causative agent was isolated on potato dextrose agar (PDA) and stored at the Sweet Potato Research Laboratory, Bioenergy Crop Research Institute, RDA, Muan (SPL17100 and SPL17101). The cultured organism produced cylindrical single-celled conidia after 5 days of incubation at 25 °C with a conidial size of 8.5–65.2 × 2.6–7.3 µm. Brownish, globose, and thick-walled aleuroconidia were produced with an 11.9–17.0 × 8.3–12.2 µm size. The perithecia were globose and dark brown with long thin necks tapering from the base to the apex. Morphologically, the fungus was identified as Ceratocystis fimbriata, which was well supported by the combined phylogenetic analysis of the sequences of the internal transcribed spacer (ITS), large subunit (LSU), and elongation factor 1-α (EF-1α) genes. Pathogenicity tests were conducted, and Koch's postulates were confirmed.

Mejdoub-Trabelsi ,et al.,2016 Studied ten nonpathogenic Aspergillus spp. and Penicillium spp. isolates, naturally occurring within healthy potato plants and previously selected based on their ability to suppress Fusarium dry rot disease, were evaluated for their in vitro antifungal potential against Fusariums ambucinum, F. oxysporum and F. graminearum and their effects against Fusarium wilt severity and on plant growth and production. Tested through the dual culture technique on PDA medium, all isolates tested had significantly decreased Fusarium spp. growth relative to the untreated control. Growth inhibition, achieved after 7 days of incubation at 25°C, varied from 32.3 to 42.9% using Aspergillus spp. and from 44.1 to 59.6% with Penicillium spp. The highest inhibition, by about 55-59%, was noted using isolates E.36.11 (P. chrysogenum) and E.39.11 (Penicillium sp.). Competition, mycoparasitism, hyphallysis, early formation of resting structures and mycelial cords, and decreased sporulating ability are the main effects recorded during antagonism exerted toward targeted Fusarium species. Fusarium wilt severity, noted 75 days posy-planting, was significantly lowered by 29 to 47% on potato plants treated using 7 out the 10 isolates tested. The highest wilt severity decrease, by 41-47% over the inoculated and untreated control, was achieved using E.13.11 (A. niger), E.25.11 (A. flavus), E.36.11 (P. chrysogenum), and E.29.11 (P. polonicum) based treatments. Plant inoculated with Fusarium spp. and treated with E.29.11 (P. polonicum), E.13.11 (A. niger), E.41.11 (A. terreus), E.60.11 (A. flavus), and E.25.11 (A. flavus) showed 36-46% higher aerial part growth. The most interesting improvements of root and tuber fresh weights, achieved using the majority of isolates tested, ranged between 22-40% and 15-21%, respectively. Further investigations are needed to more elucidate the antifungal activity of the extracellular metabolites of the most effective isolates toward Fusarium species infecting potato.

S. A. Ganie ,et al.,2013Alternaria leaf blight is one of the most important diseases of potato (Solanum tuberosum L.) worldwide. The disease was prevalent in all the potato growing areas of Kashmir valley surveyed during2009 and 2010. The overall mean disease incidence and intensity ranged from 24.54 to 28.23% and 13.84to 15.98%, respectively. The highest disease incidence (39.09%) and intensity (22.54%) was recorded indistrict Budgam. The lowest level of disease was in district Shopian (14.89 and 8.05%, respectively). The pathogen associated with the disease was identified as Alternaria solani (Ellis and Martin) Jones and Grout. In early stages of disease development, small irregular to circular dark brown spots on lower leaves appear, measuring 0.5 mm in size. Up to fourth week of June concentric rings form as a result of irregular growth patterns by the organism in the leaf tissue giving the lesion a characteristic ‘target spot’ or ‘bulls eye’ appearance. The maximum lesion size 7.4 mm was recorded in the second week of August.

Tiwari, et al., 2021 Study late the blight of potato is a devastating and one of the economic diseases of potato and other plants belonging to family Solanaceae. Late blight, caused by Phytophthora infestans, is one of the most threatening pathogenic diseases which not only results in direct crop losses but also cause farmers to embrace huge monetary expenses for disease control and preventive measure. It was first reported during the Irish Potato Famine, leading to massive starvation in Ireland and other parts of Europe during the middle of 19 th century. Phytopthora harms the foliar portion in the field and also the tuber in the storage that can result in complete crop failure in potato. The pathogen has distinct survival mechanisms and two life cycles infection processes. The development of a sexual spore known as oospore includes two types of pairs, A1 and A2. The spores are introduced to good plants by wind and rain. Different methods for prevention of crops from late blight has been developed and used worldwide. An integrated disease management strategy includes successful control of this disease. Cultural control, chemical management, and advanced disease management are the most effective interventions. Integration of late blight control in tropical regions with abundant fungal inoculants in most months of the year was also seen as one of the best choices in disease management. This paper reviews the significance of late blight of potato and controlling strategies adopted for minimizing yield losses incurred by this disease by the application of synthetic fungicides and different organic amendments.

ALLEN, J. (2008) study of the development of skin spot in the potato variety Kerr's Pink has shown that humid conditions, both before and after infection by Oospora Pustulans, increase the incidence of the disease. The results of inoculation experiments have indicated that infection of the tuber does not take place much before the normal time of lifting. It has been found that the pathogen may enter the tuber by way of the lenticels, and that invasion of the cortex and the production of a cork cambium takes place shortly after infection. Some damage to buds was observed within 16 days of inoculation. Although the affected pocket of cortical tissue soon dies, discoloration of the periderm is not apparent until much later. It is suggested that this may be the reason for the comparatively long period which elapses between infection and the appearance of skin-spot symptoms.

Seifi, et al.,2018 Study enteropathogenic bacterium Bacillus thuringiensis belongs to Bacillus cereus group. This bacterium is ubiquitous and widely used as bioinsecticide for the control of many agricultural pests. Also, some studies have reported that B. thuringiensis was able to colonize the root and increase of legumes nodulation. In this study, sampling was carried out in order to isolate plant growth-promoting (PGP) and bio-control bacteria from tomato rhizosphere. Tomato seeds were treatment with bacterium suspension to evaluate the PGP effect of B. thuringiensis on seed germination in vitro and greenhouse condition. Furthermore, the ability of this strain to produce various metabolites like siderophore, HCN, auxin and phosphate solublization were examined. All tests were performed in completely randomize design with three replicates. This strain increased the germination rate of tomato seeds compared to untreated control. The results of the pot experiment showed that this strain promoted tomato root and shoot length, as well as fresh and dry weight of root and shoot compared to control. The ability to produce siderophore, auxin and ability to dissolve mineral phosphate have been proven in this isolate. Moreover, antifungal activity in dual culture and volatile compounds assay showed that, this strain can inhibit the mycelial growth of the Fusarium oxysporumfsp. lycopersici up to 67 and 54 % respectively. Also tomato root treatment with B. thuringiensis can suppress the wilt symptoms compare to control, significantly. For molecular investigation, total DNA was extracted using Kiagen Kit and the whole genome was sequenced using the Iliuminia Hiseq technology in Cornell University. After obtaining the nucleotide sequence, its quality was controlled by Fast QC software and annotated with RAST database .Then the sequencing data was compared with deposited sequence in GenBank via BLAST available at NCBI and SEED websites. Results showed that, this strain has 99.8% similarity with B. thuringiensis bt185. In conclusion, this strain of B. thuringiensis has potential to be introduce as a multifunctional biocontrol agent.

Nowicki et al., 2013 Study Late Blight of Tomato. 10.1002/9781118728475.ch13. The most sustainable strategy to manage tomato late blight (LB) would be to deploy an integrated system including cultural practices, fungicide application, and the use of cultivars with broad-spectrum genetic resistance against LB. This chapter summarizes the current understanding of Phytophthora infestans. It discusses its effects on tomato production, and the genetics and breeding of LB resistance in tomato. LB has been identified as a major disease of tomato and potato and is one of the most devastating plant diseases of all time. P. infestans can quickly devastate tomato and potato crops at any time during plant ontogeny. The most sustainable strategy for managing tomato LB is to deploy an integrated system including cultural practices, fungicide application, and the use of cultivars with broad-spectrum genetic resistance against LB.

Borges et al., 2015 Study greenhouse conditions are favorable to the growth of Botrytis cinerea, and an increase in the occurrence of gray mold caused by this pathogen is therefore expected. Biocontrol using microbial antagonists is one of the approaches to control the pathogen. In other experiments, Clonosta chysrosea isolates suppressed B. cinerea in tomato leaves, but it was not evaluated in wounds caused during pruning, where the pathogen predominantly infects. Here, the efficacy of four C. rosea isolates to control B. cinerea in wounded tomato stems was evaluated. Influence of the following factors on the antagonist's efficiency were evaluated: i) application time of C. rosea respectively to time for B. cinerea inoculum deposition, ii) conidial concentration of C. rosea, and iii) application of individual isolates versus isolate mixture. Results indicated that the four C. rosea isolates are effective in controlling gray mold, and that they may be applied either individually or as a mixture. The biocontrol efficiency of C. rosea was higher when it was applied 1 day before or simultaneously with the pathogen inoculation at a concentration of 106 conidia/mL-1, reaching 100 % in stem segments and more than 90 % in whole plants. The antagonist has potential to be used in greenhouse tomato, especially in an integrated management context.

Jung et al., 2018 In this paper, they studied an image recognition algorithm based on the convolution neural network (CNN) to detect an outbreak of powdery mildew on tomatoes. We propose a method to artificially generate the powdery mildew images using an image fusion technique to prepare various forms of CNN learning data. The artificial powdery mildew images are produced in three steps: mildew image extraction, transformation, and overlapping. The CNN is learned using these artificial images, and we test the recognition performance of the CNN using real tomato leap images captured in the greenhouse. The experimental results show that the proposed image recognition algorithm presents a recognition rate of 93.02% for 43 test images .

FLETCHER et al., 2007 They studies 19 tomato cultivars and six breeders' lines were susceptible as well as Nicotiana tabacum. N. xanthi.Solanium melongena, S. pseudocapsicum, S. tuberosum, Datura stramonium and Petunia hybrida. Conidia germinated readily at 15, 20 and 25 C and were viable for 2 days in the laboratory and at least 6 days in the greenhouse. The disease was well controlled by a range of fungicides including benomyl, bupirimate, carbendazim, chlorothalonil, fenarimol and pyrazophos. All of these except pyrazophos are approved for use on tomatoes in the UK. The pathogen was very sensitive to low concentrations of benomyl and fenarimol but less so to bupirimate.

Gomaaand Naema. (2017). They studied tomato (Solanum lycopersicumL.) is one of the most important economically crops, which belongs to family Solanaceae. The economic importance of this crop appears in both local consumption and exportation purposes. Tomato is grown either in the open field or under protected houses. Sclerotiniarot disease is worldwide in distribution. This disease causes significant yield losses of various important crops including tomato.

They obtained some results from this investigation that are follows:

1. The causal organism of Sclerotiniarot disease was isolated from diseased samples of tomato, which collected from 5 different locations representing four governorates, i.e. EL-Behaira, Menufiya, Qaluobiya (Toukh and Moshtohor) and Elminya.
2. The pathogenicity tests of five isolates of Sclerotinia sclerotiorumon tomato hybrid Super Strain Bunder greenhouse conditions, indicate that, S. sclerotiorumisolate1 (El Behaira) was the highest virulent isolate followed by S-3 isolate (El Qalyubia, Toukh) and S-4 isolate (El Qalyubia, Moshtohor) respectively. Whereas isolate S5 that isolated from Elminya was the least virulent.
3. All used antagonistic fungireduced growth of S.sclerotiorum. Trichoderma album was the best antagonistic fungus in inhibiting the mycelial growth by 67.78 % followed by Trichoderma lignorumby 64.44 % growth reduction.
4. Bacillus subtilis was the more effective antagonistic bacteria and reduced growth of S. sclerotiorum by 57.78% followed by Pseudomonas fluorescens giving 45.56% growth reduction.

5. Results indicated that all tested chemical inducers reduced both growth and production of sclerotia of S. sclerotiorum. Reduction in linear growth and sclerotial formation was increased by increasing concentration of most tested chemical inducers. Regarding linear growth, salicylic acid (SA) at 8 mm completely inhibited the mycelial growth and production of sclerotia followed by salicylic acid (SA) at 4 mm which reduced linear growth and production of sclerotia by 67.77 and 88.89% respectively.
6. The linear growth of S. sclerotiorumwas completely inhibited by most tested fungicides. Moreover, all fungicides caused complete inhibition of sclerotial formation of S. sclerotiorum. All concentration of the fungicide Rovral stopped the growth of the fungus.
7. Results indicate that all the tested isolates of Trichodermaspp. significantly reduced white rot disease incidence and disease severity, as well as increased fresh weight and dry weight of shoots and roots. Integrated treatments with compost were effective more than the individual treatment. The highest increase in shoot, root fresh weight and shoot, root dry weight were effective in case of treatment with T.album combined with compost.
8. Results indicate all the tested antagonistic bacteria significantly reduced white rot disease incidence and severity, as well as increased fresh weight and dry weight of shoots and roots. Integrated treatments with compost were effective more than the individual treatment. The highest increase in shoot, root fresh and dry weight was recorded in case of treatment with Ps. fluorescens combined with compost.
9. Results showed that all chemical inducers significantly reduced white rot disease incidence and disease severity, as well as increased fresh weight and dry weight of shoots and roots. Integrated treatments with compost were effective more than the individual treatment. The highest increase in shoot fresh weight was recorded for plants treated with SA combined with compost.
10. Results indicated that integration between the tested fungicides and compost had a great combatable impact in reducing white rot disease incidence, disease severity and increasing fresh weight and dry weight of shoots and roots compared to untreated control treatment. the highest reduction% of disease incidence and disease severity was obtained in case of Bellis and punch integrated with compost.
11. Results showed that, Integrated commercial biocides with compost were effective more than the individual treatment. Bio-Zeid combined with compost significantly reduced white rot disease incidence and disease severity as well as induced the highest increase in shoot, root fresh and dry weight.
12. Results indicate that all tested antagonistic fungi positively increased the activities of PO, PPO and Chitinase enzymes in leaves of tomato plants comparing with control treatment. In this respect, the highest effective treatment on PO, PPO and Chitinase enzymes was that expressed in the integration between T. album with compost where the recorded efficacy was 242.30, 142.36 and 151.78% respectively. However, the highest activity of PO, PPO and Chitinase enzymes in case of soil inoculated with Glomussp combined with compost was 296.92%, 103.25% and 40.89%.
13. Results indicate that all tested antagonistic bacteria affected positively the activities of PO, PPO and chitinase enzymes in leaves of tomato plants comparing with control treatment. In this respect, the highest effective treatment on PO and PPO enzymes was that expressed on the integration between Ps. fluorescens and compost where the recorded efficacy was 297.62 and 208.70% respectively. On other hand, the treatment of B. subtilis and compost was the highest effective one on Chitinase where the recoded efficacy was 57.50 %.

14. All tested treatments of integration between chemical inducers and compost affected positively the activities of PO, PPO and Chitinase enzymes in leaves of tomato plants comparing with control treatment. The highest effective treatment on PO, PPO and Chitinase enzymes was that expressed on the integration between Salicylic acid and compost where the recorded efficacy was 553.50, 157.29 and 188% respectively.
15. The highest effective treatment on activity of PO, PPO and chitinase enzymes was that expressed on the integration between Bellis and compost where the recorded efficacy was 721.28, 151.63 and 157.33% respectively followed by integration between punch and compost where the recoded efficacy was 674.58, 52.83 and 146.40% respectively.
16. Integration between Bio-Zeid with compost was the highest effective treatment on PO, PPO and chitinase enzymes that recorded efficacy 171.8, 145.12 and 103.48%, respectively.
17. Results indicate that all tested treatments of biological fungi affected positively the activities of flavonoids and total phenols in leaves of tomato plants. The highest effective treatment on flavonoids and total phenols was that expressed on the integration between T. album with compost where the recorded efficacy was 303.68 and 767.89% respectively.
18. Integration between B. Subtilis with compost was the highest effective treatment on flavonoids and total phenols in leaves of tomato plants that recorded efficacy 64.73 and 336.90%, respectively
19. Results showed that integration between Bellis with compost was the highest effective treatment on flavonoids and total phenols in leaves of tomato plants that recorded efficacy 217.89 and 1074.71%, respectively.
20. Results indicate that integration between SA with compost was the highest effective treatment on flavonoids and total phenols in leaves of tomato plants that recorded efficacy 226.84 and 526.42% respectively.
21. Results revealed also that integration between Bio-Zeid with compost was the highest effective treatment on flavonoids and total phenols in leaves of tomato plants that recorded efficacy 44.21 and 657.10% respectively.
22. Under field conditions integration between T. album + Bellis + SA was most effective treatment which reduced disease incidence and disease severity and recorded 8.33 and 2.23%, respectively compared with control which recorded 70.83 and 35.40%, respectively. As well as, increased fruit weight per plant and recorded 4.53kg/ plant.
23. Under field conditions results showed also that Adding compost to the soil pre-transplanting decreased the percentage of infection and increased yield of plants compared with un-amended treatments with compost. Integration between T. album + Bellis + SA and compost was the most effective treatment and reduced disease incidence and disease severity and recorded 4.16 and 1.03%, respectively compared with control which recorded 70.83 and 35.40% respectively. As well as, increased fruit weight per plant to 5.59 kg which recorded in control 2.10 kg.

Tomazoni et al., 2019 They study toxicity of four essential oils extracted from Baccharis articulata, Baccharis ochracea, Baccharispsiadioides and Baccharis trimera was tested against the phytopathogen Alternariaalternata, which causes Alternaria stem canker on tomatoes. Diseases caused by Alternaria fungi are responsible for great economic losses in terms of production and are controlled by synthetic fungicides; however, essential oils offer an alternative, since they have been proven to be effective for controlling against various plant pathogens. In this way, the antifungal activity of Baccharis essential oils was tested using potato dextrose agar medium with concentrations ranging from 0.1 to 20.0 µL

mL^{-1}. Baccharis trimera and Baccharis ochracea essential oils presented 100% mycelial growth inhibition of A. alternata and were also able to control Alternaria stem canker disease under greenhouse conditions. Tomato plants treated with these essential oils exhibited area under the disease progress curve (AUDPC) values of 230.10 and 241.42, differing from the control condition, which showed an AUDPC value of 268.92. The essential oils of B. trimera and B. ochracea can be an alternative for controlling Alternaria stem canker disease of tomatoes and should be formulated as a potential fungicide against the A. alternata pathogen.

Hossain et al., 2013 They studied Control of Phomopsis Blight of Egg Plant through Fertilizer and Fungicide Management. The experiments were conducted at Laboratory of the Department of Plant Pathology and in the farm of Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh during Rabi season of the year 2007-2008. Four fungicides viz. Bavistin 50 WP (Carbendazim), Tilt 250 EC (Propiconazole), Cupravit 50 WP (Copperoxychloride) and Dithane M-45 (Mancozeb) and micronutrients (Gypsum, ZnO and Boric acid) were evaluated against Phomopsisvexans causing Phomopsis blight and fruit rot of eggplant. The fungicides and micronutrients either applied individually or in combination showed significant effect in terms of per cent leaf infection, fruit infection, leaf area diseased and fruit area diseased in comparison to control. Effect of each fungicide applied in combination with micronutrients always showed better performance in reducing disease incidence and disease severity than the fungicides applied alone. Among the fungicides, Bavistin 50 WP (0.1%) proved to be effective arresting the spore germination and mycelia growth of Phomopsisvexans assayed in in vitro test. Reduction of leaf area diseased caused by Bavistin 50 WP (0.1%) in combination with micronutrients were 58.17, 67.37, 78.41 and 85.25%, respectively at preflowering, post-flowering, fruiting and fruit ripening stages while Bavistin 50 WP (0.1%) alone reduced by 52.22, 58.67, 74.19 and 83.09%, respectively at those stages. Similarly reduction of fruit area diseased caused by Bavistin 50 WP (0.1%) in combination with micronutrients were 57.93 and 79.79%, respectively at fruiting and fruit ripening stages while Bavistin 50WP (0.1%) alone reduced by 56.93 and 76.14%, respectively at those stages. Micronutrients had little effect against the disease but significantly better than control.

Chandrasehar et al., 2000 They studied Bio control of root rot disease of brinjal The efficacy test of native fungus antagonist, Trichodermaviride was carried out by the Department of Plant Pathology, FIPPAT, Padappai, Tamil Nadu during September 1999 to February 2000. The talc-based product of T. viride was studied against the root rot disease incidence of brinjal, under field conditions. The results of the study revealed that the combined method (seed treatment and soil application) of T. viride @ 4 g/kg of seed + 3 kg/20 m2 has significantly reduced the per cent root rot disease incidence of brinjal.

Ridout, Christopher. (2009). Studied Powdery Mildews are an important group of parasitic fungi causing disease in over 7600 species of host plants. They are obligate biotrophic parasites, obtaining their nutrients from the host through intracellular feeding structures known as haustoria. Many species of powdery mildews have a high degree of host specialization, infecting only one or a few closely related host genera. Some powdery mildews have well-documented gene-for-gene (GFG) resistance interactions with their host plant, revealing information about the nature of host specificity. This article focuses on the interactions between powdery mildews and the host plant. Events in the establishment of haustoria and biotrophy are reviewed and their influence of infection on host metabolism described. GFG, durable mlo and nonhost-resistance mechanisms are also described.

Romanazzi, Gianfranco &Feliziani, Erica. (2014).Studied Botrytiscinerea (Gray Mold) is the causal agent of gray mold, and is considered the most important pathogen responsible for postharvest decay of

fresh fruit and vegetables, having a wide range of hosts. Infections by B. cinerea that cause postharvest decay usually occur at the field stage, and they can remain latent until storage when B. cinerea can develop from rotted fruit next to healthy fruit, causing extensive breakdown of the commodity, and sometimes spoiling entire lots. The traditional control of gray mold infections consists of field applications of synthetic fungicides during the crop growing cycle. However, the high risk of fungal resistance development has led to integrated use of synthetic fungicides with natural compounds or several other non-chemical means. Further studies on plant and pathogen genomes and their interactions will be helpful to obtain new knowledge and then optimize application of management strategies.
Mondal, Bholanath et al.,2021 They studied two fungal diseases of chilli and bell pepper in West Bengal. Foot rot chilli and bell pepper is prevalent in west bangal P. capsici from chilli and bell pepper infected bringal , guwava ,cucumber ,tomato fruites black pepper leaves in laboratory condition .Twig blight caused by Choanephora cucurbitarum that also causes extensive damage of chilli and ball pepper. Initially the pathogen infected actively growing young branches. Water soaked leasion was formed at a point of an individual branch above the which the ultimate branches are produced .the laision encircled the branch above of young branch above the laision . Prominent hairy growth of C. cucurbitarum on the infected tissue was found in morning horurs .the diseases gradually spreaded to more and more branches, even to the stem causing severe crop damage under warm and humid condition. Spraying of copper oxychloride checked the disease.

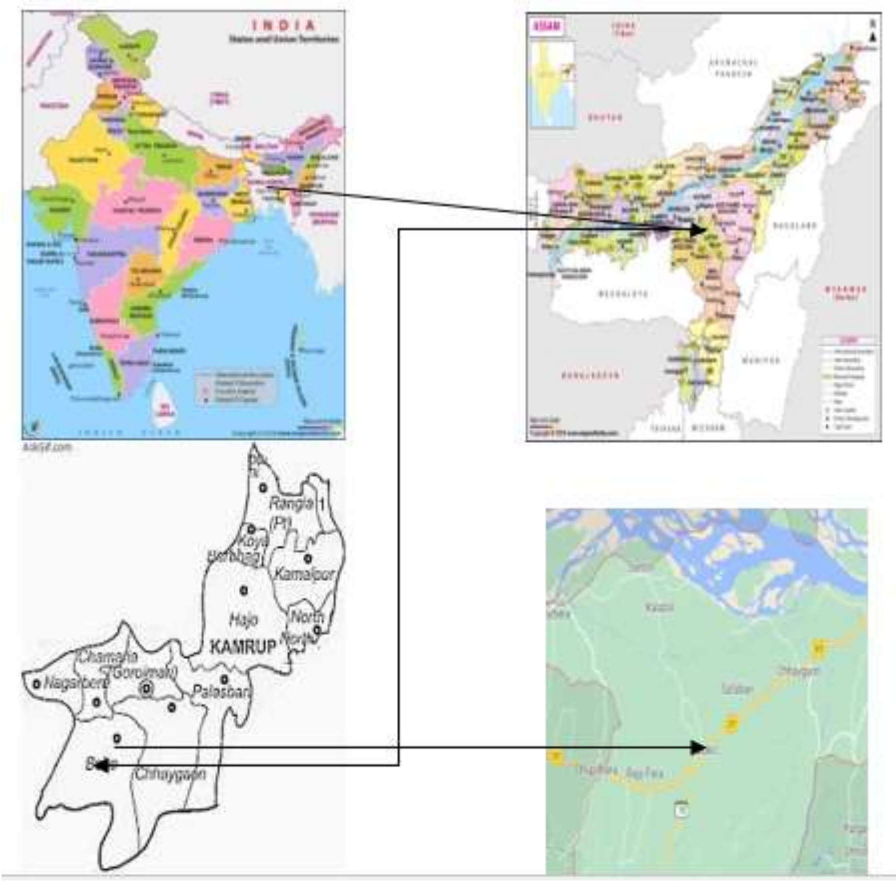
3. MATERIAL AND METHOD

EXPERIMENTAL SITE

The investigation was carried out from the vegetable market of Boko Area, District: Kamrup, State: Assam.

GEOGRAPHIC LOCATION

Boko is a town in kamrup district in the state of Assam, India. The latitude 25.944160°N and longitude 91.156740°E. It has an average elevation of 49.0 m (160.8 ft). Situated at the weast side of Brahmaputra river, the city is approximately 80 km from Jalukbari. Boko is surrounded by Mirza towards East ,Dhupdhara towards west , Chamaria towards north , Meghalaya towards South.
Boko has the moderate climate prevailing. There is a lot of rainfall in the summer, and in the winter it is quite dry again. The average annual temperature for Boko is 33° and there is about 248 mm of rain in a year. It is dry for 282 days a year with an average humidity of 42% and an UV-index of 7. Over the course of the year, the temperature typically varies from 52°F to 89°F and is rarely below 49°F or above 94°F. The hot season lasts for 6.8 months, from March 22 to October 15, with an average daily high temperature above 85°F. The hottest day of the year is August 14, with an average high of 89°F and low of 79°F. The cool season lasts for 1.7 months, from December 13 to February 4, with an average daily high temperature below 76°F. The coldest day of the year is January 10, with an average low of 52°F and high of 72°F. The rainy period of the year lasts for 9.6 months, from January 30 to November 19, with a sliding 31-day rainfall of at least 0.5 inches. The most rain falls during the 31 days centered around July 2, with an average total accumulation of 12.2 inches. The rainless period of the year lasts for 2.4 months, from November 19 to January 30. The least rain falls around December 24, with an average total accumulation of 0.3 inches.
The economy of the Kamrup district is basically agrarian where the majority (about 90%) of the population is engaged in agriculture and allied activities.



CENSUS DETAIL

The population of Boko constituency based on the 2011 census is 111,880. The average sex ratio of Boko is 983 women to 1000 men, or 56,415 males and 55,465 females. 23,509 families resided there. The total literacy rate is 76.17%. The male literacy rate is 70.85% and the female literacy rate is 61.9%. Based on population, Boko is ranked 8th in Kamrup district and ranked 122nd in Assam.

GPS DATA OF BOKO TOWN

Latitude 25.978239 degrees N
Longitude 91.235598 degrees E
Elevation of 49.0 m (160.8 ft).

EXPERIMENTAL MONTH

March, April, May and June months were considered for conducting experiment. The observations were done on Potato, tomato, brinjal and bell pepper from the town market of Boko town, district Kamrup(R) in the state of Assam.

METEROLOGICAL PARAMETER

Meteorological Parameter and weather forecasting and climatology have been carried out on the basis of experimental months. The main meteorological parameters in this field are:
Temperature
Humidity

Rainfall

Table 1 :Meteorological parameter of 2024

Months	Rainfall(mm)	Relative Humidity (%)	Temperature(minimum maximum °F)
March	566	77.0	99-76
April	536	80.7	99-76
May	593	84.3	103-83
June	682	86.5	96-83

Collection of experimental vegetables with fungal infections:
Potato
Tomato
Brinjal
Capsicum
Slide and cover slips
Media(PDA)
Microscope
Laminar air flow and etc.
METHODS:
Isolation:- An infected plant or vegetables was brought to the laboratory from the field for isolation of pathogen. Initially the symptoms were examined under microscope or by hand lens. The infected lesionic part was removed by a knife and quickly transferred to the sterilizing solution. Surface sterilization of the infected plant was done by transferring the excised. Infected leaf segment into a Petridis containing mercuric chloride solution (1: 1000). and kept for 2 – 3 min. Then the leaf segment was transferred to a series of petridishes containing sterile distilled water for washing of mercuric chloride. Finally the excised leaf segment. was placed aseptically into the slant for culture of pathogen. The slant was then incubated at a 24-26°C temperature for 3 – 5 days after proper leveling. Finally, the culture will be developed And examined Under microscope.
TECHNIQUES:
These are the materials and methods which are followed PDA Media and Serial Dilution. In this area (Boko Town) I can use this same method for isolating the fungi:

PREPARATION OF CULTURE MEDIA:
Standard culture media viz. potato dextrose agar (PDA) and Czapeck's Dox Agar media would be used for isolation and maintenance of the microorganisms during the curse of investigation.

PDA MEDIA:
The different chemical composition used for preparation of PDA media :
Peeled potato: 200 gm
Dextrose: 20 gm
Agar: 15 gm
Distilled water: 1 liter

PROCEDURE:

Peeled potatoes (200gm) is boiled and then smashed by adding ½ liter of distilled water and then the boiled potato extract was separated by using muslin cloth and measured amount of the dextrose was added to the extract. In another beaker, remaining ½ liter distilled water was placed on the hot plate and bit by bit agar is added into the warm water and then both the solution is mixed and made up to ½ liter and then the media was sterilized in the autoclave at 121°c ± 1°c (15lb pressure) for 20 minutes.

CZAPECK'S DOX AGAR MEDIA:

The different chemical composition used for the preparation of Czapeck's Dox Agar media are as follows:

Sodium nitrate:	3.0 gm
Di-Potassium hydrogen phosphate:	1.0 gm
Potassium chloride:	0.5 gm
Magnesium sulphate:	0.5 gm
Ferrous sulphate:	0.01 gm
Sucrose:	30 gm
Agar-Agar:	15 gm
Distilled water:	1000 gm

PROCEDURE:

Dissolve all the ingredients except phosphate in half of the water and dissolve phosphate separately add to the rest. Make a volume to 1000 ml. Then sterilized it by autoclaving at 121°c (15 lb pressure) for 20 minutes.

SOIL DILUTION PLATE METHOD:

Soil dilutions (Waksman, 1922) were made by suspending 1g of soil of each sample in 10 ml of sterile distilled water. Dilutions of 10^{-3}, 10^{-4} and 10^{-5} were used to isolate fungi in order to avoid over-crowding of the fungal colonies. 1ml of the suspension of each concentration was added to sterile Petri dishes, in triplicates of each dilution, containing sterile Potato Dextrose Agar medium. 1% streptomycin solution was added to the medium for preventing bacterial growth, before pouring into Petri plates. The plates were then incubated at 28±2°C for 4-7 days. Organisms were easily isolated because they formed surface colonies that were well dispersed, particularly at higher dilutions.

STATISTICAL ANALYSIS:

Population density expressed in terms of Colony Forming Unit (CFU) per gram of soil with dilution factors. The percent contribution of each isolate was calculated by

$$\% \text{ Contribution} = \frac{TotalNo.\ of CFU of an individual Sps}{TotalNo. of CFU of all sps} \times 100$$

**CFU – Colony Forming Unit*

RESULT & DISCUSSION

1. Potato (Solanum tuberosum):

The first fungal disease Identify in potato leaves Is Early blight and pathogen is Alternaria sp.

The following Symptoms are:-

1.Initial symptoms Are small Brown or black lesion And farther development the Lesions Will enlarge and Surrounded By a yellow holo.

B. The second Fungal disease Identify in Potato (Solanum tuberosum) is Verticillium wilt and the Pathogen is Verticillium dahliae or Verticillium albo-atrum

The following Symptoms are :-Verticillium wilt becomes evident when lower leaves on the vine turn yellow and wither. Symptoms progress upward until the entire plant yellows and wilts. Vascular tissue of stems becomes a light brown.

2. Tomato (Solanum lycopersicum):

A.The first fungal diseases identify on tomato plants is Septoria leaf spot is caused by a fungal Pathogen Septoria lycopersici.

The following Symptoms are - A diagnostic feature of this disease is The presence of many dark-brown, pimple-like structures called pycnidia (fruiting bodies of the fungus) that are readily visible in the centers of the spots. When spots are numerous, affected leaves turn yellow and eventually shrivel up, brown, and drop off.

B.The second Fungal disease identify in tomato is Powdery mildew caused by the fungal pathogen Leveillula taurica.

The following Symptoms are- Tomato powdery mildew begins with pale yellow spots on leaves. The spots soon become covered with white spores, which makes the leaves look like. They have been dusted with flour. As this fungal disease advances, the whitish parts of the leaves turn brown and shrivel, becoming dry and brittle.

3. Brinjal (Solanum melongena):

The first Fungal diseases identify in the Brinjal is Phomopsis blight The disease is caused by the fungal Pathogen Phomopsis vexans.

The following Symptoms are - It affects mostly stems, leaves and fruits of brinjal. Serious infection stem symptoms of this fungal disease include brown or dark sunken lesions slightly above the soil surface and can result in cankers.

4. Capsicum (Capsicum annuum):

The first Fungal diseases identify in capsicum is Blossom-end rot and the causing fungal Pathogen is saprophytic Alternaria fungal species.

The following Symptoms are - An early symptom of blossom-end rot is a light tan patch on the blossom end of the green fruit. Over time the area turns dark brown or black and may become sunken or leathery. Fruit which is one-third to one-half developed is most commonly affected.

DISCUSSION

From the external symptoms of the infacted vegetables the Pathogen are identify that are –

1. Potato -Early blight and pathogen is Alternaria sp. And another is verticillium wilt and pathogen is Verticillium dahliae or Verticillium albo-atrum
2. Tomato-Septoria leaf spot is caused by a fungus, Septoria lycopersici and another is Powdery mildew of tomato is caused by the fungus Leveillula taurica
3. Brinjal-Phomopsis blight is a serious Fungal disease caused by the fungi Phomopsis vexans.
4. Capsicum-Blossom-end rot caused by saprophytic Alternaria fungal species.

CONCLUSION

From the above results it can be theoretically concluded because of the present pandemic situation it was not possible to do such work practically in laboratory on the isolation of the vegetables which I have taken by observing the characteristics present on it. All the data was based on some journal and researchers work.

From the above study the diversity of fungal Pathogen In solanaceae family studies and reported. Future work can be carried out to isolate and characterization to identify this isolated fungi up to genus lavel . The occurance Of the diseases also help us to generate a data for the management of this pathogen for further control and save consumption by the people of BOKO area.

The initial isolation is done in PDA media.

The pathogen found in the experiment Are- Alternaria sp, Verticillium wilt, Septoria lycopersici, Leveillula taurica, Phomopsis vexans etc .

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