Journal of the Plant Protection Society

Volume 5 **2018**

Plant Protection Society Nepal

Research Article

PLANT DISEASE DIAGNOSIS ON VEGETABLE CROPS FROM DIFFERENT LOCATIONS OF THE COUNTRY

Chetana Manandhar[1], Suraj Baidya[1], Shrinkhala Manandhar[1], Bimala Pant[1], Baidhya N. Mahto[2]

ABSTRACT

Diseases are one of the major constraints on cultivation of crops and reduce production and productivity. Accurate disease diagnosis and proper identification is the first steps of disease management strategy. The activities of carrying out disease diagnosis help to know the distribution of the diseases in the country, explore new disease outbreak and its epidemiology, and provide information for disease management and support in research area prioritization. During fiscal year 2070/71, 252 different disease samples of different vegetable crops were received from various locations and sources for disease diagnosis. Examination of such samples identified 192 samples with fungal infection, 23 with bacterial infection, 28 with viral infection and 9 with nematode infection. In solanaceous crops, 70% disease caused by fungus and 11% by bacteria, 14% by virus and 5% by nematodes respectively. Likewise, in cucurbit crops, occurrence of pathogens is 61% fungal, 26% viral and 13% nematode respectively. The fugal pathogens were dominant in case of crucifer crops as well. The fungal pathogens were found in 79% of samples and followed by bacterial in 14% and viral in 7% respectively. Only fungal pathogen was detected in bulb and root crops. Fungal pathogens (76%) are the common problem in vegetable crops by followed by bacteria (9%) and virus pathogens (11%) and nematode (4%). The study revealed that management of fungal disease is prime concern to minimize the losses due to disease

Key words: bacteria, disease diagnosis, fungus, nematode, virus

INTRODUCTION

Plant disease causes significant economic loss throughout the country, but their effect is felt most severe in developing regions where most of the families obtain their livelihood from farming. Severe problems of different diseases are noticed every year on different agricultural crops from different agro ecological zones of the country. Accurate disease diagnosis and proper identification is the first steps of disease management strategy.

[1] Plant Pathology Division, Khumaltar, Nepal Agricultural Research Council NARC, Nepal
[2] Nepal Agricultural Research Council NARC, Singhadurbar, Plaza, Kathmandu, Nepal.
Email for correspondence:chetana.manandhar@gmail.com

Diagnosis is one of the most important aspects for proper identification of the disease and their causal agents to apply any measures for disease management. Without knowing causal agent, application of any measures for disease management will be a waste of the time and money and can lead to further plant losses. Proper disease diagnosis is therefore vital. The disease diagnosis and identification methods adopted in Nepal includes: gathering of information, visual observation, symptomatology study, incubation, microscopic examination, indicator host plant test and ELISA for virus detection, literature consultation and image study. Lack of sophisticated equipment for molecular diagnosis detection limits the plant disease diagnostic capacity in Nepal. Molecular diagnosis is now very important part of diagnosis.

The objective of the study is to find out distribution of pathogens in different vegetables in the country and to explore possibility of new disease outbreak and its epidemiology to prioritize the research area for the management of the disease problems.

MATERIALS AND METHODS

During fiscal year 2070/71, in total of 252 disease samples of different vegetable crops from various locations were received. Such samples were either collected during survey and fields visit or received from different stakeholders for disease diagnosis, proper identification and advisory services. Such information includes the crop history on field distribution, year of crop cultivation, variety, previous crop, weather condition, time of disease appearance, level of incidence and severity of disease, soil type, use of organic and inorganic manures and pesticides applied. Sign and symptoms of disease samples were observed prior to microscopic observation. The suspected disease samples were checked for its distribution pattern i.e., localize of systemic. The samples were categorized according to its causal organism viz fungal, bacterial, and viral or others by visual examination of sign and symptom of disease. Ooze test was used for bacterial disease diagnosis. Leaf blight, blast, wilt, anthracnose, scab, mosaic, leaf curl are the common symptom and mildew, mold, smut, rust, sclerotonia are common sign to diagnose the diseases (Manandhar and Amatya, 1992). Laboratory test was followed on those samples which could not be diagnosed from their sign and symptom.

The first step in the laboratory was to keep the diseased tissue in a moist chamber to induce sporulation. The moist chamber was a sterile petri dish containing a wet filter paper in the bottom of the dish and a triangle of glass tube. The sample was placed on the glass tube so that the sample could not have direct contact with the wet filter paper and get exposed to humid conditions (Mathur and Kongsdal, 2003). Plastic bags or boxes were used for larger specimens. To discourage the growth of saprophytes present on the specimen in the moist chamber, a brief surface swab with 70% isopropanol or 0.1-1% sodium hypochlorite was done. Moist chambers were generally incubated at room temperature. Direct inspection, washing test, blotter test, Agar and selected media plate test and seedling test were common method used to diagnose fungal diseases. Likewise, morphological test, biochemical test,

pathogenicity test, hypersensitive test and serological test were applied for bacterial disease diagnosis (Manandhar and Amatya, 1992). Dry seed inspection, seedling growing test, indicator plant test and serological test were used for viral disease identification. Extraction and morphological identification methods were used for charactering plant parasitic nematodes. In addition, to precise the diagnosed result with comparing the visual color pictures of internet and crop (Barnett and Hunter, 1972).

RESULT AND DISCUSSION

The disease samples collected by Plant Pathology Division (PPD) of Nepal Agriculture Research Council (NARC) during survey and field visits as well as those received from farmers, growers and other stakeholders to get advisory services for its management were diagnosed and identified. Out of received 252 samples for diagnosis, 192 (76%) was diagnosed as fungal infection, 23 (9%) as bacterial infection, 28 (11%) as viral infection and 9 (4%) as nematode infection. (Figure 1). All together 121 disease samples of five solanaceous crops were examined. Among them, 36 were pepper, 73 were tomatoes, 4 were brinjal, 7 were potatoes and 2 were okra. sclerotonia rot, collar/ crown/ fruit rot, phytopthora light, leaf spot, downy mildew, powdery mildew, early and late blight, bacterial wilt, bacterial stem rot, complex viral diseases and root knot nematodes were commonly diagnosed on pepper, tomato and brinjal. Similarly, root rot, late blight and powdery scab disease were diagnosed in potato. Root rot and leaf blight were diagnosed in okra (Table 1). Early and late blight were common in both tomato and potato. In total of 85, 17, 13 and 6 pathogen of fungi, virus, bacterial and nematodes were diagnosed in pepper, brinjal, tomato, potato and okra (Figure 2).

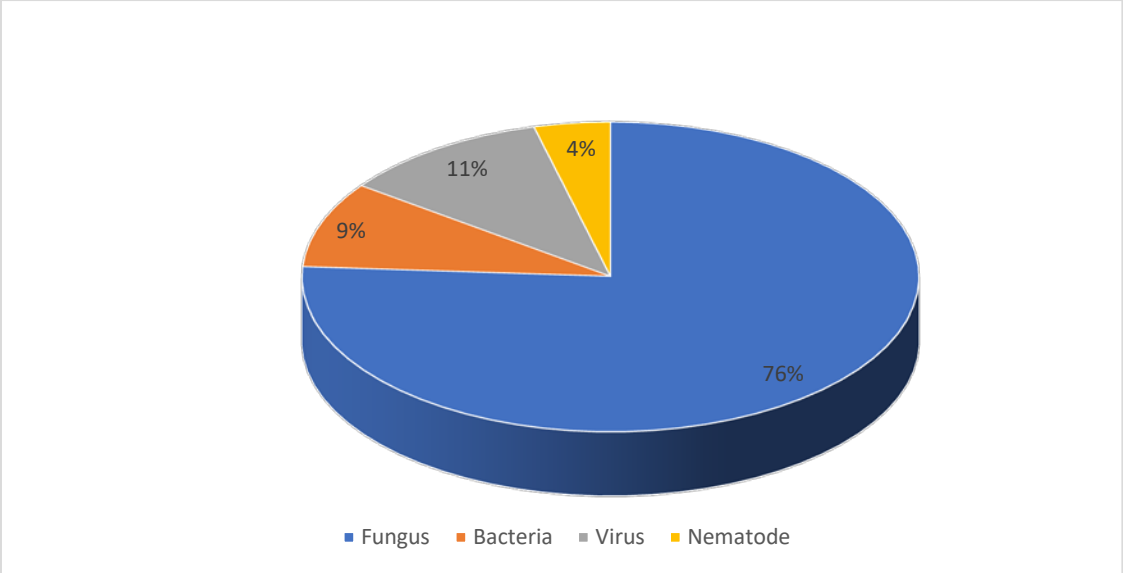

Fig. 1 : Percentage distribution of different pathogen in different vegetable crops

The fungal pathogen was recorded in higher percentage than other pathogen in the solonaceous crops (Figure 3).70 disease samples of crucifer crops were diagnosed. Among them, 20 samples were of cauliflower, 8 were of cabbage, 26 were of mustard, and 10 samples were of carrot, radish and turnip. Likewise, six diseased samples of cress, fenugreek and pakchoi were also diagnosed. Root rot, wire stem, downy mildew, collar rot, sclerotinia rot, top root bulging, leaf spot and club root were major fungal diseases, bacterial soft rot and black rot head rot were common bacterial diseases of crucifer crops. Mosaic viral diseases were also identified in turnip and radish. Clubroot as fungal and black rot as bacterial disease are getting spread over most of the crucifer growing area of the country (Annual report, 2014; Annual report 2015; Annual report, 2016; Annual report; 2017).

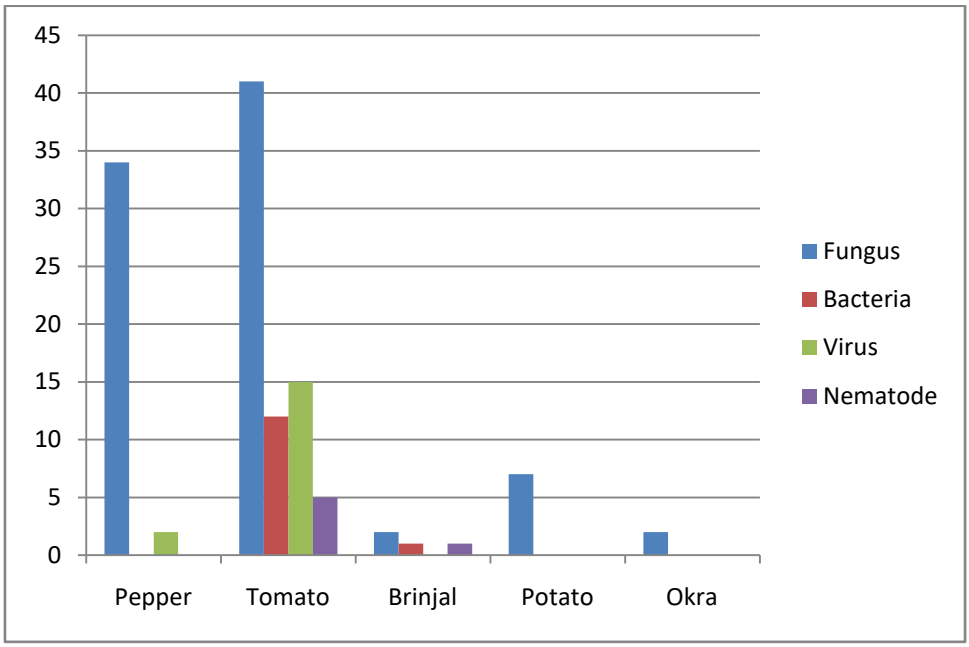

Fig. 2 : Incidence of different pathogen in various solanaceous crops

Root rot disease, downy mildew and clubroot were also observed in cress, fenugreek and pakchoi (Table 2). In total of 55, 10 and 5 samples were detected as the presence of fungi, bacteria and virus in the crucifer crops. The distribution of disease pathogens was by 79% of fungi and followed by 14% and 7% of bacterial and virus (Figure 4 and 5)

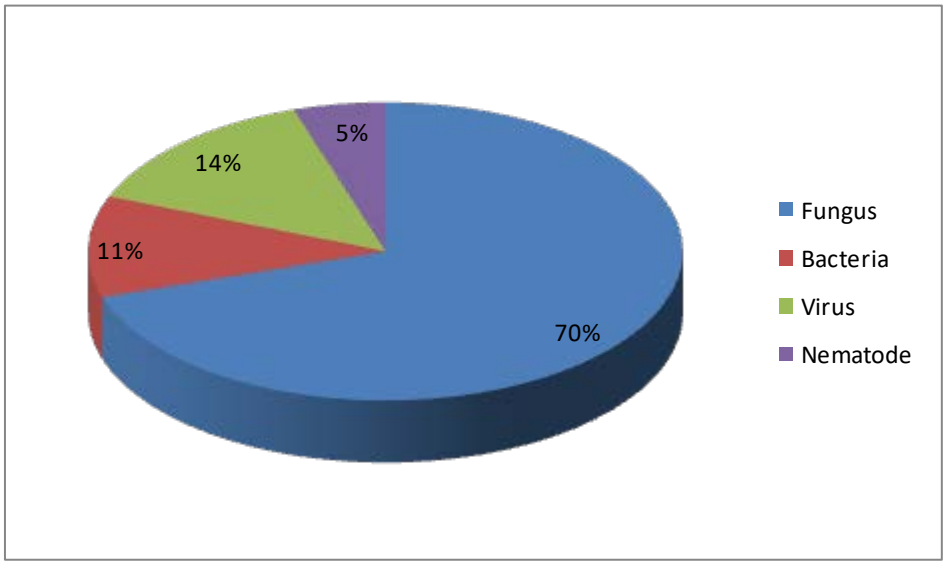

Fig. 3 : Percentage distribution of different pathogen in various solanaceous crops

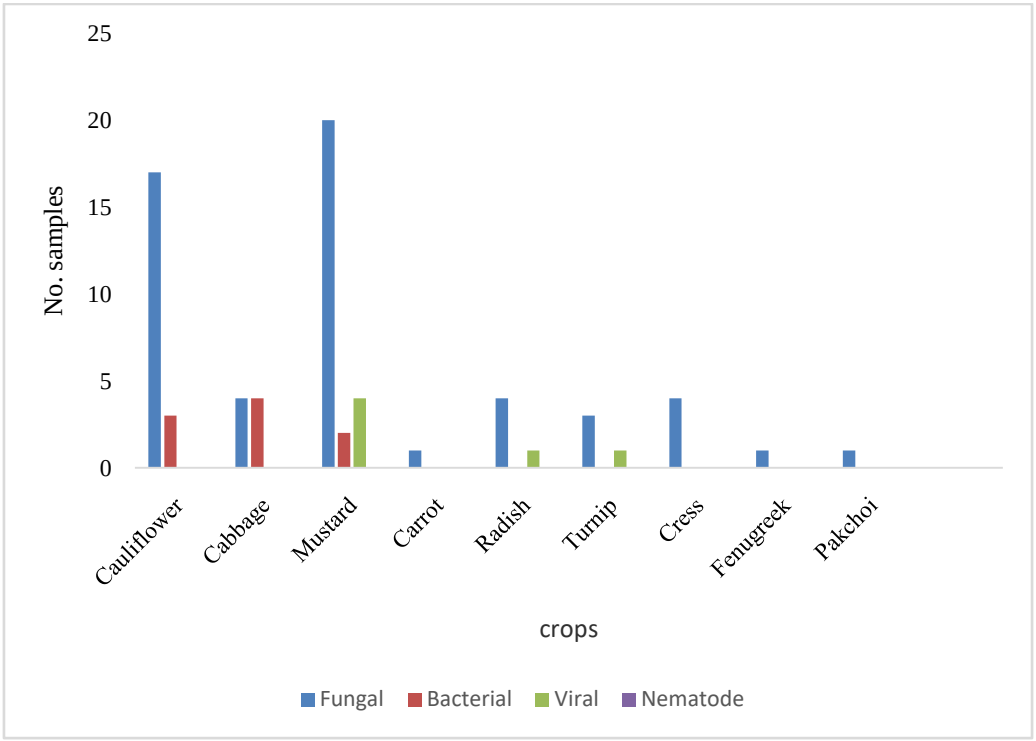

Fig. 4 : Incidence of different pathogen in various crucifer crops

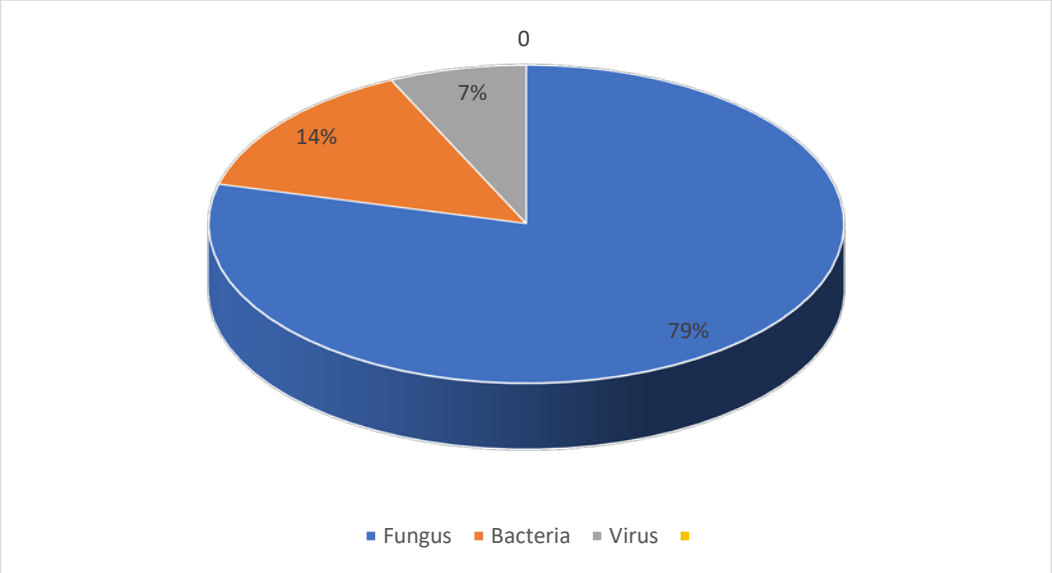

Fig. 5 : Percentage distribution of different pathogen in various crucifer crops

Likewise, in cucurbits, out of 23 disease samples diagnosed, 14 samples possessed fungal diseases such as leaf spot, powdery mildew and gummy stem blight. Gummy stem blight is the major one among them. Six samples consist of mosaic virus, vein banded mosaic virus and other virus complex. Root knot nematode was found in three samples (Table 3). In 23 samples, 14 samples had fungal pathogens, six had virus and three had nematodes but no bacterial pathogens were observed in cucurbit crops (Figure 6 and 7).

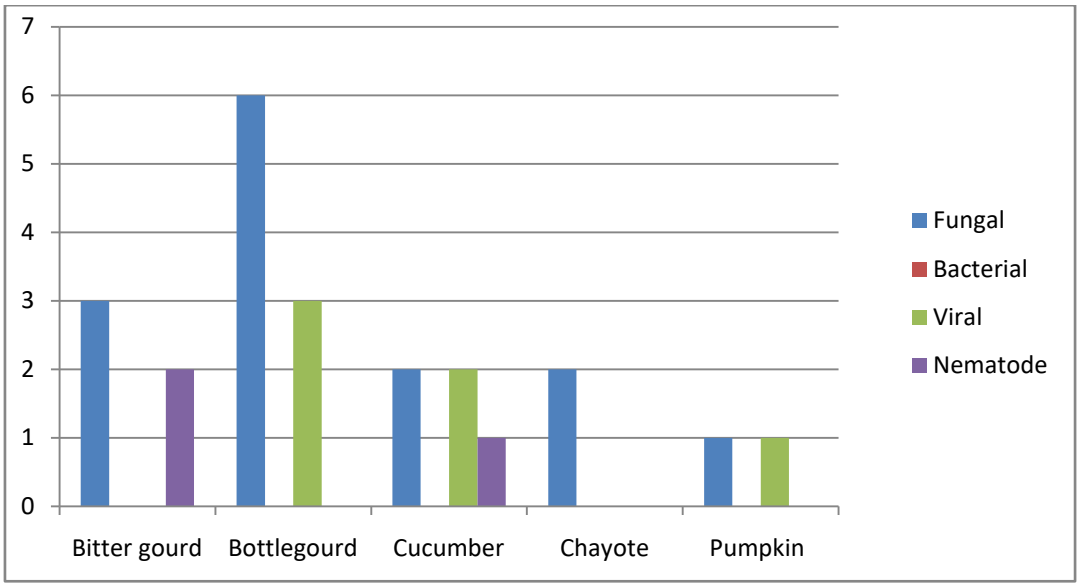

Fig. 6 : Incidence of different pathogen in various cucurbit crops

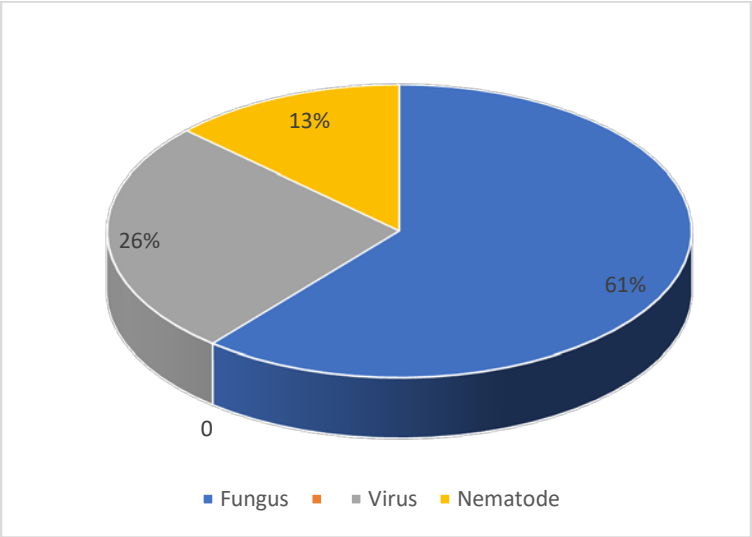

Fig. 7 : Percentage distribution of different pathogen in cucurbit crops

Similarly, out of 36 samples related to bulb and root crop, 12, 3, 18, and 3 samples of garlic, onion, ginger and turmeric were found infected with fungal pathogens respectively (Figure 8). There were no other than fungal pathogens were detected in the samples. In garlic, root tip pink, leaf blight, rust, white rot and purple blotch were identified. Downy mildew, Bulb rot and Purple blotch were found in onion (Table 4). Similarly, in ginger and turmeric Phyllosticta leaf spot, Taphrina leaf spot and leaf blight were identified.

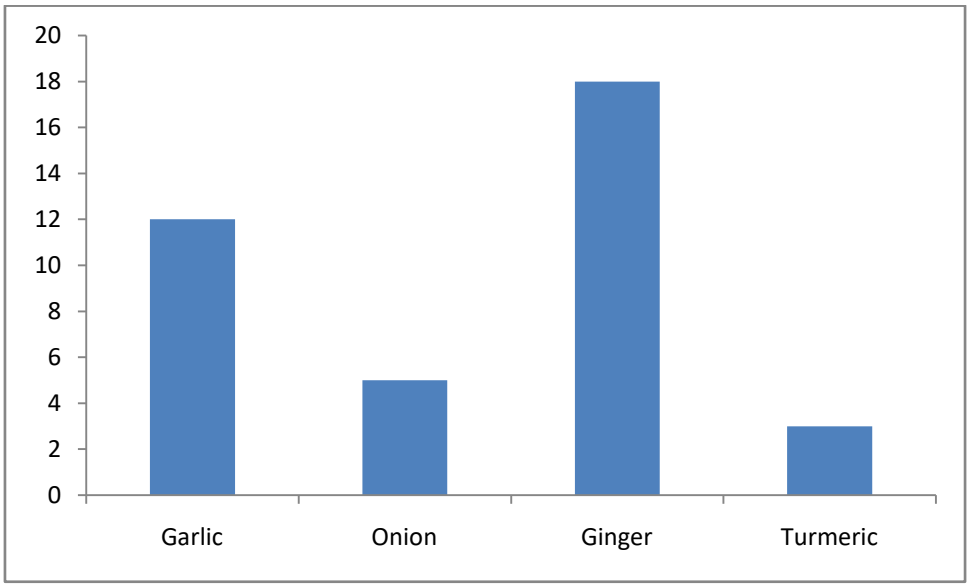

Fig. 8 : Number of fungal diseases in bulb and root crops

Vegetable disease caused by fungi, bacteria, viruses, nematodes and other pathogens are the major production constraints in the country. They are causing both qualitative and quantitative losses of crop yields every year. Direct losses are caused by both quantitative and qualitative yield reductions. Indirect losses are due to control measures and to the quarantine status. Plant Pathology Division is primarily concerned with researches on different aspects of host-pathogen interactions on various crop plants to develop appropriate and economically viable technologies for disease management. So, continued survey of diseases is prerequisite for successful planning of pathological research to know what diseases we have and what not.

CONCLUSION

Plant disease diagnosis is a knowledge-driven process and often requires specialized training for accurate diagnosis and laboratory testing may be needed. Plant diseases must be correctly identified to allow farmers, growers and other stakeholders to put in place effective integrated management strategies. The change in pathogen diversity may be caused by selection pressure due to change in cropping system, introducing new genotypes and climate change. Hence, a continual survey, monitoring, identification and prioritization of vegetables diseases are the most important part of research work for the updating the national data base in the agriculture system. Regular monitoring of pathogen is necessary for successful planning to manage the disease in vegetable crops to minimize the losses due to plant diseases.

LITERATURE CITED

Barnett, H.L. and B.B. Hunter. 1972. Illustrated genera of imperfect fungi.

Mathur, S.B., P. Amatya, K. Shrestha, and H.K. Manandhar. 1992. Plant diseases seed production and seed health testing in Nepal. Proceeding of first HMG/DANIDA/FAO training course in seed health testing in Nepal. pp.15-25.

Mathur, S.B. and O. Kongsdal. 2003. Common laboratory seed health testing methods for detecting fungi. 89p.

PPD, 2014. Annual Report 2070/71 (2013/14). Plant Pathology Division, NARC (B.N. Mahto, S. Baidya, R.D. Timila, S. Joshi and B. Pant eds.), Khumaltar, Lalitpur, Nepal.

Annual Report, 2072/73 (2015/16). Plant Pathology Division (PPD), NARC, Khumaltar, Lalitpur, Nepal.

Annual Report, 2073/ 74 (2016/17). Plant Pathology Division (PPD), NARC, Khumaltar, Lalitpur, Nepal.

Table 1. Pathogens diagnosed in solanaceous crops in FY 2070-71

Pathogen	Disease	Hosts
Rhizoctonia sp.	Root/ collar rot	Pepper, Brinjal, Potato,Tomato
Fusarium solani	Root/crown rot	Okra, Pepper, Tomato
Alternaria solani	Leaf spot/early blight	Pepper, Tomato, Okra
Sclerotium rolfsii	Sclerotonia root rot	Tomato
Cercospora sp.	Leaf spot	Pepper
Leveillula taurica, L. sp	Powdery mildew	Tomato, Pepper
Septoria lycopersici	Leaf spot	Tomato
Phytopthora infestan	Late blight	Tomato, Potato
Phytopthora capasii	Phytopthora blight	Pepper
Fusarium oxysporium	Fruit rot	Pepper
Colletotrichum capsici	Anthracnose	Pepper
Cladosporium sp.	Plant/ bud dried	Tomato
Ralstonia solanacearum	Bacterial wilt	Tomato, Brinjal
Tomato Mosaic Virus	Viral disease	Tomato, Pepper
Tomato Leaf Curl Virus	Leaf Curl Virus	Tomato
Meloidogyne sp.	Root knot nematode	Tomato
Streptomyces scabies	Powdery scab	Potato

Table 2. Pathogens diagnosed in crucifer crops in FY 2070-71

Pathogen	Disease	Hosts
Rizoctonia sp.	Root rot/ wire stem	Cauliflower, Mustard, Radish, Cress, Turnip
Sclerotinia sclerotorium	Root rot/ head rot	Cauliflower, Cabbage
Alternaria sp.	Leaf spot	Cauliflower, Cabbage, Mustard, Radish, Turnip
Plasmodiophora brassicae	Clubroot	Cauliflower, Cabbage, Cress, Mustard, Turnip, Pakchoi
Phoma sp., *Culvularia* sp.	Leaf spot	Cauliflower
Cladosporium sp.	Leaf blight	Cauliflower
Fusarium sp., *Myrothecium* sp.	Root rot	Radish
Peronospora parasitica	Downy mildew	Cauliflower, Cabbage, Cress
Xanthomanas campestris pv. *campestris*	Black rot	Cauliflower, Cabbage, Rayo
Pseudomonas marginalis pv. marginalis	Bacterial soft/ root rot	Cauliflower, Rayo
Pseudomonas maculicola	Bacterial disease	Turnip
Turnip mosaic virus	Viral disease	Mustard
Thielaviopsis sp.	Root rot	Fenugreek
Alternaria dauci	Blight	Carrot
Albugo candida	White rust	Mustard

Table 3. Pathogens diagnosed in cucurbits crops in FY 2070-71

Pathogen	Disease	Hosts
Sphaerotheca fuliginea	Powdery mildew	Pumpkin, Bitter gourd
Phoma cucurbitacearum	Leaf spot	Bottle gourd, Chayote
Didymella bryoniae	Gummy stem blight	Bottle gourd
Achochyta sp.	Leaf spot	Bitter gourd, Chayote
Leveillula taurica	Powdery mildew	Cucumber
Cucumber Mosaic Virus	Viral disease	Bottle gourd, Bitter gourd, Sponge gourd, Pumpkin
Vein Banded Mosaic Virus	Viral disease	Bottle gourd
Meloidogyne sp.	Root knot nematode	Cucumber

Table 4. Pathogens diagnosed in root crops in FY 2070-71

Pathogen	Disease	Hosts
Fusarium sp.	Root tip pink	Garlic
Fusarium sp.	Bulb rot/ Rhizome rot	Onion, Ginger
Alternaria solani, *Stemphylium* sp.	Purple blotch	Garlic, Onion
Puccinia allii	Rust	Garlic
Peronospora destructor	Downy Mildew	Onion
Pythium sp.	Rhizome rot	Ginger
Phyllosticta zingiberi	Phyllosticta leaf spot	Ginger
Cercospora sp.	Leaf blight	Ginger
Colletotrichum sp.	Leaf spot	Turmeric
Cercospora sp.	Leaf spot	Turmeric
Taphrina maculans	Taphrina leaf spot	Turmeric