



The Uzi Fly (*Exorista bombycis*): Biology, Damage, and Integrated Management in Sericulture

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Among the insect pests of the mulberry silkworm, the uzi fly (*Exorista bombycis* Louis, synonym: *Exorista sorbillans* Wiedmann) is one of the most destructive pest. It is a primary larval endo-parasitoid of the silkworm, *Bombyx mori*, causing substantial economic loss to sericulture. In nature, more than 55 alternate host species have been recorded. However, the mulberry silkworm (*Bombyx mori*) remains the most preferred host. The extent of crop loss due to uzi fly infestation generally ranges from 10–30%, depending on environmental conditions and management practices.

Distribution

Exorista bombycis is predominantly prevalent in South and Southeast Asian countries including Burma (Myanmar), China, Thailand, Sri Lanka, Japan, Korea, and India.

In India, the pest was first reported to cause serious outbreaks in the southern states, which were earlier considered free from uzi fly infestations (Jolly and Kumar, 1985). Since then, it has emerged as one of the major challenges to mulberry sericulture in the region.

Biology of the Uzi Fly (*Exorista bombycis*)

The uzi fly, *Exorista bombycis* (Louis), is a tachinid endoparasitoid that completes its development through four distinct stages: **egg, maggot (larva), pupa, and adult**. The duration of each stage and the total life cycle are strongly influenced by **temperature, humidity, and seasonal conditions**, resulting in considerable variation in developmental time across different regions and times of the year.

Adult Morphology

Adult uzi flies are **larger than common houseflies** and exhibit a **blackish-grey coloration**. The thorax bears **four distinct longitudinal black stripes**, while the abdomen is **conical in shape**, marked with **three broad transverse bands**.

- **Size and Dimensions:**
- **Males:** 12 mm long
- **Females:** 10 mm long
- **Wing span:** 10 mm
- **Wings:** Covered with dark grey hairs.
- **Abdomen:** Lateral regions covered with dense bristles in males; less dense and restricted to the last two abdominal segments in females.
- **Pulvilli:** Larger and broader in males than females.
- **Eyes:** Chocolate brown.
- **Antennae:** Blackish-brown.
- **Proboscis and Mouthparts:** Well developed, adapted for feeding on nectar and honeydew.

Sexual Dimorphism

Males and females of the species can be differentiated based on several morphological characters:

1. **Body size:** Males (12 mm) larger than females (10 mm).
2. **Head bristles:** Five in males, three in females.
3. **Thoracic stripes:** More prominent in males.
4. **Pulvilli:** Larger in males.
5. **Frons:** Narrower in males than in females.
6. **Abdominal bristles:** Denser in males, sparse in females.
7. **Male genitalia:** Distinct, covered with brownish-orange hairs on the ventral abdominal region.

Longevity

The life span of adults varies with **sex and season**:

- **Males:** 5–15 days
- **Females:** 20–25 days
- Survival is lowest in **summer months** (Patil & Govindan, 1984a).

Mating and Reproduction

Newly emerged flies attain **sexual maturity within 1.5–2 days**. Copulation occurs primarily in the air, although it may also take place on resting surfaces. Adults feed on **floral nectar** and **honeydew secreted by aphids and scale insects**.

Mating Behaviour:

- Adults are polygamous.
- Copulation usually takes place within 24 hours of emergence.
- A single fly may mate **3–7 times** in its lifetime.
- Duration of mating: **30 minutes to 2.5 hours**.

Oviposition:

- Begins ~2 days after emergence.
- A single female lays **300–1000 eggs** during her life span (average: 500–600 eggs).
- Eggs are deposited preferentially on **later instars of silkworms**, with 2–3 eggs placed per host larva.
- **Preferred oviposition sites:** Ventral surface and inter-segmental membranes of silkworm body.

Egg

- **Shape:** Oblong, oval, bean-shaped.
- **Colour:** Creamy white.
- **Dimensions:** 0.45–0.56 mm (length) × 0.25–0.30 mm (width).
- **Attachment:** Ventral surface is flat and membranous, firmly adhering to host integument.

Incubation period:

- Varies from **2–5 days** depending on environmental conditions.
- On hatching, maggots bore into the host body by perforating the integument.
- The empty eggshell remains attached externally.
- Penetration site is marked by a **black scar**, a characteristic symptom of uzi fly infestation.

Maggot (Larval Stage)

The maggot is the **destructive stage** of the pest.

- **Appearance:** Fusiform, creamy white, with 11 body segments.
- **Size:** 1.4–1.7 cm long, 0.3–0.5 cm wide.
- **Special features:** Possesses a pair of pharyngeal hooks at anterior end.
- **Instars:** Three larval instars are completed inside the silkworm body.
- First two instars: Yellowish-white.
- Third instar: Creamy white.

Feeding behaviour:

- Maggots consume **fat bodies** of the silkworm, sparing the silk glands.
- They remain inside the host for **4–6 days**.

At maturity, the maggot uses its pharyngeal hooks to cut through the host integument, leading to the **death of the silkworm**. It then exits and searches for **dark crevices, cracks, or soil** to pupate.

Pupa

- **Shape and Colour:** Oblong; reddish-brown to dark brown.
- **Behaviour:** Before pupation, the larva shrinks and becomes immobile, forming a **puparium**.
- **Duration:** 10–12 days.
- **Emergence:** Males generally emerge earlier than females.

Life Cycle and Generations

The number of generations per year varies with climate:

- **Tropical regions:** 10–14 generations
- **Temperate regions:** 6–7 generations
- **Arctic/subtropical regions:** 4–5 generations

Environmental influence:

- Life cycle duration is **shorter at higher temperatures**.
- Development is favoured by **higher relative humidity** (Narayanaswamy et al., 1993b).

Period of Occurrence

The uzi fly occurs throughout the year in tropical sericultural regions, but its population dynamics are strongly influenced by seasonal conditions.

- **Rainy season:** Peak incidence and maximum crop losses.
- **Winter season:** Moderate infestation levels.
- **Summer season:** Minimum survival and least infestation (Kumar, 1987).

In India, particularly, the incidence is consistently higher from August to September, coinciding with favourable temperature and humidity conditions that support rapid multiplication of the pest.

Extent of Damage

From the standpoint of economic loss, the uzi fly (*Exorista bombycis*) is regarded as the most destructive tachinid parasitoid of silkworms. Its attack results in direct larval mortality and substantial cocoon crop losses.

- **Damage intensity:** Typically ranges from 10–30%, depending on season and management practices.
- **Seasonal pattern:** Infestation is highest in rainy season, moderate in winter, and lowest in summer (Kumar, 1987).
- **Geographic variation:** The pest poses a greater challenge in tropical sericultural regions compared to temperate areas, where population build-up is slower.

The repeated outbreaks during the critical silkworm-rearing months make this fly one of the major constraints to profitable sericulture in South and Southeast Asia.

Symptoms and Nature of Damage

The damage caused by the uzi fly is both **direct** (killing of silkworm larvae) and **indirect** (rendering cocoons unsuitable for reeling). The symptoms vary depending on the stage of silkworm parasitized and the timing of maggot emergence.

Early Signs of Infestation

- **Egg deposition:** The earliest visible symptom is the presence of **minute, creamy-white, oval eggs** (smaller than a pinhead) on the body surface of silkworm larvae.

- **Black scar:** After hatching, maggots penetrate the host integument, leaving behind a **characteristic black scar** at the site of entry, which serves as a diagnostic marker of infestation.

Larval Mortality

- When parasitization occurs during the **3rd, 4th, or early 5th instar**, the silkworms usually die before reaching the spinning stage.
- This leads to complete loss of affected larvae and significant reduction in cocoon yield.

Damage during Spinning

- If parasitization occurs in the **late 5th instar**, the maggot completes its development inside the host and emerges by **piercing through the cocoon shell**.
- This emergence makes the cocoons **unsuitable for reeling**, as they lose compactness and structural integrity.

Impact on Bivoltine Races

- In case of **bivoltine silkworms**, where cocoons are compact and stiff, late-instar maggots often fail to cut through the shell.
- Such maggots remain trapped inside, pupate, and eventually die within the cocoon.
- Though the maggot perishes, the cocoon still becomes unsuitable for commercial reeling.

Seasonal Losses

- Infestation intensity shows strong seasonal variation.
- In **West Bengal**, Krishnaswami et al. (1964) reported cocoon crop losses exceeding **40%** during peak seasons of infestation.
- Similar patterns of heavy damage have been observed in other tropical sericultural regions of India.

Host Range

The uzi fly (*Exorista bombycis*) is a **polyphagous parasitoid**, capable of parasitizing a wide range of insect hosts in nature.

- **Overall diversity:**
- Documented to parasitize **95 insect species** belonging to **20 families of Lepidoptera** and **one family of Hymenoptera** across the world (Narayanaswamy & Devaiah, 1999).
- **Successful development:** Although eggs may be deposited on many hosts, the **complete life cycle** of *E. bombycis* has been reported only on the following species:
- *Achoea janata* (Castor semilooper)
- *Antheraea assamensis* (Muga silkworm)
- *Antheraea mylitta* (Tasar silkworm)
- *Helicoverpa armigera* (Cotton bollworm)
- *Samia ricini* (Eri silkworm)
- *Spilosoma obliqua* (Bihar hairy caterpillar)
- *Spodoptera litura* (Tobacco cutworm)

Among all hosts, the **mulberry silkworm (*Bombyx mori*)** remains the **most preferred and economically important host**, making the uzi fly one of the most serious constraints in sericulture.

Management of Uzi Fly

Since Uzi fly has many alternate hosts in nature, it cannot be eradicated instead it can only be managed. Beside prevention and control following strategies should be taken into consideration for management of Uzi fly.

1. Exclusion Method

- **Fly-proof barriers:** Installation of Uzi fly-proof wire mesh or nylon nets on doors, windows, and ventilators, which are to be kept closed, has been demonstrated to considerably reduce infestation levels (Jolly et al., 1982; Kumar et al., 1986b). This method is particularly effective for independent rearing houses.

- **Antechamber provision:** Each rearing house should be equipped with an antechamber to minimize the entry of Uzi flies during the movement of workers into the rearing space.
- **Tray and stand protection:** Covering individual rearing trays with nylon nets effectively prevents the Uzi fly from ovipositing on silkworms (Siddappaji and Channavasavanna, 1981; Kotikal *et al.*, 1989). Similarly, enclosing rearing stands with fly-proof wire mesh has been reported to block access to ovipositing females (Kumar, 1987).
- **Safe transportation of cocoons:** Movement of only healthy cocoons to new seed-producing regions is essential to prevent accidental introduction and spread of Uzi flies into uninfested areas.

2. Cultural and Mechanical Methods

- **Removal and destruction of infested larvae and maggots:** Uzi-infested silkworm larvae and emerging maggots in rearing trays should be picked and destroyed. Similarly, maggots and pupae collected from cocoon markets, grainages, and rearing establishments must be eliminated either by burning or immersing them in a 0.5% soap solution.
- **Maintenance of rearing infrastructure:** Floors of rearing houses, cocoon markets, and grainages should be constructed and maintained without cracks or crevices to prevent maggots from pupating in hidden spaces.
- **Early cocoon detection:** Since Uzi-infested larvae spin cocoons one or two days earlier than healthy ones, such cocoons should be identified, harvested separately, and stifled to stop further fly emergence.
- **Community-level rearing breaks:** Coordinated skipping of silkworm rearing by all farmers in a locality disrupts the continuous availability of host larvae, thereby reducing Uzi fly multiplication.
- **Collection and disposal of maggots:** Maggots falling from mountages should be routinely collected and destroyed to prevent further life-cycle completion.
- **Sorting of pierced cocoons:** Infested cocoons should be separated before transporting to markets. This prevents further spread of Uzi maggots and also ensures better market value for healthy cocoons.
- **Indoor mounting practice:** Placing mountages indoors during spinning facilitates easy collection and destruction of maggots emerging from infested larvae.
- **Safe cocoon transportation:** Seed cocoons from Uzi-infested areas must not be transported to uninfested regions to prevent new outbreaks.
- **Use of protective coatings:** Application of levigated China clay on silkworm bodies has been reported to reduce oviposition by Uzi flies.

3. Physical Methods

- **Light-cum-sticky traps:** Installation of light-cum-sticky traps has been found effective in attracting adult Uzi flies, which get immobilized upon contact with the sticky surface (Devaiah and Patil, 1986).
- **Kerosene water traps:** Placement of kerosene water traps near doors and windows helps in luring and killing ovipositing adults, thereby reducing their entry into rearing houses (Jolly *et al.*, 1982).
- **Fishmeal traps:** Fishmeal-based traps set outside rearing rooms serve as attractants to capture adult Uzi flies before they can access silkworms.
- **Food bait traps:** An agar-based bait formulated with jaggery, D-maltose, citral, vanillin, and weak formaldehyde has shown remarkable efficiency in attracting and killing both sexes of Uzi flies. When placed in silkworm rearing houses, this bait recorded up to 90% effectiveness in trapping adult flies (Singhamony *et al.*, 1990).

4. Chemical Methods

- **Use of commercial formulations:** Application of formulations such as Uzicide or Uzi-powder inside rearing houses has been recommended to suppress Uzi fly infestation.
- **Ovicidal compounds:** Diflubenzuron at low concentration (100 ppm) has been reported to exhibit strong ovicidal activity and is effective in killing Uzi fly eggs.

- **Bleaching powder solution:** Spraying a 2% bleaching powder solution has also been documented as an effective ovicide for controlling Uzi flies (Bhattacharya et al., 1993; Kumar et al., 1995).

Uzi Trap

The Uzi trap is a chemo-trap developed from a mixture of indigenous chemicals. Unlike conventional insecticides, it is free from toxic compounds, cost-effective, and eco-friendly. The trap specifically targets adult Uzi flies without posing harm to silkworms, humans, or domestic animals.

- **Preparation:** One tablet of Uzi trap is dissolved in one liter of water.
- **Placement:** The prepared solution is placed in light-coloured flat trays positioned near windows (both inside and outside) at the base level.
- **Timing:** The solution is used from the 3rd instar stage of silkworms until spinning.
- **Maintenance:** Once the solution becomes contaminated with dust, litter, or dead insects, it should be discarded and replaced with a fresh preparation.
- **Integration:** Uzi trap can be effectively combined with other control strategies as part of an Integrated Pest Management (IPM) program.
- **Dosage:** One packet (12 tablets) is sufficient for managing Uzi infestation in the rearing of 100 Disease-Free Layings (dfls).

The Uzi trap is simple to adopt, environmentally sustainable, and highly effective for reducing adult Uzi fly populations.

Uzicide

Uzicide is a liquid ovicidal formulation based on benzoic acid, specifically developed for the control of Uzi fly (*Exorista bombycis*). Its primary mode of action is to destroy the eggs laid on silkworm larvae, thereby preventing the emergence of maggots.

- **Application schedule:** Uzicide is sprayed on silkworm larvae from the 3rd instar stage onward, on alternate days, except during moulting. Standard recommendations include spraying on the 2nd and 4th day of the IV instar, and the 2nd, 4th, and 6th days of the V instar. Feeding should be resumed about half an hour after spraying.
- **Dosage:** Approximately 4–5 liters of Uzicide is required for treating silkworms reared from 100 disease-free layings (dfls). The spray can be applied using any ordinary hand sprayer.
- **Mode of action:** When applied on silkworms, Uzicide destroys Uzi fly eggs deposited on their bodies, effectively preventing the development of maggots.
- **Effectiveness:** Field studies have reported up to 93% reduction in Uzi infestation at the farmers' level (Kumar et al., 1987).
- **Safety:** Uzicide has been demonstrated to be safe for silkworm rearing, with no adverse effects on silkworm growth or cocoon quality. It is also non-hazardous to farmers and others involved in its application.

Uzi Powder

Uzi Powder is an ovicidal dust formulation designed to destroy the eggs of the Uzi fly (*Exorista bombycis*) when applied to silkworm larvae. Its use has been standardized for effective management of Uzi infestation under field conditions.

- **Application stage:** Dusting is initiated from the 3rd instar stage of silkworms and continued on alternate days until the commencement of spinning. The powder should not be applied during moulting periods.
- **Method of application:** The powder is taken in a muslin cloth and dusted uniformly over the silkworm bed immediately after bed cleaning. Feeding should resume half an hour after dusting.
- **Dosage:** About 4–5 kg of Uzi powder is required for treating larvae from 100 disease-free layings (dfls). The standard rate of application is 3 g per sq. ft. of silkworm bed.
- **Precautions:**
- Uzi powder should be stored safely and kept out of reach of children.

- It should not be applied simultaneously with bed disinfectants.
- Silkworm litter contaminated with Uzi powder must not be used as cattle feed.
- A protective facemask should be worn during dusting to avoid inhalation hazards.
- Uzi powder has been found to be a simple, practical, and effective field-level ovicidal measure for reducing Uzi fly incidence in sericulture.

Levigated China Clay

Silkworm larvae in the spinning stage, particularly when mounted on *chandrike* (mountages) in open spaces, are highly vulnerable to Uzi fly infestation. Dusting with **finely powdered levigated China clay** has been found effective in reducing egg deposition by Uzi flies during this period.

- **Application method:** China clay should be evenly dusted through a muslin cloth over both the spinning larvae and the mountages.
 - **Dosage:**
 - Approximately **3 g per 100 spinning larvae** should be applied before mounting.
 - Around **4 g per sq. ft.** of bamboo *chandrike* area should also be dusted prior to mounting.
- This physical barrier method not only minimizes Uzi oviposition but also provides a simple, non-toxic, and farmer-friendly technique for protecting silkworms during the most susceptible stage of cocoon formation.

Bleaching Powder Solution

A **2% bleaching powder solution** has been reported to be highly effective against the egg stage of the Uzi fly (*Exorista bombycis*).

- **Application schedule:** The solution is sprayed on silkworm larvae from the 2nd day of the 3rd instar up to the initiation of spinning, at alternate-day intervals following bed cleaning. Spraying should be avoided during moulting.
- **Mode of action:** Apart from its ovicidal property, the solution also acts as a **degumming agent**, causing the eggs of the Uzi fly to detach from the silkworm body upon contact.
- **Dosage:** Approximately **10 liters of 2% bleaching powder solution** is required for treating silkworms reared from 100 disease-free laying's (dfls).

This method is simple, economical, and effective in significantly reducing Uzi fly infestation, making it a practical tool for farmers in sericultural regions.

5. Biological Methods

Biological control represents the **safest and most eco-friendly strategy** in integrated pest management (IPM). It relies on natural enemies of pests that possess desirable characteristics such as high searching efficiency, synchrony with the host's life cycle, host specificity, adaptability to field conditions, and ease of rearing and multiplication (Devanathan et al., 1982).

Several natural parasitoids have been identified as potential biological control agents against the Uzi fly (*Exorista bombycis*). These include *Nesolynx thymus*, *N. dipterae*, *Trichopria*, *Exoristobia phillipinensis*, and *Dirhinus anthracia*, among others (Kumar et al., 1989; 1993a, b). To date, nearly **20 larval and pupal parasitoids** of Uzi fly are known.

Nesolynx thymus – A Key Parasitoid

Among these, *Nesolynx thymus* has emerged as the most effective and widely used biological control agent. Its advantages include a **high reproductive rate, female-biased sex ratio, strong host-searching ability, and high parasitization efficiency**, which make it superior to other parasitoids.

- **Release strategy:** About **100,000 adult females** are recommended for release in three installments corresponding to the IV and V instars of silkworms and within 1–2 days after cocoon harvest. The release schedule is as follows:
- 8,000 adults at IV instar
- 16,000 adults at V instar
- 76,000 adults after cocoon harvest

- **Release points:** Parasitoids should be released immediately after sunset in rearing houses, around mountages with spinning larvae, in mountage storage places, and near manure pits where pupation occurs.

Table 1: Searching ability and parasitization potential of parasitoids of uzi fly

Parasitoids	Searching ability(distance in feet)	Parasitization range (percent)
<i>Nesolynx thymus</i>	200	33-94
<i>Exoristobia phillipinensis</i>	90	0-9
<i>Trichopria sp.</i>	90	0-3
<i>Dirhinus sp.</i>	200	0-66

Integration with IPM

Biological control of Uzi fly is most effective when combined with other management practices in an IPM framework. A recommended package includes:

- **Ovicides (Uzicide)** for killing Uzi eggs.
- **Augmentative or inoculative release** of indigenous parasitoids such as *N. thymus* (gregarious) and *Dirhinus sp.* (solitary) against pupae.
- **Dusting with Diflubenzuron (Dimilin)** on maggots/puparia to suppress adult reproductive potential.
- **Mechanical exclusion methods** (such as nylon nets) to minimize entry of adult flies.

This integrated approach has shown high effectiveness in field conditions, providing sustainable and environmentally safe management of Uzi fly infestations in sericulture.

6. Induction of Sterility

Induction of sterility in Uzi fly (*Exorista bombycis*) has been explored as a potential control strategy aimed at reducing its reproductive capacity and population build-up.

- **Radiation-induced sterility:** Exposure of maggots and puparia to gamma irradiation has been reported to induce sterility in both male and female flies, thereby suppressing their reproductive success (Kumar et al., 1990).
- **Chemosterilants:** Treatments with chemosterilants such as **Tepa, Thiotepa, Penfluron, and Diflubenzuron** have been shown to significantly affect fertility in Uzi flies. These chemicals impair **eclosion, longevity, mating ability, competitiveness, and fecundity**, ultimately leading to population decline (Datta and Mukherjee, 1978b; Kumar, 1987).
- **Semiochemicals and natural products:** Semiochemicals, including pheromones and allelochemicals (Kasturibai et al., 1986; Persoons et al., 1993), as well as certain essential oils (lemon, lime, and orange) and aqueous extracts of plant products (e.g., eucalyptus oil), have demonstrated potential in disrupting Uzi fly behavior and reproduction.
- **Quarantine measures:** In addition to sterilization techniques, strict quarantine practices are essential to prevent the spread of Uzi flies into uninfested areas, thereby reinforcing other management strategies.

Induction of sterility, when integrated with cultural, mechanical, and biological methods, offers a promising avenue for sustainable suppression of Uzi fly populations within an Integrated Pest Management (IPM) framework.

7. Quarantine Measures

Quarantine is an important component of pest management aimed at **preventing the spread of pests across regions or countries** (Channabasavanna et al., 1993). By restricting the movement of infested materials, it helps contain the pest within existing boundaries and safeguards uninfested areas.

The Uzi fly (*Exorista bombycis*) is considered an **accidentally introduced pest** in Karnataka, one of India's major silk-producing states. Its entry into the region has been attributed to the movement of pest-infested cocoons from the eastern parts of the country. Once established, the fly caused significant economic losses by parasitizing silkworms.

To avoid similar introductions into new sericultural zones, it has been recommended that **only silkworm eggs be transported to new areas**, rather than moving seed cocoons for egg production (Govindan et al., 1998). This preventive approach minimizes the risk of pest dissemination and ensures safer expansion of sericulture into fresh regions.

8. Plant Products

Plant-derived products represent an important eco-friendly option in insect pest management. They are valued for their high biological activity, target specificity, low mammalian toxicity, rapid degradation in the environment, and effectiveness at low concentrations (Narayanaswamy and Devaiah, 1999).

In the management of the Uzi fly (*Exorista bombycis*), plant isolates have shown activity against multiple developmental stages, including eggs, larvae, maggots, pre-pupae, and adult females. These products act through various mechanisms, such as ovicidal, larvicidal, and pupicidal effects, as well as by functioning as oviposition deterrents or repellents.

Several studies have reported encouraging results using plant products for Uzi fly suppression (Berman et al., 1990; Narayanaswamy and Devaiah, 1998). Such botanicals not only reduce reliance on synthetic chemicals but also fit well into Integrated Pest Management (IPM) strategies, ensuring safer and more sustainable sericulture practices.

9. Integrated Pest Management (IPM)

Integrated Pest Management (IPM) offers a holistic and eco-friendly approach for the suppression of Uzi fly (*Exorista bombycis*) infestation in sericulture. By combining chemical, biological, and mechanical methods, IPM reduces pest populations effectively while minimizing environmental risks and safeguarding silkworm health.

A comprehensive IPM package has been developed comprising:

- Ovicides (e.g., Uzicide, a liquid formulation containing 1% benzoic acid) for destroying Uzi eggs.
- Biological control agents, including augmentative release of the gregarious parasitoid *Nesolynx thymus* and the solitary parasitoid *Dirhinus* sp., to target pupal stages.
- Insect growth regulators (e.g., dusting of Dimilin) to reduce reproductive efficiency of maggots and puparia (Kumar et al., 1991).

A simplified IPM package involving only Uzicide sprays and releases of *N. thymus* has also been tested and found effective (Kumar et al., 1993a). Further refinement of the strategy led to the incorporation of Uzi traps as an additional component (Kumar et al., 1996).

Among different combinations evaluated, the package consisting of Uzicide + Uzi trap + *N. thymus* has shown the highest effectiveness, maintaining Uzi incidence below the economic injury level.

The adoption of IPM against Uzi fly not only ensures sustainable and eco-friendly management but also provides a higher level of pest suppression and contributes to the optimization of cocoon production in sericulture.

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