

BIBLIOGRAPHY

TOGAY-AN, JANET L. APRIL 2013. Symptoms, Incidence, and Potential Vectors of Carnation (*Dianthus caryophyllus*) and Chrysanthemum (*Chrysanthemum morifolium*) Diseases Under Greenhouse Condition in Paoay, Atok, Benguet. Benguet State University, La Trinidad, Benguet.

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ABSTRACT

The study was conducted at Paoay, Atok, Benguet from December 2012 to January 2013 to document the symptoms and identify the infecting diseases of carnation (*Dianthus caryophyllus*) and chrysanthemum (*Chrysanthemum morifolium*); determine the incidence of these diseases and associated insects and; determine the prevalence of the potential alternate hosts in the production areas in Paoay, Atok, Benguet.

Through symptomatology, diseases observed include: wilt (*Fusarium oxysporum* f. *dianthi*), gray mold rot (*Botrytis cinerea*) and fairy ring leaf spot (*Heterosporium echinulatum*) in carnation; rust (*Puccinia chrysanthemi*), stunt and mottle viral diseases in chrysanthemum. Documentation of insects associated with diseased plants includes mites (*Tetranychus urticae*) in carnation, aphids (*Macrosiphoniella sanborni*) and leaf miner (*Phytomyza syngenesiae*) in chrysanthemum. No other plant that may serve as alternate hosts was documented.



Wilt (*Fusarium oxysporum f. dianthi*) and fairy ring leaf spot (*Heterosporium echinulatum*) had the highest incidence of carnation diseases and rust (*Puccinia chrysanthemi*) in chrysanthemum in the production areas. These were considered the most destructive diseases resulting to yield loss. Incidence of mites on carnation is high while low on aphids and leaf miners on chrysanthemum.



RESULTS AND DISCUSSION

During the survey, several diseases were observed to affect carnation and chrysanthemum grown inside greenhouse in Paoay, Atok, Benguet. Through symptomatology, diseases observed include: wilt, gray mold rot and fairy ring leaf spot in carnation; rust, stunt and mottle viral diseases in chrysanthemum. These observations confirm the observations of carnation and chrysanthemum farmers of Atok.

Wilt (*Fusarium oxysporum f. dianthi*), gray mold rot (*Botrytis cinerea*) and fairy ring leaf spot (*Heterosporium echinulatum*) were most prevalent and were present in almost all of the carnation growing areas in Paoay, Atok area while rust (*Puccinia chrysanthemi*) infected chrysanthemum in Paoay Proper area.

Carnation is the main crop of five sitios of Paoay, Atok. No viral symptoms were observed in carnation but major diseases observed which were the wilt (*Fusarium oxysporum f. dianthi*), gray mold rot (*Botrytis cinerea*), and fairy ring leaf spot (*Heterosporium echinulatum*). White rust (*Puccinia chrysanthemi*), stunt and mottle viral symptoms were observed in chrysanthemum. To control these diseases farmers spray fungicide like Score, Muntana, Saprool and Bravo were the chemicals used for the fungal diseases. At present, farmers practice the rouging of the infected chrysanthemum plants to prevent spread of virus diseases.



Incidence of Diseases

Rust had the highest incidence with 14.77%. The survey was conducted in December where temperature ranged from 10-15°C and high relative humidity. Forsberg (1975) stated that infection is favored by cool, wet weather conditions, and the disease is found most commonly in late summer and autumn. Incidence of virus symptoms like mottling and stunting ranged from 0.13% and stunt with 0.10% respectively. The low incidence of virus symptoms especially mottle was because chrysanthemum was a new crop in the area (Table 2).

Carnation wilt usually occurs when the environment is cool and damp at night, and warm with high humidity in the daytime (Forsberg, 1975). Conditions at Paoay, Atok favored the infection of wilt because all the sitios were affected inspite of the utilization of imported planting materials. Sitio Sayangan had the highest incidence of wilt with 38.51%, followed by Lower Paoay (2) with 37.40%, Englandad with 35.35%, Proper Paoay with 32.08%, Lower Paoay (1) lowest incidence at with 19.27% (Table 3).

Table 2. Incidence of chrysanthemum diseases in Proper Paoay

| DISEASE | INCIDENCE (%) |
|---------|---------------|
| Rust | 14.77 |
| Mottle | 0.13 |
| Stunt | 0.10 |



Incidence of gray mold rot in the production areas was low. If weather is dry in the greenhouse, affected parts of carnation infected with gray mold rot appear as brown, dry, and brittle spot (Forsberg, 1975). These symptoms appear dry as is the condition in the greenhouse in Paoay, Atok. Sitio Lower Paoay (2) had the highest incidence with 9.66%, followed by Sayangan with 4.03%, Paoay Proper with 2.32%, Englanddad with 2.15%, and Lower Paoay (1) had the lowest incidence with 1.63% (Table 4).

Table 3. Incidence of carnation wilts in Paoay, Atok

| SITIO | INCIDENCE (%) |
|---------------|---------------|
| Paoay Proper | 32.08 |
| Englanddad | 35.35 |
| Lower Paoay 1 | 19.27 |
| Lower Paoay 2 | 37.40 |
| Sayangan | 38.51 |

Table 4. Incidence of carnation gray mold rots in Paoay, Atok

| SITIO | INCIDENCE (%) |
|---------------|---------------|
| Paoay Proper | 2.32 |
| Englanddad | 2.15 |
| Lower Paoay 1 | 1.63 |
| Lower Paoay 2 | 9.66 |
| Sayangan | 4.03 |



Result showed that conditions in Paoay, Atok favored the fairy ring leaf spot diseases in carnation. Sitio Lower Paoay (2) had the highest incidence with 34.82%, followed by Englanddad with 30.81%, Sayangan with 20.70%, Paoay Proper with 19.92%, and Lower Paoay (1) had the lowest incidence with 6.82%. To minimize the spread of the disease, some farmers of remove the infected leaves if the infection is high (Table 5).

Identification of Diseases of Chrysanthemum

Virus Diseases. Stunting was observed in some chrysanthemum plants. This was exhibited by the reductions in size, leaves and flowers, which was recognized when healthy and infected plant of the same age are grown side by side (Figure 1).

Mottle virus showed leaves which were distorted, irregular in the form with broken and crinkled margins turning downward. These symptoms were observed at the flower stage of chrysanthemum. However, this disease occurs at any growing stage of the plant (Figure 2).

Table 5. Incidence of carnation fairy ring leaf spot in Paoay, Atok

| SITIO | INCIDENCE (%) |
|---------------|---------------|
| Paoay Proper | 4.03 |
| Englanddad | 30.81 |
| Lower Paoay 1 | 6.82 |
| Lower Paoay 2 | 34.82 |
| Sayangan | 20.70 |





Figure 1. Chrysanthemum stunt virus

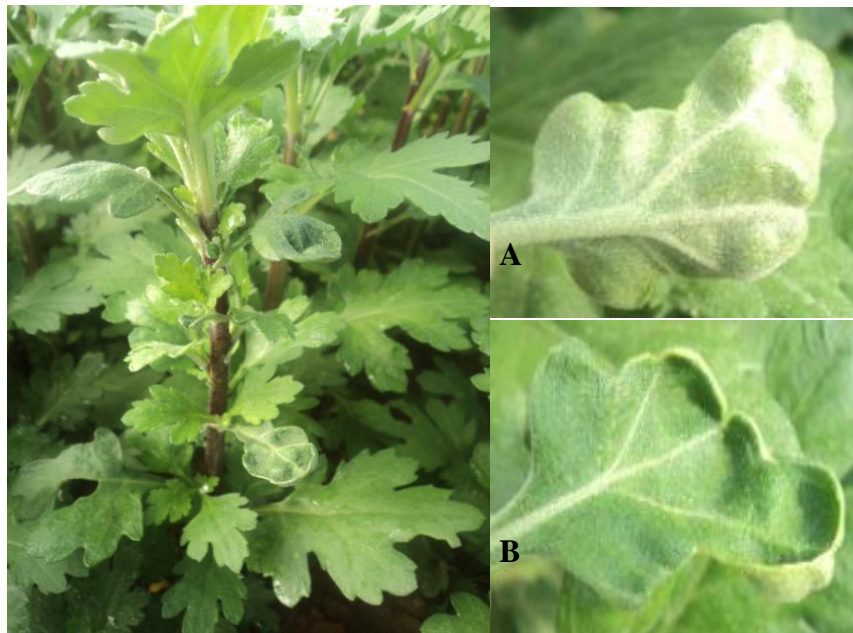


Figure 2. Chrysanthemum mottle virus (a) mottle on the upper part of the leaf and (b) lower part of the leaf

Fungal Diseases

Wilt caused by *Fusarium oxysporum f. dianthi*. Greater losses of carnation growers in Paoay, Atok was caused by wilt (*Fusarium oxysporum f. dianthi*). Plants showed color change with the normal deep green color of the leaves and stems changing first to a lighter gray-green and finally to yellow (Figure 3).

Microscopy results indicated the macroconidia as finely pointed and usually slightly curved, banana or sickle-shaped and usually septated. Microconidia are one-celled ovoid or oblong shaped (Figure 4).



Figure 3. Symptoms of *Fusarium* wilt in carnation

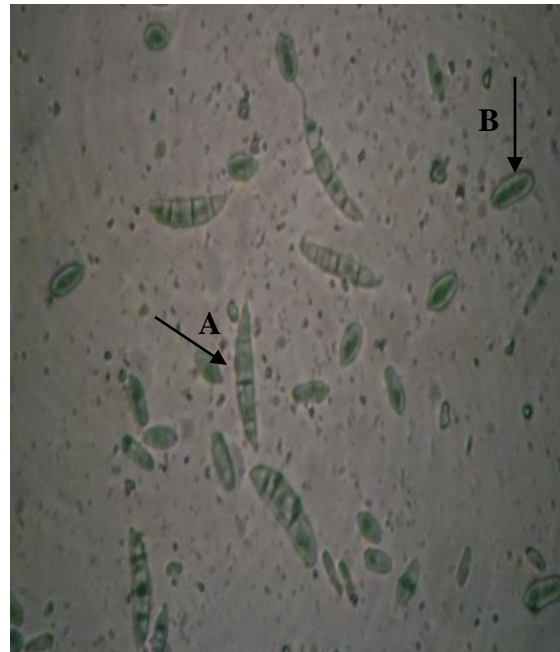


Figure 4. Conidia of *Fusarium*

oxysporum f. dianthi (400X):
a. Macroconidia
b. Microconidia

Gray mold rot caused by *Botrytis cinerea*. The gray mold rot was observed in the five sitios of Paoay, Atok. Forsberg (1975) stated that this occurs only during periods of extremely high humidity like in greenhouses conditions. The gray mold rot appeared as black soft rot, dry and brittle on the buds (Figure 5).

The causal organism *Botrytis cinerea* under the microscope has round hyaline spores (Figure 6)



Figure 5. Gray mold rot of carnation buds



Figure 6. Structure of *B.cinerea* (400X)

Fairy ring leaf spot caused by *Heterosporium echinulatum*. Fairy ring spot were observed in the five sitios of Paoay, Atok. Its spots are usually circular, about one-fourth inch in diameter and black spores, which is confined to the center of the spots (Figure 7).

Microscopy results indicated the macroconidia as elongated and septated. Microconidia are oblong, round lemon-shaped (Figure 8).



Figure 7. Symptoms of Fairy ring leaf spot on carnation

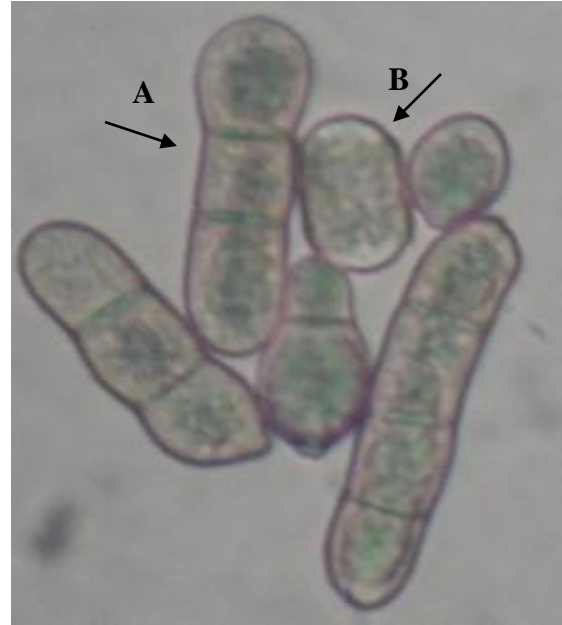


Figure 8. Conidia of *H. echinulatum* (400X): a) Macroconidia
b) Microconidia

White rust caused by *Puccinia chrysanthemi*. White rust is the most destructive disease of chrysanthemum in La Trinidad. In Paoay Proper, disease incidence of 14.77% was recorded. The disease appeared as small white growth about the pin head size of which soon become dark-brown (Figure 9).

The causal organism *Puccinia chrysanthemi* under the microscope has structure of teliospore hyaline (Figure 10).



Figure 9. Chrysanthemum rust pustules on under surface of the leaves



Figure 10. Teliospore of *P. chrysanthemi* (a) 400X and (b) 100X

Insect Pests of Carnation and Chrysanthemum

The insect pests of chrysanthemum reported in Cebu Technoguide which includes leafrollers, aphids, thrips, and mites were not observed in Paoay Proper production area. However, the aphids (*Macrosiphoniella sanborni*) which damaged the buds and the leaves (Figure 11) and, leaf miner (*Phytomyza syngenesiae*) on the leaves were observed (Figure 12 and 13). In carnation mites (*Tetranychus urticae*) which is considered as the serious pest of carnation was observed in Paoay, Atok, Benguet (Figure 14 and 15).



Figure 11. (a) Matured aphids (*Macrosiphoniella sanborni*) cluster over chrysanthemum buds (b) young aphids (*Macrosiphoniella sanborni*) on leaves



Figure 12. Leaf miners (*Phytomyza syngenesiae*) on chrysanthemum leaves



Figure 13. Leaf miners damage



Figure 14. a. Two-spotted spider mite (*Tetranychus urticae*)
 b. Two spotted spider mite (*Tetranychus urticae*)
 cluster over carnation leaves

Figure 15. Mites damage

Mites (*Tetranychus urticae*) is the most prevalent and was present in almost all growing areas of carnation in Paoay, Atok, while aphids (*Macrosiphoniella sanborni*) and leaf miner (*Phytomyza syngenesiae*) on chrysanthemum was only observed in Paoay Proper area. Agrimek, Kotetso, Abamectin, and Padan were the insecticides used by the farmers to control these insect pests (Table 6).

Table 6. Insect pests of Carnation and Chrysanthemum occurring in the production areas

| SITIO | CUTFLOWER | VECTORS OBSERVED | INSECTICIDES |
|-----------------|---------------|------------------|----------------------|
| Paoay Proper | Carnation | Mites | Agrimek |
| | Chrysanthemum | Aphids | Leaf miner |
| Englandad | Carnation | Mites | Kotetso Abamectin |
| Lower Paoay (1) | Carnation | Mites | — |
| Lower Paoay (2) | Carnation | Mites | Any Insecticides |
| Sayangan | Carnation | Mites | Padan |
| | | | Kotetso |

Minimal incidence of leaf miner (3.17%) and aphids (2.34%) was observed. Leaf miner damages the leaves through the egg which hatches into larva that causes mines on the leaves leading to chlorophyll loss (Mula, 2003). On the other hand, aphids usually serve as vectors of virus diseases the usually appear as colonies on the underside of chrysanthemum leaves (Table 7).



Table 7. Incidence of insect pests of chrysanthemum

| VECTORS | INCIDENCE (%) |
|------------|---------------|
| Leaf Miner | 3.17 |
| Aphids | 2.34 |

Mites are serious pests of carnation in Paoay, Atok. It feeds on the undersurface of the leaves and buds. Their presence often escapes detection until plant damage is obvious. Sitio Sayangan had the highest incidence with 42.36%, followed by Lower Paoay (2) with 29.64%, Proper Paoay with 22.40%, Englandad with 20.99%, and Lower Paoay with 18.60% (Table 8).

Plants observed around the greenhouse include: galinzoga (*Galinzoga parviflora*), calcalapcap (*Euphorbia maculata*) and violet wood sorrel (*Oxalis corymbosa*) but no disease and pest were observed in the weeds.

Since the ornamentals were grown in the greenhouse, alternate hosts, some vectors and other diseases were controlled. According to the farmers of Paoay, when alternate hosts were noticed, they remove. Greenhouses in Paoay are relatively small area hence, weeds growing near or between crop plants in the row, are easily remove by hand pulling.



Table 8. Incidence of mites of carnation

| SITIO | INCIDENCE (%) |
|---------------|---------------|
| Proper Paoay | 22.40 |
| Englandad | 20.99 |
| Lower Paoay 1 | 18.60 |
| Lower Paoay 2 | 29.64 |
| Sayangan | 42.36 |

Secondary Organism

Secondary organisms developed in carnation kept/stored for two weeks. Carnation flowers showed blue molds. When seen under the microscope causal organism was *Penicillium sp.*



Figure 16. Blue mold

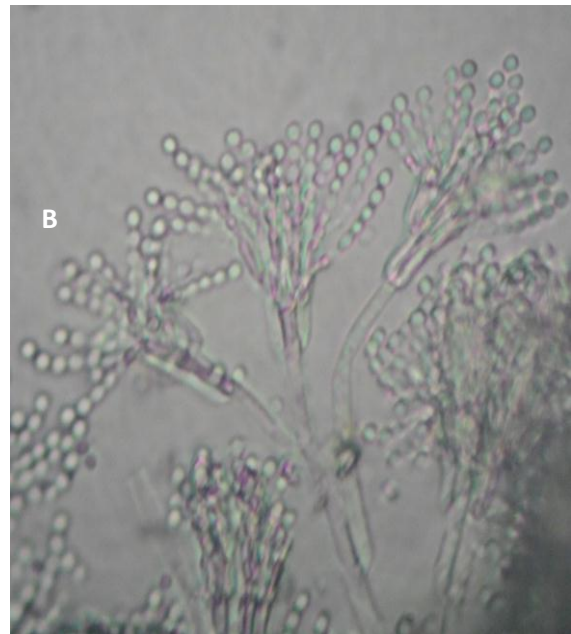


Figure 17. Photomicrograph of *Penicillium sp.* (400X)

Physiological Disorder

Calyx splitting was observed in one farm, Lower Paoay, is an emerging problem in carnation. This is due to extreme fluctuation in temperature, over wintering of dry plant, moisture situation, low N, high ammonical N, boron deficiency and varietal character. This can be prevented by uniform watering, application of higher nitrate to ammonical N ratio, spraying of borax and avoiding planting of varieties which are prone to split. It is also recommended to use small rubber band on bud when it show Opening (Figure 18). In addition, curly tips was observed in Paoay, Proper. It causes the growing tips of foliage to curl and distorted (Figure 19).



Figure 18. Calyx Splitting



Figure 19. Curly tip

Chrysanthemum Deficiency

Chrysanthemum leaf marginal browning was observed (Figure 20). This symptom is caused by lack of potassium. Severe deficiency results in shortened plants and small dark green leaves. Marginal browning spreads up the plant and lower leaves die prematurely. Flowering is delayed, bloom size reduced and sprays carry fewer blooms than normal (Barlow, 2008).



Figure 20. Potassium Deficiency

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The study was conducted to document symptoms, incidence, and potential vectors of carnation (*Dianthus caryophyllus*) and chrysanthemum (*Chrysanthemum morifolium*) diseases under greenhouse condition in Paoay, Atok, Benguet. Among the diseases reported are wilt (*Fusarium oxysporum f. dianthi*), gray mold rot (*Botrytis cinerea*), fairy ring leaf spot (*Heterosporium echinulatum*), and rust (*Puccinia chrysanthemi*). Some symptoms of virus were observed; like mottling and stunting on chrysanthemum. Documentation of insects associated with diseased plants includes mites in carnation, aphids (*Macrosiphoniella sanborni*) and leaf miner (*Phytomyza syngenesiae*) in chrysanthemum. No other plant that may serve as alternate hosts was documented.

Wilt (*Fusarium oxysporum f. dianthi*) and fairy ring leaf spot (*Heterosporium echinulatum*) had the highest incidence of carnation diseases and rust (*Puccinia chrysanthemi*) in chrysanthemum in the production areas. These were considered the most destructive diseases resulting to yield loss.

Lower Paoay 1 had the lowest incidence of diseases because they were implementing the Good Agricultural Practices (GAP) and changed their planting materials. These materials are sourced mostly from the Netherlands.



Conclusions

Among the diseases documented to affect carnation are wilt and fairy ring and rust in chrysanthemum. Minimal infect was observed in Paoay, Atok, Benguet. Stunt and mottle viral diseases were also observed in chrysanthemum. Incidence of mites on carnation is high while low on aphids and leaf miners on chrysanthemum.

Recommendations

Effective management of diseases and insect pests should be done to prevent disease infection. Further study on the severity of these diseases is recommended.



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