Asian Journal of Research in Biosciences

Volume 6, Issue 2, Page 125-130, 2024; Article no.AJORIB.1559

Managing Marigold Insect Pests: Effective Control Strategies

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Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

Article Information

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://prh.globalpresshub.com/review-history/1559

Minireview Article

Received: 04/02/2024
Accepted: 07/04/2024
Published: 10/04/2024

ABSTRACT

Marigolds (*Tagetes spp.*) are well-liked ornamental plants that have a variety of uses in the landscape and colorful blooms. They are, however, prone to a variety of insect pests that can harm their development and appearance. This study's main objective is to evaluate integrated pest management (IPM) strategies that reduce the usage of chemical pesticides and support environmentally friendly pest management. A comprehensive pest management strategy must include cultural practices including crop rotation, trap cropping, and maintaining garden hygiene. Utilizing advantageous insects like parasitoids and predators aids in biological control and lessens the need for chemical treatments. Furthermore, we assess the use of natural therapies like neem oil and *Bacillus thuringiensis* as secure and sustainable substitutes for conventional pesticides. For these therapies to be effective, time and accuracy are essential. The need for routine inspection and early insect infestation detection is also emphasized in this abstract to protect marigold plants from severe harm. Successful and long-lasting marigold pest management can be achieved by putting a combination of these techniques into practice that is customized to the particular pest pressures in a given setting. A comprehensive and diversified strategy is needed to control insect pests in the marigold growth process. Growers can enjoy healthy, bright marigold displays while minimizing the environmental impact of pest management procedures by integrating a variety of control strategies and giving ecologically friendly techniques priority.

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Keywords: Aphids; cutworms; Helicoverpa; Spidermites; Whiteflies.

1. INTRODUCTION

A popularly grown and well-known blooming plant recognized for its colorful and fragrant blossoms is the marigold (*Tagetes spp*.). This plant is a member of the Asteraceae family, also known as the sunflower, daisy, or aster family, and sayapatri in Nepal [1]. Native to America, especially Mexico and Central America, marigolds have long been cultivated and prized for their decorative, culinary, and therapeutic qualities. The genus *Tagetes*, which includes several species, is where marigolds are classified. The *Tagetes erecta* (African marigold), *Tagetes patula* (French marigold), and *Tagetes tenuifolia* (signet marigold) species are the most widely cultivated ones [2]. Marigold plants can be annual or perennial herbaceous depending on the type and region. They typically stand from a few inches and three feet tall. The leaves are frequently scented when crushed and are typically pinnate, with numerous leaflets. The bright and spectacular flowers of marigolds are their most remarkable feature. The flowers of the marigold come in a variety of yellow, orange, and red hues, and they frequently have a distinctive, spicy scent. Multiple petals are placed in a tight, rounded, or pom-pom-like arrangement to form the flower heads. The fibrous root system of marigolds makes it ideal for securing the plant and drawing nutrients from the soil. Due to their colorful and long-lasting blooms, marigolds are frequently planted in gardens, parks, and flower beds. They are frequently used in floral arrangements or as border plants. Marigolds are well-liked companion plants in vegetable gardens because of their reputation as effective pest deterrents. They can keep insects like nematodes and aphids away with their potent aroma [3]. Marigold extracts have been employed in conventional medicine because of their conceivable healing, antibiotics, and anti-inflammatory effects [4]. When treating minor skin irritations, they are occasionally administered topically. Some marigold types are edible, though this application is less frequent than ornamental use. To give color and a somewhat peppery flavor to salads, soups, and other foods, several species' petals are utilized.

2. MAJOR INSECTS OF MARIGOLD

Generally speaking, marigolds (*Tagetes spp*.) are resistant to many insect pests because of their potent scent and inherently pest-repelling substances. Marigold plants can still be harmed by a few common insect pests, though. Some of them are as follows:

1. ***Aphids:*** Small, soft-bodied insects known as aphids occur in a range of hues, including green, yellow, and black. They normally have bodies that are pear-shaped and range in length from 1 to 4 mm. With tiny needle-like mouthparts, aphids pierce the tissues of marigold plants to feed on the sap. This may result in wilting, leaf yellowing, and the production of honeydew, a sticky material that draws ants and may encourage the spread of sooty mold [5].

2. ***Spider mites:*** Although they are tiny arachnids rather than insects, spider mites are frequently seen as a pest of marigolds. They are often red or green and have a length of 0.5 mm. Spider mites pierce the leaves with their mouthparts to feed on the plant's cell contents. This feeding can result in leaf discoloration and decreased plant vigor. It also creates stippling, or tiny yellow or white spots, on the leaves.

3. ***Whiteflies:*** Small, winged whiteflies are often white or pale yellow in color. They have a characteristic powdered look and are only 1-2 mm long. Whiteflies consume the sap from plant tissues on the undersides of marigold leaves. This may cause the leaves to yellow, wilt, or distort. Additionally, they expel honeydew, which might encourage the development of sooty mold.

4. ***Cutworms:*** The larval stage of some moth species is known as a cutworm. They are typically gray or brown caterpillars that, when startled, wrap up into a C shape [6]. Marigold plants are severed at the base by cutworms, which feed on the stems at or just below the soil's surface. Young marigold seedlings may suddenly wilt and die as a result of this.

5. ***Helicoverpa:*** A pest bug known as Helicoverpa, also referred to as the cotton bollworm or corn earworm, damages a variety of crops, including cotton, corn, soybeans, and different vegetables [7] It is a highly adaptable and destructive pest

that can seriously harm agricultural crops economically. Moth adults often have mottled markings on their wings which are brown or gray in color. Their wingspan ranges from 2.5 to 3.8 cm, or roughly 1 to 1.5 inches. One of the primary characteristics of the genus Helicoverpa is the forewings' frequent "helicoidal" or helix-like design. The hindwings are paler and have a thin pale band running along the edge. Depending on their stage of development and the host plant, larvae can range in color from green to brown. Their bodies are covered in longitudinal stripes or patterns. The caterpillars contain numerous pairs of prolegs (fleshy, leg-like appendages) down the abdomen in addition to three pairs of genuine legs close to the head. Around marigold plants, adult Helicoverpa moths can also be seen, especially when they are mating and laying eggs. By consuming the blooms and foliage of marigold plants, Helicoverpa larvae can seriously harm them. Rough edges on leaves, holes in flower petals, and damaged buds are examples of damage. Small, dark-colored pellets or feces on the plant's leaves or nearby can be a sign that Helicoverpa larvae are present.

Fig. 1. Marigold plant attacked by *Helicoverpa*

3. CONTROL OF INSECTS OF MARIGOLD

Marigolds are generally used as insect repellant in the field. These are the plants that are attacked very occasionally by insect pests but when get attacked these insects affect the mechanism of marigold overall. Thus following measures (IPM and chemical) can be adopted to get rid of the insects:

1. ***Aphids:*** If the aphid infestation is minimal, marigold plants can be physically cleaned of them. Put on gloves, squeeze them gently, or put them into a bucket of soapy water. To stop the aphids from spreading further, cut away the areas of the marigold plant that are badly affected. To get aphids off the plants, use a powerful water jet. A natural insecticide that works well against aphids is neem oil [8]. Neem oil is diluted in water at a rate of 3-5ml per liter, and it is then sprayed over marigold plants. Introduce lacewings and ladybugs, which are aphids' natural predators, to the garden. These insects control the aphid population by eating them [9]. Marigolds that deter aphids should be planted alongside plants like garlic, chives, or nasturtiums. These species can aid in keeping aphids away from marigolds. A chemical spray of Imidacloprid is effective against aphids [10].

2. ***Spider Mites:*** Start by routinely looking for spider mite infestations on marigold plants. Look for thin webbing on the undersides of the leaves, stippling (small yellow or white dots), and an overall loss in plant health [11]. If a plant has spider mites, keep it separate from other marigolds to stop the infestation from spreading. Trim and get rid of plant portions that are very infected. To prevent the mites from spreading to other plants, dispose of the clipped debris in a sealed plastic bag. Spider mites prefer dry environments to thrive. Maintain optimum soil moisture by regularly watering marigolds to deter them [12]. Don't overwater the soil or allow it to totally dry out. Spider mites enjoy a dry environment. By sprinkling marigold plants with water, you can raise the relative humidity in the area. Introduce natural predators to the garden, such as ladybugs, predatory mites, and lacewings. These predators, which eat spider mites, can aid in controlling their population. An efficient natural treatment for spider mite control is neem oil. Neem oil can be sprayed on the marigold plants after being combined with water and a few drops of dish soap (for improved adherence). Until the infestation is under control, carry out this treatment again every few days. Consider using a miticide like sipromesifen that is labeled for spider mite control if the infestation is severe and other measures have failed. Imidacloprid is

also found effective against mites it helps to reduce the population of mites once infected in plants [13].

3. ***Whiteflies:*** In the vicinity of marigold plants, hang yellow sticky traps. Yellow attracts whiteflies, and when they fly near the plants, they will become stuck to these sticky surfaces. Check marigold plants frequently for indications of whitefly infestations. On the undersides of leaves, keep an eye out for the tiny, white insects that resemble moths and the whitefly nymphs. Pruning and removing highly affected leaves or plants should be done. Spray the undersides of marigold leaves, where whiteflies are known to assemble, with a forceful stream of water. By doing this, you can assist in removing them from the plants. Introduce ladybugs, parasitic wasps (such as *Encarsia formosa*), and lacewings as natural whitefly predators to your garden. An organic insecticide that works well against whiteflies is neem oil. Neem oil, water, and a few drops of dish soap should be combined before being sprayed on marigold plants, paying specific attention to the undersides of leaves. Apply once more every 7 to 14 days. Use insecticidal soap that has been specially designed for controlling whiteflies. Pay special care to the undersides of the leaves while applying them to the marigold plants. Whiteflies can be discouraged from laying their eggs on the soil by covering the area around marigold plants with reflective mulch or aluminum foil, which lowers the likelihood of an infestation. By removing weeds and other items from your garden that may be home to whiteflies, you can keep it clean. Avoid overfertilizing since too much nitrogen can draw in whiteflies. A chemical spray of Imidacloprid is effective against whiteflies [10].

4. ***Cutworms:*** Regularly inspect marigold plants, particularly in the early morning or late evening when cutworms are most active. Cutworms should be removed and disposed of immediately. Marigold plants should have physical barriers built around them to keep cutworms away. Use of toilet paper rolls, aluminum foil, or even cardboard. When transplanting, press these collars into the ground close to the base of each plant. Encourage the presence of birds, parasitic wasps, and other natural cutworm predators in the garden [14]. Provide shelter and food sources for them, such as birdhouses or plants that release nectar to draw helpful insects. Cutworms may be sensitive to *Bacillus thuringiensis*, a natural bacterial pesticide [15]. In areas where cutworms are prone to feed, directly apply it to the leaves. Another natural option for preventing cutworms is neem oil [16]. Don't repeat the marigold planting in the same spot every year. Rotating crops can help cutworm populations by disrupting their life cycle. Think about growing trap crops like tomatoes, which cutworms find more alluring than marigolds. Cutworms may be redirected from marigold plants as a result of this. Regularly remove any plant waste and weeds from the garden as these can serve as cutworms' hiding places and food sources.

5. ***Helicoverpa:*** Regularly check marigold plants, particularly in the morning or evening when the caterpillars are most active. Simply remove and discard any Helicoverpa caterpillars observed. An organic insecticide that can aid in controlling Helicoverpa is neem oil. Controlling male Helicoverpa is benefited by the use of light traps and heli lures and floral lures [17]. Emamectin Benzoate can be used to control chemical damage [18].

4. CONCLUSION

Controlling insect pests in marigold gardens necessitates a complex strategy that includes a variety of efficient management techniques. Vigilance and preventative actions are essential for keeping marigold plants healthy and vibrant, whether dealing with cutworms, Helicoverpa, aphids, whiteflies, or spider mites. Gardeners can successfully reduce pest damage by using techniques including handpicking, physical barriers, helpful insects, natural insecticides like neem oil and *Bacillus thuringiensis*, trap crops, and proper garden hygiene. The significance of environmentally responsible and sustainable pest management techniques must also be emphasized. To maintain the health of the ecosystem and the beneficial insects that are essential to the ecology of gardens, it is imperative to use chemical pesticides sparingly, and only as a last resort. Effective marigold pest management combines prevention, early detection, and the use of the right control

strategies. Gardeners may appreciate the brilliant beauty of marigolds without the disruption of damaging insect pests by implementing these tactics and tailoring them to unique pest issues.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://prh.globalpresshub.com/review-history/1559