# Inventory of Pest Attacking *Adenium* spp. in Denpasar City

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## ABSTRACT

The cultivation of *Adenium* spp. encountered several challenges involving physical, environmental, and plant pest interference factors. Inventory of pests aimed to find out the kind of pests, the symptoms of the attacks, and the percentage of the pests that attack *Adenium* spp. Samples were taken using a purposive method by taking pictures and observing plants attacked by pests in 4 sub-districts in Denpasar, namely West Denpasar, East Denpasar, South Denpasar, and North Denpasar. The research results show that several pests attack *Adenium* spp. in Denpasar City, including mealybugs, spider mite, red cotton bug, and aphids. The study's findings indicate that *Adenium* spp. in Denpasar City are susceptible to several pests, such as mealybugs, spider mite, red cotton bug, and aphids. These organisms induce the dehydration, withering, and stunted growth of plants due to fluid loss. Mealybugs exhibit the highest incidence of infestation, with a prevalence rate of 85%. Spider mites follow with an infestation rate of 50%, while red cotton bug and aphids display infestation rates below 50%. The presence of several pest insects in *Adenium* spp. is indicative, with certain pests posing a significant threat to the plants, perhaps resulting in severe damage or even plant mortality. This research can provide additional information of pests that attack ornamental plants so that the strategy of pest control on ornamental plants, especially Adenium, can be developed.

**Keywords:** incidence, insect, ornamental, percentage, symptoms.

## INTRODUCTION

Ornamental plants support a distinct ambiance in various settings such as home spaces, offices, and public spaces, thus positively impacting and fostering a comfortable atmosphere. Various ornamental plants are widely used as outdoor plants, including Adenium plants. This plant requires constant exposure to full sunshine, rendering it well-suited for open areas that receive direct sunlight. The Adenium plant, known as *Kamboja Jepang*, has high aesthetic and economic value. The Adenium plant is known worldwide and is now one of the popular ornamental plants in various Asian nations, including Indonesia, Thailand, Taiwan, and India. With the advancement of information technology, there has been an increasing interest among the Indonesian population in the Adenium plant. This surge in popularity can be attributed to the emergence of several new flower varieties resulting from the hybridization of the *Adenium obesum* species. In addition to the *Adenium obesum* species, there is a growing interest in other forms, such as *Adenium arabicum*. The aesthetic appeal of the *Adenium arabicum* is evident through its distinctive blooms and tubers. The *Adenium arabicum* type is highly desirable due to its distinctive tuber morphology and abundant branching (Rochayat et al., 2017). The Adenium plant has the capacity to serve as a highly valuable plant species owing to its aesthetically attractive plant crown, diverse flower colors, abundant branching, and unique tubers. The diverse range of flowers exhibited by Adenium plants and their resemblance to bonsai make them highly appealing to enthusiasts of ornamental plants. Adenium's bonsai-like appearance is generally cultivated in pots, so it has ornamental plant agribusiness prospects. The development of Adenium plant cultivation technology is required to meet consumer needs.

In order to optimize the growth of Adenium plants, many measures are undertaken to control the environment, lighting conditions, water management, humidity levels, and composition of the planting media. Similar to other plants, Adenium plants encounter various challenges during growing, encompassing physical limitations, environmental factors, and interference by plant pest organisms. However, information regarding Adenium plant pests in Indonesia, particularly Bali, remains limited. Therefore, it is essential to investigate the pests that attack Adenium plants. This research seeks to determine what pests attack *Adenium* spp. plants, the population of pests that attack, and the percentage of pest attacks so that the data and information can be used to control *Adenium* spp. plant pests.

## MATERIALS AND METHODS

This research was carried out at the Plant Protection Laboratory, Faculty of Agriculture, Udayana University and in four locations in each sub-district in Denpasar City, namely North Denpasar District (115.20545102692476 East Longitude, -8.624131032024353 South Latitude), East

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Denpasar District (115.2473335314659 East Longitude, -8.642960501761097 South Latitude), West Denpasar District (115.196256767907 East Longitude, -8.667630720014632 South Latitude), and South Denpasar District (115.21619597749054 East Longitude, -8.706133874710735 Lin Southern pliers). This research was conducted from November 2020 to January 2021.

**Sampling**

The sampling procedure was conducted using a purposive method, where 20 samples were collected at each designated location. Observations were then performed on plant parts that exhibit signs of pest infestations; if pests are present on the affected plant part, they are removed and placed in a container for further identification.

**Inventory of Pest Types on *Adenium* spp.**

A pest inventory of Adenium spp. plants was carried out to determine the pests that attack Adenium spp. plants. The pests found were then categorized by type and their numbers were tallied. Each type of insect found is then observed and matched based on the Insect Identification Key Book from Triplehorn & Johnson (2005) and research on the insect pests found.

**Data Analysis**

This study employed a descriptive technique for data analysis. The percentage of attacks was calculated by comparing the number of plants attacked with the number of plants observed in one sub-district and expressed as a percentage (%) using the following formula (Supriatna et al., 2017):

$$P = \frac{A}{B} \times 100\%$$

Note:

$P$ : Attack percentage (%)
$A$ : Number of plants affected
$B$ : Total number of plants

## RESULTS AND DISCUSSION

**Identification of pests that attack *Adenium spp.* plants in Denpasar City**

There were four types of plant pests that attack *Adenium spp.* in the city of Denpasar, namely mealybugs, spider mite, red cotton bug, and aphids. All of these pests were found in all sub-districts in Denpasar City. **Mealybugs** (Hemiptera: Pseudococcidae) are small insects with the length of adult males ranging from 1.1-1.3 mm and width ranging from 0.5-0.6 mm. Adult female insects have a size of 3.1-4.3 mm and a width of around 2.0-2.1 mm. The observations compared with research results from Williams and Henderson (2005) and Germain et al. (2015) indicate that these mealybugs come from the genus *Rastrococcus*. This mealybug has a pair of antennae that can be longer than the prepupa (nymph). The body of this insect is white with white membranes like cotton and has segments on the body that are clear. Mealybugs are reported to be one of the important pests on ornamental plants in Western Burkina Fuso (Nébié et al., 2018) and citrus orchards in Valencia, Spain (Plata et al., 2023). **Spider mite** (Acari: Tetranychidae) have a red body and dark red color with white legs and mouthparts. The observation findings were compared to the research findings of Álvarez et al. (2012), which demonstrated that this spider mite is classified within the genus *Tetranychus*. According to multiple other studies, the spider mite that attack ornamental plants are primarily of the genus *Tetranychus*. Based on research conducted in Kerala (India), *Tetranychus okinawanus* Ehara spider mites have been discovered attacking Adenium plants (Prakash et al., 2021). The spider mite life cycle consists of eggs, nymphs, and adults (Fasulo & Denmark, 2009). Adult insect embryos measure up to 0.5 mm in length (Pramudianto & Sari, 2016). Spider mite spread to other plants via wind and human activity (Pramudianto & Sari, 2016), as well as spider webs found on these plants. **Red cotton bug** (Hemiptera: Pyrrochoridae) is a yellowish-red insect with black on the lower corner of the back and a white stripe on the outer side of the black color. This insect has a length of 11-17 mm and a width reaching 4.5 mm. The red cotton bug has a pair of brown wings and black spots. The life cycle of the red cotton bug pest consists of eggs, nymphs, and imago. The nymphs of the red cotton bug pest are bright red, predominantly black on the back of the head to the middle of the body, and have black spots on the lower back. **Aphids** (Hemiptera: Aphididae) have a yellow oval body shape and no wings. The findings of these observations align with the research by Ștef et al. (2021) and McAuslane (2017). The aphids exhibit a variation in body length, spanning from 1.5 to 2.5 millimeters. The life cycle of aphids consists of eggs, nymphs, and adult insects. This insect reproduces its progeny without sexual reproduction (McAuslane, 2017).

**Symptoms and Percentage of Pest Attacks Associated with *Adenium spp.* Plants in Denpasar City**

**a. Symptoms of a Mealybug Pest Attack**

On *Adenium spp*. plants, mealybugs are frequently found on the undersides of juvenile to adult leaves. Ginting et al. (2020) stated that the mealybug pest *Rastrococcus sp.* is more suited to living on leaves, considering its highest population on leaves, especially older leaves. Keberadaan mealybug Sebagian besar terdapat pada struktur kanopi tanaman seperti daun, bunga, ranting, dan buah (Martínez-Blay et al., 2018). Namun, pada bulan februari hingga September, mealybugs akan bermigrasi ke bagian batang pohon dan tanah. Mealybug menghabiskan sekitar setengah tahun dari masa hidupnya di dalam tanah, terutama pada daerah yang memiliki musim dingin (Vercher et al., 2023). Symptoms of aphid attacks on *Adenium spp.* plants include yellow to black spots on the veins of the leaves caused by fluid loss in the affected parts. Spots on the veins of the leaves are caused by powdery mildew from mealybugs, which can then cause abnormal plant conditions such as wrinkling or stunted plant shoots. Several studies also state that an attack by one species of mealybug can cause disturbances in the form of shortened and bent stems, which can cause the leaves to fall easily (Abduchalek et al., 2017).

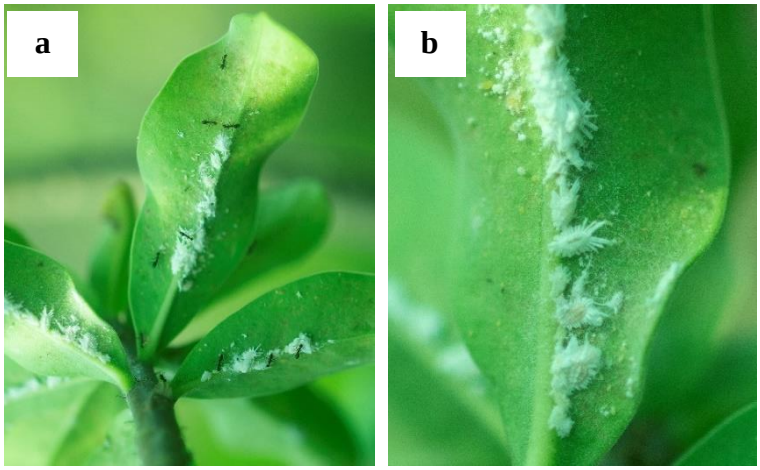


Figure 1. Mealybug pests: (a) attacks on the lower surface of the leaves, (b) attacks in groups

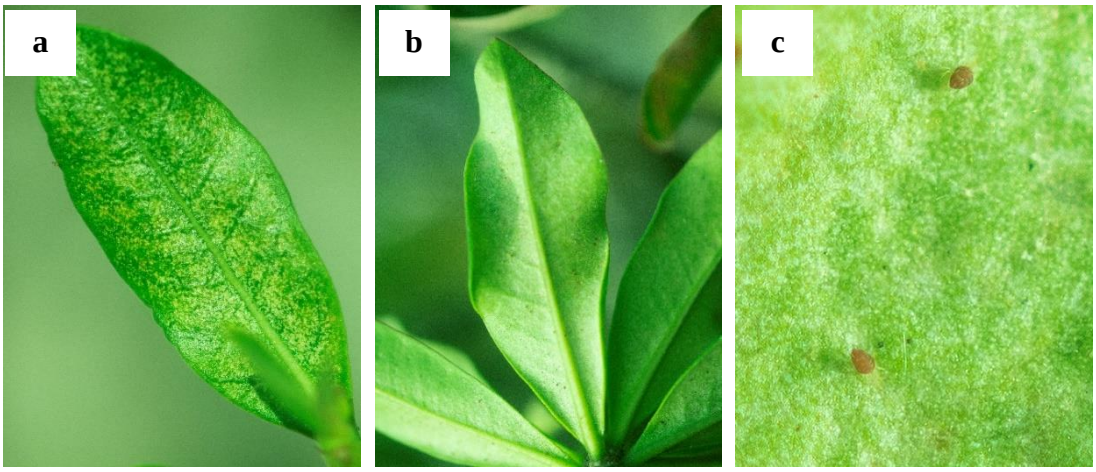


Figure 2. Spider mite pest: (a) symptoms of attack on the leaves, (b) pest attacks in clusters on the lower surface of the leaves, (c) adult insects (imago)

**b. Percentage of Mealybug Pest Attacks**

The incidence of mealybug infestations on *Adenium spp*. in Denpasar City exhibits significant variation, with rates of 60% in North Denpasar District, 75% in West Denpasar, 85% in South Denpasar, and 70% in East Denpasar. The percentage of attacks varies throughout different sub-districts. The variation in planting conditions and the compatibility of pests with the environment may contribute to the variability in the frequency and intensity of assaults (Agustin, 2022). Aside from this, distinctions in species may influence variations in attack frequency. This is because each species has distinct environmental adaptability, resistance, and reproductive capabilities.

**c. Symptoms of Spider Mite Pest Attacks**

The initial symptoms of a spider mite infestation, as observed, are yellowish-white spots. This is similar to the findings of Santoso and Astuti (2014), who discovered that the symptoms of mite attacks on cassava plants are the presence of yellow spots on the underside of the leaf veins. This is due to the loss of fluid in the afflicted plant parts and the loss of chlorophyll and other pigments in the leaves (Goftishu et al., 2016). As the mite population increases, the mites spread throughout the leaves, including the upper surface, and yellow patches spread throughout the leaves, causing them to turn a rusty, reddish color. In the long term, it will cause plant leaves to dry out, causing death (Goftishu et al., 2016).

**d. Percentage of Spider Mite Pest Attacks**

The percentage of spider mite attacks on *Adenium spp.* plants in Denpasar City fluctuates, with 50% in the North Denpasar District, 60% in the West, 75% in the South, and 60% in the East. It has been reported that spider mite attack plants and can cause up to 90% leaf damage (Santoso et al., 2014). In addition, Pramudianto and Sari (2016) reported that spider mite can cause yield losses of up to 90% and plant mortality during severe infestations.

**e. Symptoms of Red Cotton Bug Pest Attack**

Red cotton bug attacks the flowers of *Adenium spp.* Symptoms caused by red cotton bug attacks are black spots on the affected flowers, leading to their subsequent wilting and eventual detachment.

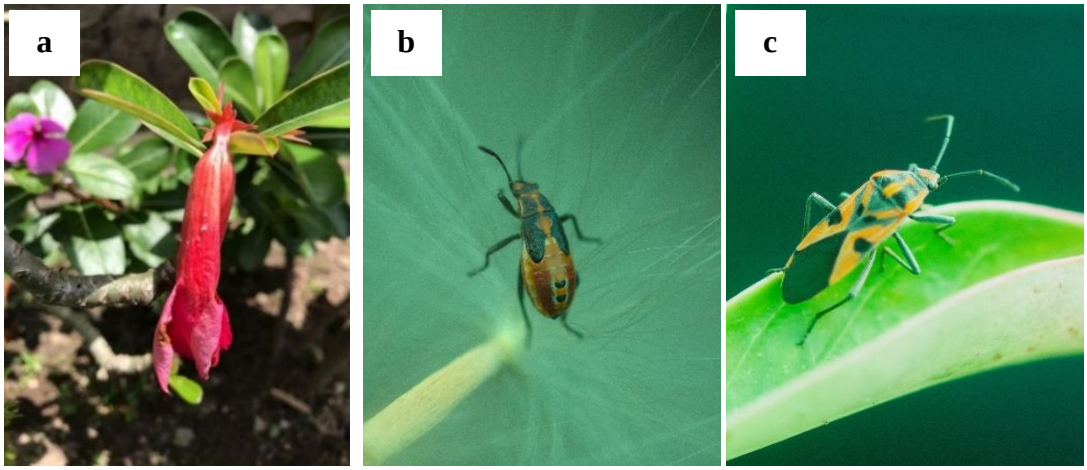

Figure 3. Red cotton bug pests: (a) symptoms of an attack on the flower, (b) immature (nymph), (c) adult insect (imago)

Figure 4. Aphid pests: (a) pest attacks on flower parts, (b) group attacks on flower parts

The red cotton bug attacks plants by poking and sucking fluids from the targeted plant part. Hibiscus, an ornamental plant, has been reported to be infested with red cotton bugs in India. The nymphs and adults of the red cotton bug attack flower buds, petals, leaves, petioles, stems, and fruit. The impact on the affected plant parts is in the form of decay and degeneration of the affected parts (Gurung et al., 2022).

**f. Percentage of Red Cotton Bug Pest Attacks**

The percentage of red cotton bug pest attacks on Adenium plants in Denpasar City varies, with 10% in the North Denpasar District, 10% in the West Denpasar District, 15% in the South Denpasar District, and 10% in the East Denpasar District. The rate of red cotton bug attacks in Denpasar is still relatively low, below 25%. South Denpasar District had the highest rate of attacks, at 15%, while other districts had only 10%. The percentage of red cotton bug attacks may be related to the number of red cotton bug populations that associated with Adenium. The higher of red cotton bug population, the higher of attack percentage. The high and low population may be related to environmental factors such as temperature. The results of research by Karar et al. (2021), showed that there was a significant relationship between maximum and minimum temperatures and the total population of red cotton bugs, while rainfall and humidity had no significant effect.

**g. Symptoms of Aphid Pest Attacks**

Aphids were often observed at the base of the leaves and flowers of *Adenium* spp. This pest attacks plants in groups. Aphid infestations on the flowers in large numbers diminish the plant's aesthetic value by altering the flowers' appearance (Rabeea, 2021). In severe infestations, aphids can cause plant parts to turn yellow, curl, wilt, and even die. The reason for this occurrence is attributed to the depletion of fluids in the afflicted plant sections as a result of aphids extracting plant fluids (McAuslane, 2017).

**h. Percentage of Aphid Pest Attacks**

The percentage of aphid attacks on *Adenium spp.* plants in Denpasar City varies considerably, being 15% in the North Denpasar District, 40% in the West, 15% in the South, and 15% in the East. The percentage of aphid attacks may be affected by the field's temperature and precipitation. Sampaio et al. (2017) and Barton et al. (2021) stated that high temperatures are more favorable for the presence of aphids and support the abundance of these insect pests. High rainfall has a very positive impact on the presence and abundance of aphid pests. The presence of natural enemies such as parasitoids is one of the factors that may affect the high or low percentage of aphid attacks, as reported by Sæthre et al. (2011).

## CONCLUSION

Pests associated with *Adenium* spp. in Denpasar City are mealybugs, spider mites, red cotton bugs, and aphids. Symptoms caused by mealybugs and spider mites include yellow spots on the underside of the leaves. Symptoms on flowers include wilting and shrinking caused by red cotton bug and aphid. Mealybugs and red mites have an attack percentage of 50%. While, red cotton bugs and aphids have a percentage attack below 50%. So that, some pests have the potential to cause damage to *Adenium* spp.

## AUTHORS CONTRIBUTIONS

IWDG collected the data, interpreted the data and compiled the final manuscript. IPS designed the experiment, took pictures, and identified the insects. KAY designed the experiment and identified the insects. IWAS collected data and prepared the draft script. The authors provided responses and comments on the research flow, data analysis, and interpretation as well as the shape of the manuscript. All the authors have read and approved the final manuscript.

## CONFLICT OF INTEREST

There is no conflict of interest.

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