

Vistas in disease management in ornamental horticulture

Ornamental horticulture, focused on the aesthetic cultivation of plants, faces significant challenges due to various plant pathogens, particularly fungi, which can severely impact yield and quality. This article explores Integrated Plant Disease Management (IDM), highlighting key methods such as sanitation, seed treatment, use of biocontrol agents, disease-resistant varieties, and chemical treatments. Emphasizing sustainability, IDM balances traditional and modern approaches to protect ornamental crops, ensuring healthier and more profitable production amidst pathogen threats.

ORNAMENTAL horticulture, which includes both floriculture and landscape horticulture, focuses on growing and marketing plants for aesthetic purposes, with activities such as flower arrangement and landscape design. While ornamental crops like flowering bulbs, seeds, and cut flowers are significant in nations like India, the Netherlands, Ecuador, and Colombia, they remain relatively minor in the global trade market. Ornamental plants stand out due to their natural beauty and unique characteristics, such as vibrant blooms, colourful leaves, and attractive fruits. They are grown for decorative purposes as potted plants, woody ornamentals, cut flowers, or bulbs. Floriculture, in particular, has been experiencing a global boom, driven by increasing demand, with cut flowers making up nearly a third of the global ornamental market.

However, ornamental horticulture faces significant challenges due to plant pathogens, which cause substantial losses in both yield and quality. These pathogens, including fungi, bacteria, and viruses, severely affect ornamental plants' appearance and commercial value, especially in cut flowers and potted plants, where visual quality is critical. Fungi, responsible for about 70% of plant diseases, are the leading cause of damage in ornamental crops, often

reducing yield by 30–40%. Additionally, phytoplasma diseases in ornamental plants have been rising due to increased plant material exchange.

Some of the important and emerging diseases affecting ornamental crops are listed in Table 1. These diseases pose a growing threat to the industry, highlighting the need for effective disease management strategies to ensure the health and sustainability of ornamental horticulture.

Managing plant health is essential for ornamental producers, as the visual appeal of flowers, stems, and leaves directly influences market value and profitability. To ensure this, disease management requires more than reactive treatments; it demands a proactive, integrated approach that focuses on prevention and maintaining plant quality. Key principles in effective management include maintaining clean plant stock, creating optimal growing



Disinfection of tools



Pruning off infected parts



Uprooting of wilted plants

Table 1. Top ten diseases that cause damage to ornamental plants

Disease	Pathogen	Important host
Phyllody	<i>Candidatus Phytoplasma asteris</i>	Marigold, Aster, Gerbera, Chrysanthemum, Petunia, Zinnia Gladiolus, Hibiscus
Wilt	<i>Fusarium oxysporum</i> f. sp. <i>gladioli</i>	Gladiolus
	<i>Fusarium oxysporum</i> f. sp. <i>chrysanthemi</i> ; <i>Fusarium incarnatum</i>	Chrysanthemum
	<i>Fusarium oxysporum</i>	Aglaonema
Powdery mildew	<i>Podosphaera pannosa</i>	Rose
	<i>Leveillula taurica</i>	Marigold
Dieback	<i>Diplodia rosarum</i> Fr., <i>Botrydiplodia theobromae</i> (Pat.), <i>Colletotrichium gleosporoides</i> (Penz.)	Rose
Sclerotium stem rot	<i>Sclerotium rolfsii</i>	Marigold, Chrysanthemum, Tuberose
Leaf spots	<i>Alternaria tagetica</i> , <i>A. alternata</i> , <i>Septoria</i> spp.	Marigold
	<i>Alternaria polianthi</i>	Tuberose
Damping off	<i>Pythium</i> spp. and <i>Phytophthora</i> spp.	Marigold, Chrysanthemum
Gray mold	<i>Botrytis cinerea</i>	Rose, Marigold, Chrysanthemum
Crown gall	<i>Agrobacterium tumefaciens</i>	Rose
Foliar blight	<i>Periwinkle</i>	<i>Phytophthora nicotianae</i>

conditions to deter disease, and swiftly addressing any emerging issues. Integrated Plant Disease Management (IPDM) has become a cornerstone strategy, combining sanitation, host resistance, biocontrol agents, and chemical treatments. Recent advances in genetic engineering have further reduced reliance on chemical pesticides, while the agrochemical industry continues to develop more specialized, targeted solutions. The adoption of IPDM is vital for the sustainable growth of the ornamental industry, offering a holistic approach that incorporates modern diagnostic tools and regulatory measures. By balancing innovation with sustainability, these integrated methods not only reduce the risk of resistance and ecological harm but also safeguard the quality and commercial viability of ornamental plants, ensuring a healthier future for the industry.

Sanitation

Sanitation in ornamental crop production focuses on preventing and eliminating pathogen propagules. This involves key practices like using certified disease-free plant material, maintaining weed-free zones, implementing physical barriers, and regularly cleaning tools and

equipment. These methods reduce the risk of pathogen introduction and spread. Disinfectants such as sodium hypochlorite (bleach) is crucial in pathogen control. Its effectiveness varies with pathogen type and environmental conditions. For example, sodium hypochlorite’s lethal activity ranges from 0.2% to 5.25% for viruses, 1% to 10% for fungi, and 10% to 12.5% for bacteria. It is absorbed rapidly between 20°C and 30°C. Reusing plant containers and stakes poses a risk if they harbour pathogen propagules, so proper cleaning and sterilization, including soaking in disinfectants or steam treatment, is essential. Clean propagation materials, such as stem and leaf tissues, should come from healthy stock plants. If disease-free stock is unavailable, strategies like micro-propagation, and plant indexing, should be employed to minimize contamination. These practices form an integral part of an overall disease management strategy in horticulture.

Seed treatment in ornamental crop production focuses on eradicating pathogens associated with seeds, which can be external, internal, or surface-level. Effective treatments depend on the type of pathogen. Hot water treatment is commonly used for corms, bulbs, tubers, and seeds, as it

Table 2. Disease-resistant/tolerant varieties of ornamental crops available in India

Crop	Variety	Disease resistance
Rose	Pusa Ajay	Moderately tolerant to powdery mildew and black spot
	Pusa Mohit	Tolerant to black spot
	Pusa Gaurav	Tolerant to dieback and black spot
	Arka Parimala	Moderately resistant to thrips and black spot, with fragrant red-purple flowers
Chrysanthemum	Baggi	Resistant to Phoma and Septoria leaf spot
	Ratlam Selection	
Gladiolus	Kum Kum	Moderately resistant to <i>Fusarium</i> wilt
Carnation	Arka Flame	Tolerant to <i>Fusarium</i> wilt and nematodes



Corm treatment with biocontrol agents

penetrates to eradicate internally harboured pathogens. However, it can be risky for delicate seeds. Aerated steam treatment (56°C–57°C for 30 minutes) is safer than hot water and more effective than hot air, particularly if seed moisture is increased beforehand. While short-term high-temperature exposure can eliminate bacteria and fungi, longer treatments are needed to target viruses. Due to limited pesticide options for ornamental crops, these physical treatments are preferred. Seed health testing is essential to ensure seeds are pathogen-free before planting.

Host resistance

Utilization of disease-resistant cultivars is one of the most effective and environmentally sustainable methods for managing plant diseases, including those affecting ornamental crops. Breeding programs, particularly through classic hybridization followed by progeny screening, have led to the development of cultivars that are resistant to common diseases. For roses, chrysanthemums, and other popular florists' crops, cultivars with resistance to specific diseases have been developed by various agricultural research institutes/SAUs in India (Table 2).

Biocontrol

Biocontrol is a highly effective non-chemical method for managing pests and pathogens, particularly suited for organic cultivation. It is environmentally safe, sustainable, economically viable, and highly specific. One example of biocontrol products specially recommended in ornamental horticulture is Arka Krishi All Rounder and Arka Plant Growth Booster, developed by ICAR-IIHR, Bengaluru. The product contain beneficial microbes such as *Pseudomonas fluorescens* IIHR Pf-2 and *Trichoderma harzianum* IIHR Th-2, which are recommended for crops like tuberose, gerbera, Cassandra, gladiolus, and carnation. Application methods include seed treatment at a rate of 20 g or 20 mL per kilogram of seed, substrate treatment with 10 g or 10 mL per kilogram of cocopeat to control soil-borne pathogens, and soil application at 5 kg or 5 litres per

hectare after enrichment in 5 tons of FYM before transplanting or sowing. These biocontrol agents offer a natural and efficient approach to pathogen management, promoting healthier crops without relying on chemical pesticides.

Chemical control remains a critical part of disease and pest management in ornamental crop production, especially in India, where the availability of registered chemicals for use in ornamentals is limited. Despite the rise of Integrated Pest

Management (IPM) strategies, chemicals still play a dominant role in controlling diseases and pests, particularly in the commercial production of ornamentals like roses, chrysanthemums, and gerberas. Several fungicides and chemicals have been traditionally used to control a wide range of plant diseases. However, only a few have been registered specifically for use in ornamental crops in India. For example, captan is registered for the control of *black spot* in roses, and bupirimate, carbendazim, and lime sulphur are used to manage powdery mildew in roses. The restricted availability of registered chemicals for ornamental crops highlights the need for targeted and judicious use of these fungicides to manage diseases effectively.

CONCLUSION

In the ornamental horticulture industry, disease management is crucial for maintaining the aesthetic and commercial value of plants. This article highlights the importance of a multi-pronged approach, integrating sanitation, seed treatments, biocontrol, chemical treatments, and the use of disease-resistant varieties. While chemical controls remain essential, the limited availability of registered fungicides for ornamental crops in India necessitates careful use. The development of resistant cultivars and biocontrol agents offers environmentally sustainable alternatives that, when combined with proper cultural practices, can significantly reduce the impact of pathogens on ornamental crops. By adopting Integrated Plant Disease Management (IDM) strategies, ornamental horticulture can achieve healthier and more profitable crop production.

For further interaction, please write to:

Dr K V Shivakumar (Scientist), ICAR-Directorate of Floricultural Research, Pune, Maharashtra 411 036. *Corresponding author email: shivakumarpat05@gmail.com