BIBLIOGRAPHY

RAYMUNDO, LAILANI A. APRIL 2013. Diseases Observed on Different Cultivars of Cabbage at Harvest Time. Benguet State University, La Trinidad, Benguet.

Adviser: Andres A. Basalong, M.Sc.

ABSTRACT

This study was conducted to determine the disease infecting cabbages in Dada, Poblacion, Bakun, Benguet and the incidence of diseases in cabbage cultivars.

Diseases observed were black rot (*Xanthomonas campestris* pv. *campestris*), *Cercospora* spot (*Cercospora brassicae*), and watery soft rot (*Sclerotinia sclerotiorum*). *Cercospora* leaf spot showed the highest percent incidence followed by black rot and least was watery soft rot.

Among the six cultivars, evaluated, cultivar "Repolyo" had the lowest incidence of black rot infection and cultivar "Rareball" for *Cercospora* leaf spot. Watery soft rot incidence was very low with no significant effects among the cultivars evaluated.

RESULTS AND DISCUSSION

Diseases Observed and Symptoms

The diseases observed are block rot caused by *Xanthomonas campestris* pv. *campestris*, leaf spot caused by *Cercospora brassicae* and watery soft rot caused by *Scleretinia sclerotiorum.*

Black rot in the field appeared as yellowish irregular angular spot and brownish at the inner part of the lesion (Figure 2). Infections appear to start on the leaf margin and advancing towards the midsections of the leaves. Similarly, Snowdon (1992) reported that diseased plants from black rot infection turn yellow then brown and dry out.

Infections of *Cercospora* leaf spot observed in the farm at harvest appeared as semicircular spot, black with thin yellow halo around the borders of the lesion and sunken appearance with ash grey center (Figure 3). Symptoms observed were quite similar to previous report that *Cercospora* leaf spot are pale grey spots, later turning brown with ash-gray centers. Subsequently, however, the affected areas became rounded spots, several mm in diameter and brownish with well-defined borders (Snowdon's 1992).

Likewise, watery soft rot lesions were observed as water-soaked, black and brownish at the advancing areas of the lesion and with white mold growth in some parts of the lesion (Figure 4). Literature cites that initial watery soft rot infections appear as pinkish-brown and watersoaked; remained firm, but more usually there was a soft breakdown with much leakage of liquid (Snowdon, 1992).

Figure 2. Black rot (*Xanthomonas campestris*) symptom (left) and isolate on nutrient agar (right)

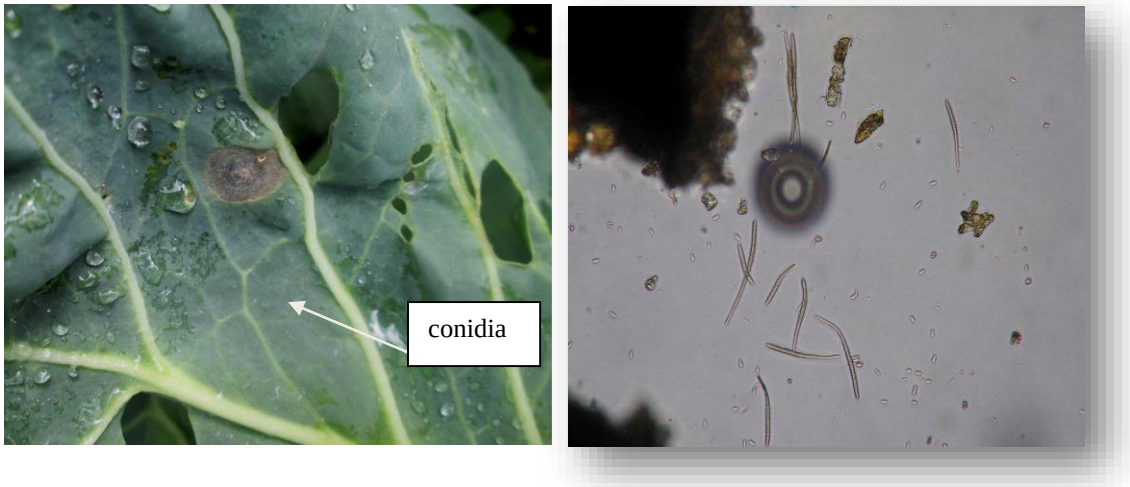

Figure 3. *Cercospora* leafspot *Cercospora brassicae* (left) and conidia (400x) (right)

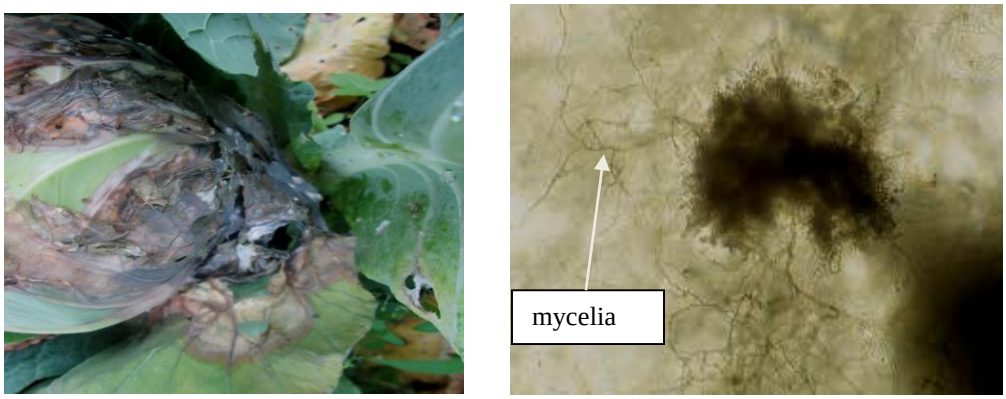

Figure 4. *Sclerotinia* (*Sclerotinia sclerotium*) rot (left) and mycelia (100x) (right)

Incidence of Black Rot Infection

Black rot infection on cabbage cultivars varied in percent of incidence with lowest on Repolyo and the highest was Luckyball, but statistical analysis revealed insignificant differences among the cultivars (Table 1).

Wrapper leaves supposed to be left to serve as protection during transport to market places were removed and weighed due to infections with black rot. With such premise, the lowest weight of infected wrapper leaves were from Scorpio and Rareball at 0.125kg and the highest was from Gladiator at 0.206 kilograms (Table 1). Discarded wrapper leaf from Gladiator was significantly different to most cultivars except that from Luckyball. With the condition that wrapper leaves are part of the cabbage head weight at farm gate price, planter of cultivar Gladiator may be losing an amount supposedly as an income. However in reference to yield per plot, Gladiator was the highest in yield, owing to it's phenotypically larges heads over the other cultivars.

Table 1. Incidence of black rot infection caused by *Xanthomonas* pv. *campestris*

CULTIVARS	Incidence (%)	Infected Wrapper Leaf (kg)
Scorpio (control)	18.35	0.125[a]
Rareball	18.88	0.125[a]
Magicball	18.35	0.163[a]
Luckyball	21.28	0.194[bc]
Gladiator	17.52	0.206[c]
Repolyo	15.41	0.138[b]
CV (%)	13.57	34.38

Means with the same letters are not significantly different at 5% DMRT.

Black rot epidemic development is favored by warm wet conditions, therefore low incidence of infection.

Figure 5. Black rot infection on old leaves (right) and on wrapper leaves (left)

Incidence of Cercospora Leaf Spot and Sclerotinia Rot

Incidence of cercospora leaf spot infection was widespread on the cultivars. The highest percent incedence of cercospora leaf spot infection was obtain from cultivars Scorpio at 36.97, followed by Luckyball at 30.15, Gladiator at 28.47, Repolyo at 28.17, Magicball at 24.34 and the lowest was from Rareball at 23.01 (Table 2). Cercospora leaf spot infections on Rareball and Magicball are significantly lower than the incidence of infection on Scorpio.

There was a very low incedence of watery soft rot infection such that some portion of the blocks did not had infections. There were insignificant defferences among the cultivars (Table 2).

Table 2. Incidence of *Cercospora* leaf spot and *Sclerotinia sclerotiorum*

TREATMENTS	*Cercospora brassicae*	*Sclerotinia sclerotiorum*	
		(Actual)	(Transformed)
Scorpio (control)	36.97[b]	0.53	1.02
Rare ball	23.01[a]	0.80	1.29
Magic ball	24.34[a]	0.66	1.11
Lucky ball	30.15[ab]	0.93	1.25
Gladiator	28.47[ab]	0.80	1.16
Repolyo	28.17[ab]	0.40	1.09
CV (%)	14.78	85.10	23.95

Means with the same letters are not significantly different at 5% DMRT.

The low incidence of Sclerotinia rot could be attributed to low temperatures within the cool months (from November 2012 to February 2013) during the period where cabbage cultivars were grown. This result conforms with the report of Snowdown (1992) that Sclerotinia is capable of inducing a watery breakdown of tissues at optimal temperature for decay being approximately 20^{o}C.

In reference to the percent incidences of each of the pathogens observed, *Cercospora* leaf spot appeared to be more predominant than black rot and *Scelrotinia* rot. This is attributed the condition of inoculum dispersal, whereby Cercospora leaf spot spores are wind disseminated than bacterial cells and sclerotium.

Yield Per Plot

Yield per plot showed that Gladiator have the highest yield having the mean of 46.44kg while the lowest yield was Scorpio with a mean of 32.38kg (Table 3).

Table 3.Mean yield per plot (kg)

CULTIVARS .	MARKETABLE
Scorpio (control)	32.38[c]
Rare ball	46.38[a]
Magic ball	39.50[b]
Lucky ball	42.31[ab]
Gladiator	46.44[a]
Repolyo	44.25[ab]
CV (%)	7.82

Means with the same letters are not significantly different at 5% level.

Statistically, the yield of Gladiator and Rareball were significantly higher than the yield of Scorpio and Magicball, but not to the yields of Luckyball and Repolyo.

Magic ball

Repolyo

Gladiator

Rareball

Luckyball

Scorpio

Figure 6. Cabbage cultivars

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The study was conducted at Dada, Poblacion, Bakun, Benguet from November 2012 to February 2013 to determine the incidence of cabbages diseases in Dada, Poblacion, Bakun, Benguet, the percent incidence of infections to the cabbage cultivars and the most predominant disease.

Result showed that the disease infecting cabbage cultivars in Dada, Poblacion, Bakun were black rot (*Xanthomonas campestris* pv. *campestris*), *Cercospora* leaf spot (*Cercospora brassicae*), and watery soft rot (*Sclerotinia sclerotiorum*). Percent incidence of the pathogens showed that C*ercospora* leaf spot was predominant based on percent incidence followed by black rot and least was watery soft rot.

Infections of the diseases observed did not affect the yield as most of the cultivars were able to produce satisfactory weight of marketable heads per plot.

Conclusions

The disease commonly known as black rot, Cercospora leaf spot and Sclerotinia rot infects cabbage cultivars in Dada, Publacion, Bakun, Benguet. The predominant disease is *Cercospora* leaf spot.

Percent incidence does not provide appropriate measure of disease pressure in reduction of the cabbage cultivars' yields. The six cultivars are able to produce marketable yield per plot as infections of the pathogens were observed to have started later during the growth of the cabbage plants.

The infected wrapper leaves entails trimming in the field and the wrapping in place of the trimmed wrapper leaves with recyclable clean news papers.

Recommendations

As to production per unit area, Gladiator is recommended for cultivation due to higher marketable yield, owing to larger heads than the other cultivars.

In avoiding *Cercospora* infection, the predominantly observed disease, cultivars Rareball and Magicball are preferable for having the low *Cercospora* leaf spot percent incidence of infection.

To obtain greater impact of the study, further study shall be conducted during warm and cold weather condition. Moreover, assessment on the impact of disease from field to market places shall be done.

LITERATURE CITED

ALVAREZ, A. M. and LOU K.1985. Rapid Identification of *Xanthomonas campestris* pv. *campestris* by ELIZA. Plant Disease.Wolfe Publishing Ltd., Aylesburry, England. Pp. 1082-1086.

BANDOC, G.B JR. 1976.Cabbage, Cauliflower and Broccoli: Vegetable Production in Southeast Asia. University of the Philippines, Los banos, Laguna.p.174.

DAVIS, W.H. (1925). Drop of Cabbage and our common cabbage by *Sclerotinia sclerotiorum* (Lib.) Aylesburg, England. Phytopathology 15, 249-259 illus. P. 162.

DILLARD, H. R. 1987. Department of Plant Pathology. New York State of Agricuture Experiment Station, Geneva. Sclerotinia Rot of Cabbage. Retrieved March 27 from Vegetablemdonline.ppath.cornell.edu/factsheet/crucifers.htm. P. 30.

ONSONDO, J. M. (1987). Management of Black Rot of Cabbage (*Xanthomonas campestris* pv. *campestris*) in Kenya. Tropical Pest Management 33, 5-6. Boca Raton, Florida 33431, USA, by Arrangement with the Wolfe Publishing Ltd. P. 144.

RIVERS, A. 1999. Cercospora leaf spot disease. Retrieved March 28, 2013 from www.ehow.com/html. P. 2.

SNOWDON, A. L. 1992. Postharvest Diseases and Disorders of fruits and Vegetables. BDCC Hazell Books, Aylesburg, England. P. 162.

WALKER, J. C. 1969. Plant Pathology. Tata McGraw-Hill Co. Ltd, New Delhi. P. 130.

WELLMANN, F. L. 1972. Plant Pathology.Tropical American Plant Diseases. Metuchen N.jersey: The Scarecrow Press Inc. P. 884.

WILLIAMS, P. H. 1980. Black rot: a continuing threat to world crucifers. *Plant Disease*.CRC Press Inc., 2000 Corporate Blvd, NW. P. 736.