

# Major Insects and Diseases of Carnation Cut Flower and Their Management in Nepal

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## Abstract

*Carnation is one of the most important cut flower in Nepal. It needs specific crop management and plant protection measures for production of quality cut flower. This study was conducted during rainy season in 2017 to assess the major insects and diseases of carnation cut flower by visiting the selected farms and using semi-structured questionnaire based survey and literature review. Mites, borers, thrips and leaf miners are the major insects of carnation cut flower followed by white fly and aphids. Similarly, rust, floral blight, die-back of branches and wilt are the major diseases of carnation cut flower. This study moreover illustrates the adopted management measures and available recommendations.*

**Keywords:** *Carnation, cut flower, disease, insect pest and management*

## Introduction

Nepal, the Himalayan country with extremely a large number of ecological diversity, is one of the world's richest pockets in flora and fauna diversity. About 5 percent of its flowering plants are endemic (Yanai et al. 2007). Economy of Nepal is primarily based on agriculture where floriculture sub-sector holds a great potential. Floriculture is fast emerging as a booming industry in the global context, but is relatively in a premature phase in Nepal (Gauchan, et.al, 2009). Entrepreneur's enthusiasm and investment in this sector grew spontaneously with the encouragement received from the domestic as well as foreign markets (Baral, 2010).

Carnation is a term used for the plants in the *Dianthus caryophyllus* group (Australian Government, 2006). Carnation (*Dianthus caryophyllus*) of Caryophyllaceae family is the second most important commercial cut flower in Nepal after rose (Pun, 2004 and FAN, 2017). Mild temperature (not more than 30°C) is suitable for its commercial cultivation, and has been accepted as an important competitive product for export in the international market too (FAN, 2015 and FAN, 2007). Nepal has comparative advantage for its production during summer and has great export potential.

According to the Floriculture Association Nepal (FAN, 2017), the daily demand of Carnation cut flower is 7000-9000 stems in the Nepalese market whereas the area covered by Carnation cultivation is 125 Ropanies (1 Ropani = 508.74 m<sup>2</sup>). Most of them are inside plastic house under semi-controlled condition. Crop management practice is most important for the successful cultivation of Carnation cut flower. Soil, climatic and management requirements (netting support, pinching, disbudding, di-shooting, water and fertilizer as well as insect pest control) are very specific for this cut flower. Aphids, Thrips and Mites are common insects and *Fusarium* wilt, bud rot, stems and root rot are common diseases of Carnation (FAN, 2015), but knowledge and skill on the identification and management of insects and diseases of flower crops have not been well studied, documented and utilized in Nepal so far. Thus, this study was accomplished to assess the major insects and diseases, and to list the recommendation for the general management of major insects and diseases of Carnation cut flowers.

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## Methodology

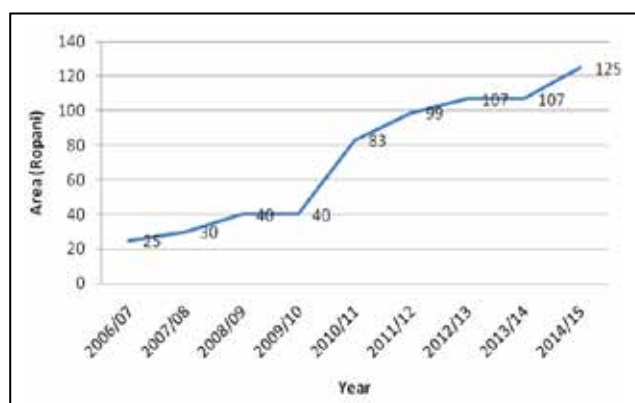
The study was carried out during the rainy season from July to August, 2017. Assessment of major insects and diseases of carnation cut flower was conducted by visiting different types of growing conditions (Top vent, Dome and Bamboo poly-house) in three carnation growing districts of Nepal viz; Lalitpur, Bhaktapur and Kavrepalanchok. The commercial farms producing carnation cut flower in the three districts were surveyed with the consultation of Floriculture Association Nepal (FAN) personnel (Annex 1). Selected farms of carnation cut flower were visited and observed to diagnose the prevalence of insects and diseases. The general list of the common insects and diseases of carnation cut flower were collected based on survey and compared with existing literature. Semi-structured questionnaire was used to collect information on insects and diseases of carnation cut flower and practices adapted to manage them. General morphological observation of insects and symptomatic diagnosis of the diseases were performed in the field and the photographs of insect pests and their damage symptoms were collected and presented in the photo-sheet. The scoring of insects and diseases was done according to the severity responded by the growers. The management measures followed by the growers and available in the literatures were compiled and presented in table 2 and 3.

## Result and Discussion

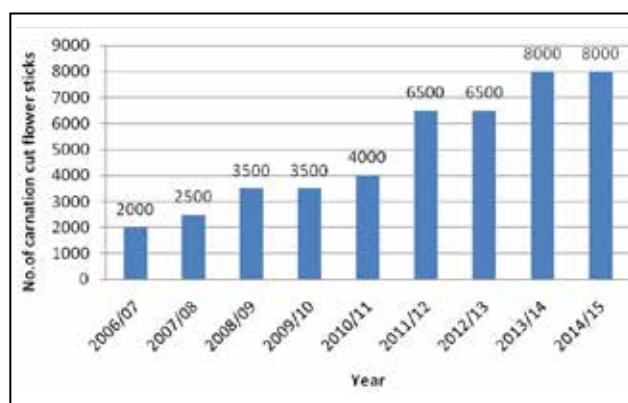
### Cultivation Status

#### Area and Demand of Carnation cut flower

According to the FAN (2017) the area under carnation cultivation and demand of cut flower both are in increasing trend (Fig. 1 and 2). This might be due to the consumers' preference to this cut flower.



**Figure 1** Area covered by Carnation in Nepal



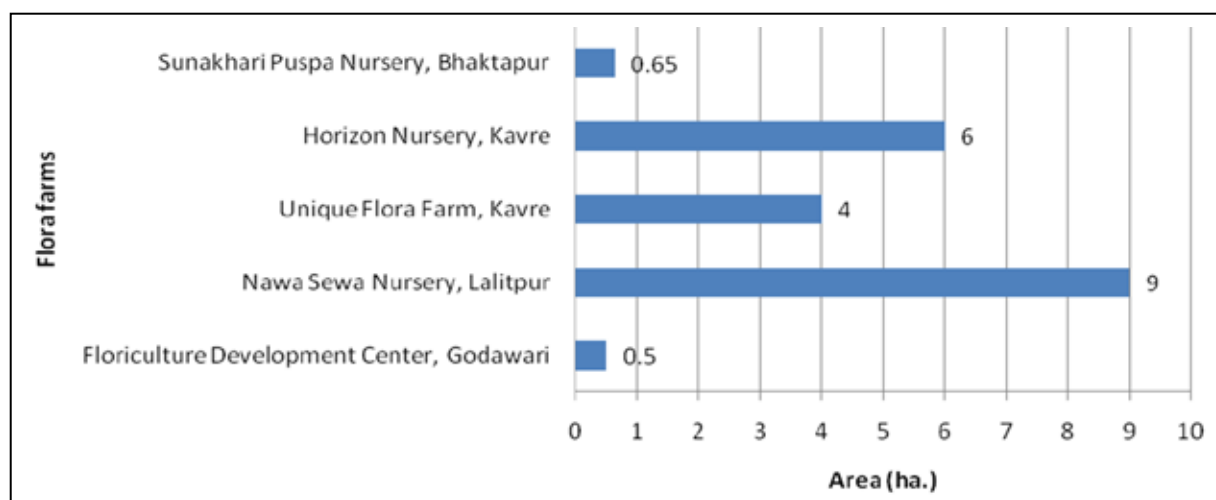
**Figure 2** Demand of Carnation cut over sticks per day in Nepal

Line graph in figure 1 gives information about areas coverage (in ropani) under carnation cut flowers in Nepal over the period of nine years between 2006/07 and 2014/15. The figure reveals gradual increment of areas in terms of Ropani over the initial three years (2006/07 to 2008/09) whereas it was static over two years between 2008/09 and 2009/10. It jumped contrastingly from 2009/10 to 2010/11. Then, it gradually increased for three years from 2010/11 to 2012/13. Thereafter it again remained constant for two years from 2012/13 to 2013/14. Ultimately, it increased moderately from 2013/14 to 2014/15 (Figure 1).

The bar chart in figure 2 represents the demands of carnation cut flower sticks/day over the period of nine years in Nepal. Overall, the demand of sticks/day was equally the highest in the two ultimate years (2013/14 and 2014/15) in comparison to those of remaining early years. However; there was the lowest demands of sticks/day in the beginning year 2006/07 followed by 2007/08. Thereafter, the demand of sticks/day was moderately high in two consecutive years 2011/12 and 2012/13.

In addition to carnation, other cut flowers such as chrysanthemum, gladiolus, rose, marigold, etc. were also found to be cultivated by the flower growers in their farms. Maximum 9 Ropanies and minimum 0.65 Ropani was the area under carnation cut flower in the respondent farms (Figure 3). Most of the flower farms are the members of Floriculture Association of Nepal (FAN). The growers had collected their experiences for more than 10 years in the floriculture sector, and they have taken it up as the major occupation for their livelihood.

Bar chart shows the surveyed areas under carnation cultivation in four different farms. Among the areas of nurseries in surveyed farms, Nawa Sewa Nursery possessed the maximum 9 ropanies whereas Floriculture Development Centre, Godawari, Lalitpur had the minimum 0.5 ropani area under carnation cut flower in the respondent's farms (Figure 3).



**Figure 3** Area under Carnation cultivation in surveyed farms

### Source of Planting Material and Varieties

The growers imported the planting materials from India, Spain and The Netherlands. Some growers used to propagate carnation themselves by cutting. The common varieties of Carnation cut flower according to the color are presented in the table 1. The name of the varieties were dependent on the companies that produce the planting materials.

**Table 1.** Major varieties of carnation cut flower according to the color

S.N.	Color	Varieties
1	Red	Master, Gadina, Robelo, Borja
2	White	Dober, Baltico, Purish, White Liberty, Pilar
3	Orange	Ponelopo
4	Yellow	Vinko
5	Double color	Star, Falicon

Source: Survey, 2017

### Cultivation Practices

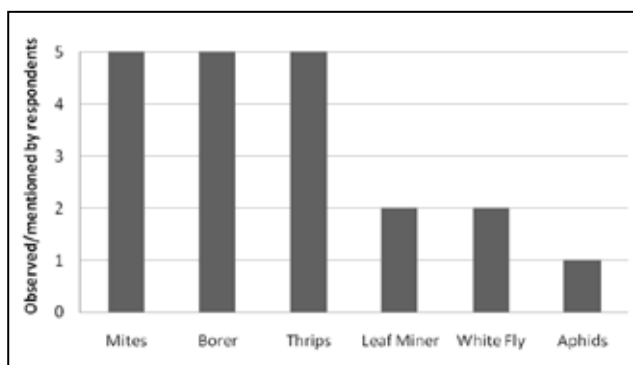
Soil having high organic matter and well-drained condition is suitable for the carnation cultivation. Carnation can do well in full sun, but it requires light shade in extremely hot areas. Irrigation facility is the prime requirement for the successful cultivation. This crop needs support for the cut flower production (UC IPM, 2016).

General plant population of the carnation cut flower is 8000 plants per Ropani (i.e. 508.74 m<sup>2</sup>). The land is prepared with the application of recommended manure (farm yard manure or compost), chemical fertilizers {Di-ammonium Phosphate (DAP) and Murate of Potash (MoP)} and organic source of nitrogen and secondary and micronutrients (Calcium, Boron etc.) (FAN, 2015).

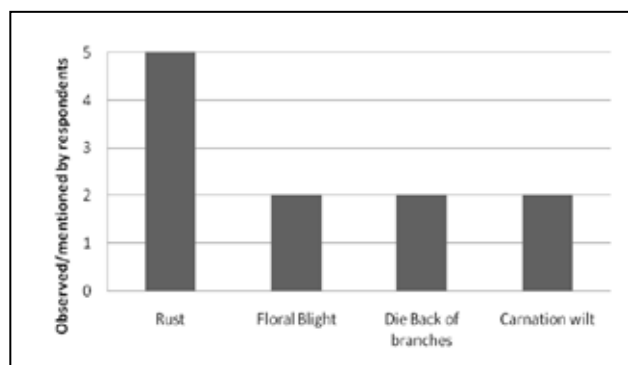
In the surveyed area, raised beds were prepared for planting seedlings. The cultivation structure for the carnation cut flowers were bamboo poly-house, upgraded Dome without ventilation and Top-vent structure. Silpaulin and Ultra Voile (UV) stabilized plastic sheet both were found getting used in the cultivation structures. Some grower used thermal net in the plastic house. Most of the farms had drip irrigation system installed. Plant support (netting) and dis-budding are the major operations in quality carnation flower production. Pinching is practiced after one month of transplanting, and dis-budding is regularly practiced after floral bud initiation.

### Insect Pests and Diseases

The major insects and diseases observed and mentioned by respondents during the farm visit were presented in the figure 4 and 5 and also listed and described in the table 2 and 3 below according to the severity of the damage.



**Figure 4** Major Insects of Carnation



**Figure 5** Major Diseases of Carnation

**Table 2.** Major insects of Carnation

S N	Name	Time of severe attack	Management measures adopted by the growers	Recommended management measures
1	<p>Mites</p> <p>Spider mite is one of the most serious pests. Both nymphs and adults suck the sap from undersurface of the leaves and affected leaves turn pale and have a dusty coating and fine webs. In severe attack the growth of the plants becomes stunted (Edge India Agrotech, 2018).</p>	<p>Summer months (the Second fortnight of March to the first fortnight of August) under and dry condition.</p>	<p>Pesticides applied: Cyromazine (KINGHUNTER), Proparizite (OMITE), Dimethoate (ROGER), Cypermethrin+Chloropyrifos (ACTION-505)</p>	<p>When the density of mite reaches 1/leaf (ETL), initiate management measures (Edge India Agrotech, 2018). Straight and flat leaved varieties are resistant to this pest. Manage proper ventilation. Discard the plant and leaf debris. Spray Azadiractin 50,000ppm 3ml/litre (TNAU, 2014). Spray Abamectin @ 0.4 ml/lit of water (Krishisewa, 2017). Spray Dicofol 18.5 EC @ 2 ml/lit (Edge India Agrotech, 2018).</p>
2	<p>Borer</p> <p>The moth lays eggs in the buds and the larvae eat into the buds completely damaging them. The larvae feed on leaves, flower buds and flowers. They make characteristic round holes in buds and flower heads. The infested buds fail to open. The attack by this pest is more during warm conditions (Jawaharlal et al. 2017).</p>	<p>All round the year</p>	<p>Pesticides applied: Emamectin Benzoate (KINGSTAR)</p>	<p>Use spodolure and/or heilure in funnel traps for monitoring of adult moth/s. Collect and destroy the larvae/borer. Spray neem based insecticides Azadiractin 3-5 ml/lit water. Spray Cypermethrin @ 1.5 ml/lit of water (Krishisewa, 2017).</p>
3	<p>Thrips</p> <p>Thrips suck the sap from the leaves, causing them to turn yellow and patchy often with black specks and slight wrinkling. They also cause streaks in the flowers making them unmarketable (FAN, 2015).</p>	<p>Dry summer months</p>	<p>Pesticides applied: Emamectin Benzoate (KINGSTAR), Dimethoate (ROGER), Imidachloroprid</p>	<p>Spray neem based insecticides Azadiractin 3-5 ml/lit water. Spraying of Fipronil 1.5 ml/lit (or) Imidachloroprid 2ml/litre or Dimethoate 30 EC @ 1ml/litre (TNAU, 2014).</p>
4	<p>Leaf Miner</p>	<p>All round the year</p>	<p>Pesticides applied: Dimethoate (ROGER)</p>	<p>Use yellow sticky traps to monitor the adult fly. Spray neem based insecticides Azadiractin 3-5 ml/lit water.</p>
5	<p>White Fly</p>	<p>Summer</p>	<p>Pesticides applied: Acetamiprid (Insecticide), and use of yellow sticky trap/s.</p>	<p>Use yellow sticky traps to monitor the adult fly. Spray neem based insecticides Azadiractin 3-5 ml/lit water.</p>
6	<p>Aphids</p> <p>Nymphs and adults suck the sap and feeds on flower buds, leaves and terminal shoots. It also transmits virus (Edge India Agrotech, 2018).</p>	<p>All round the year</p>	<p>Pesticides applied: Dimethoate (ROGER)</p>	<p>Use yellow sticky traps to monitor the adult fly. Spray neem based insecticides Azadiractin 3-5 ml/lit water. Spraying insecticides Thiomethoxam 1 ml/l or Acetamiprid 1 ml/l or Imidachloroprid 17.8 SL 0.1 (Jawaharlal et al. 2017 and TNAU, 2014)</p>

**Table 3.** Major diseases of Carnation

S N	Name	Time of severe attack	Management measures adopted by the growers	Recommended management measures
1	Rust Small blisters containing rust-red spores form on leaves. Disease is favored by cool nights alternating with warm humid days (Trujillo et. al, 1989).	All round the year, mostly during hot and humid period	Pesticide applied: Hexaconazole, Systemic fungicides	Use healthy planting materials. Clean and sterilize the equipments. Apply mancozeb based fungicides or propiconazole based products.
2	Carnation wilt ( <i>Fusarium</i> ) Affected plants show foliage wilting, rotting of the stem below ground level.	Rainy season/ Wet period/ high soil moisture condition	Most effective methods of control are planting disease-free planting materials. Sterilization of growing media and tools (TPDH, 2018). Soil drenching with Carbendazim @ 0.1 % or <i>Pseudomonas fluorescens</i> as soil application @ 25 g/m <sup>2</sup> (Adhikari, 2018, TNAU, 2014)	
3	Floral Blight ( <i>Botrytis</i> ) This fungal disease appears as tan to light brown soft rots on the petals of flower buds and opened flowers. Affected petals soon become covered with the grayish growth of the fungus filaments, which later are covered by a powdery mass of grayish spores (Trujillo et al. 1989).	Mostly during low night temperature and hot during day time and high humidity	Maintain adequate spacing between the plants for good air circulation. Spray Carbendazim / Captan @ 2 g / litre of water (Krishisewa, 2017).	
4	Die Back	High temperature, high humidity	Die back of branches after removal of flower stem. This is commonly due to the fungal attack. Sanitation is important for the management of this disease. Remove and destroy disease plant/plant parts. Spray fungicide Mancozeb or Copperoxychloride 1.5-2 gm/ lit water	
5	Viral diseases: Carnation is subjected to many viral diseases. Streak, mosaic, mottle, ring spot, etched ring and vein mottle are the most common viral diseases of carnation. Use of virus free planting material raised through shoot tip culture can eliminate viruses. Vectors can be controlled by the management measures and using spraying insecticides as mentioned above.			

Besides above illustrated diseases, damping off in cutting, leaf spots and blight in leaves, stem rot and root rot, drying lower leaves in older plants, and viral diseases were mentioned by the respondents during farm visit. The general observation during carnation flower farms visit and interaction with the growers revealed that the incidence and severity of insect pests and diseases are lesser in structures with UV stabilized plastic sheet than silpaulin plastic sheet. This might be due to that the light availability inside the plastic house is higher from UV stabilized plastic sheet than the silpaulin. In case of UV stabilized plastic, there is increase in PAR light and reduction in UV light. Similarly, the lower severity of insect pests as well as diseases were observed during carnation cut flower farm visit and mentioned by the growers in top vent (naturally-ventilated plastic house) followed by dome (non-ventilated plastic house) and bamboo-plastic house. The air circulation is better in top vent plastic house than the other structures for carnation cultivation. The growing structures, quality of plastic cover, design, orientation of structure affect the insect pests and diseases incidence, and their severity (TNAU, 2013).

## Conclusion and Recommendation

Carnation is one of the most important cut flowers in the Nepalese flower market. The demand and production of carnation cut flower is increasing yearly. The growers of Kathmandu valley and vicinity districts are producing carnation cut flower. Most of the cultivation is under protected condition i.e. plastic house. The insect pests, diseases and nutritional problems are also the factors that reduced the yield and quality of carnation cut flowers. Mite, borer, thrip and leaf miner are major insects; and rust, floral blight, die back of branches after removal of flower stem, and carnation wilt are the major diseases observed during the study period. Similarly, calyx splitting is found to be major disorder of this flower. The growers mostly used chemical measures for the pest management. The followings are recommendation for insect and pest management:

- Year round surveillance of insect pests and diseases of carnation flower should be conducted to know the time of their incidences.
- The incidence and severity of insect pests and diseases should be studied in various growing structures such as bamboo poly house, plastic house (dome), plastic house (ventilated), etc.
- The appropriate management measures should be generated to recommend to the carnation flower growers.

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### Annex. 1: Respondents Detail

S N	Name of the organization/farm	Address	Responsible/ Respondent personnel	Cultivation structure	Area under Carnation cultivation
1	Floriculture Development Center	Godawari, Lalitpur	Sirjana Poudel, Horticulture Development Officer	Top vent, Silpaulin	0.5 Ropani
2	Nawa Sewa Nursery	Godawari-2, Lalitpur	Dasharam Sunuwar 9861546964	Dome (without ventilation, U V plastic) and Bamboo Polyhouse, Silpaulin	9 Ropanies
3	Unique Flora Farm	Banepa-10, Janagal, Kavre	Bhojraj Timalisina 9841488131	Top vent, U V plastic + thermal net	4 Ropanies
4	Horizon Nursery	Dhulikhel-5, Kavre	Birendra Shrestha 9841514146	Bamboo Polyhouse, Silpaulin	6 Ropanies
5	Sunakhari Puspa Nursery	Suryabinayak-6, Katunje, Bhaktapur	Gopal Shrestha 9851022596	Top vent, Silpaulin	0.65 Ropanies

### Annex. 2: Photo Sheet

