



# INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

## Case Study On State Museum, Bhopal

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**Abstract:** A museum is a facility that looks after (conserves) a collection of artefacts and other items with significant historical, scientific, artistic, or cultural value and makes them accessible to the public through exhibits that may be permanent or transient. The State Museum of Madhya Pradesh houses 6000 prehistoric artefacts, 100,000 copper artefacts from the copper age, 60,000 copper inscriptions, 500 guns and weapons, 1,000 highly famous stone idols, 10,000 coins, 1,000 manuscripts, and 1,000 antique miniature paintings. Some insects damaging materials can be found in museum. Different non-chemical techniques can be used to kill insect pests in the museum.

**Keywords:** Monitoring, Carpet beetles, Common furniture beetle, freezing, anoxic treatments.

### INTRODUCTION:-

A museum is a facility that looks after (conserves) a collection of artefacts and other items with significant historical, scientific, artistic, or cultural value and makes them accessible to the public through exhibits that may be permanent or transient. The majority of significant museums are found in major cities around the globe, although smaller, more regional ones can be found in towns, villages, and even the countryside. The objectives of museums might range from helping researchers and experts to helping the general public. The traditional model of museums (i.e., as static "collections of collections" of three-dimensional specimens and artefacts) is evolving to also include virtual exhibits and high-resolution images of their collections for perusal, study, and exploration from any place with Internet due to the ongoing acceleration in the digitization of information and the increasing capacity of digital information storage. Mexico City has more than 128 museums, making it the city with the most. There are more than 55,000 museums in 202 countries, according to The World Museum Community. 1

State Museum: On November 2, 2005, the Chief Minister of Madhya Pradesh inaugurated the State Museum in Bhopal in its new location and building. The museum, which is situated on a sizable 5 acre precinct above the gorgeous shyamla hills, is anticipated to be a significant tourist attraction as well as a site of academic importance. This stunning structure contains 17 galleries that cover a wide range of topics, including thematic galleries, pre-history and fossils, excavated materials, metal images, inscriptions, sculptures, royal collections, textiles, the freedom movement, postal stamps, autographs, manuscripts, paintings, coins, weapons, documents from the middle ages, and rare musical instruments. . Additionally, a library, a well-equipped auditorium, and a sales counter are available.

The State Museum of Madhya Pradesh houses 6000 prehistoric artefacts, 100,000 copper artefacts from the copper age, 60,000 copper inscriptions, 500 guns and weapons, 1,000 highly famous stone idols, 10,000 coins, 1,000 manuscripts, and 1,000 antique miniature paintings.

Madhya Pradesh is referred regarded as the "Heart of India" due to the wide range of amenities it provides. Nearly all religions' cultural and spiritual heritage can be found there. The State is covered in countless monuments, intricately carved temples, stupas, forts, and palaces. Although there are numerous museums in Bhopal, only the State Museum of Bhopal has the history of both Bhopal and Madhya Pradesh. The exhibit also features a variety of sculpture from the Gupta to the Paramara eras.<sup>3</sup>



**Figure 1: State Museum (Google image)**

**History:-**

Sultan Jahan Begam, the Nawab of Bhopal State (1901–19260), who had a strong interest in art and education, founded the State Museum. She worked hard, and the King Edward Museum was born. She gathered antiques for this museum with her mother and themselves from all across the world. The artefacts in this collection come from a variety of locations in India as well as Europe, China, Japan, Turkey, and Tibet.

**Major Gallery of State Museum:-****Metal Sculpture Gallery:-**

The museum has an exhibit of metal sculptures. The gallery has a collection of organic materials. The exhibit features 87 Jaina Bronze sculptures that were acquired from the village of Bhopawar in the Dhar district. All 24 Jaina Tirthankaras—from Adinatha, the first, to Mahavira, the last—are included in this precious collection. The remaining sculptures, which include Yaksha-Yakshi deities like Gomedh-Ambika, Matanga-Shruta-Devi, and others, are all dated to the 10th to the 11th century AD. The sculptures of Nepalis, Scindhia, and Holkar are on show in the museum. In addition to the sculptures from the Bhopal State's Royal Collection, there are also Buddhist metal images on show in the metal gallery, dating from the 12th to the 20th century AD. The most significant of these include the picture of Surya with the Parmara inscription, as well as Bhairava, Lakshmi, Nrisimha, Radha-Krishna, Mahisasuramardini, Vishnu, Royal images, and animal figures.

**Coin Collection:-**

Coins from the Punch-mark (Ahat) period to the Maratha period are displayed in the gallery to illustrate the evolution and growth of Indian money. The gallery has a collection of organic materials. There are also copper regional coins, punch-marked silver coins, Satavahana coins, Kushana coins, Kshatrapa coins, Naga coins, Indo-Scythian coins, Chandella-Kalchuries gold coins, gold coins of Chalukya and south Indian monarchs, as well as Gaddhaiyan coins. Additionally, the gallery also has gold and silver coins from Sultanate monarchs, coins from Ser Shah, coins from Akbar, Jahangir, and Aurengzeb, and silver coins from later Mughal kings. The main draw over here is the gold coins from the Mughal era. The additional currency includes Scindhia, Holkar, British, and the coins donated by Dr. Major Gupta of Burhanpur.

**Ancient Inscriptions Gallery:-**

Stone and copper plate inscriptions collected from diverse locations in Madhya Pradesh are presented in the gallery. The gallery has a collection of organic materials. The Parmara and Pratihara kings released Prasasties and Danapatra. The two most significant ones are a copper plate inscription of Pratihara king Malaya Varman discovered at Kurera and a stone inscription of Paramara king Narvarman discovered in Amera (Vidisha) (Shivpuri).

## Gallery of Bagh Caves Paintings:

In district Dhar, 140 miles west of Indore, are the Bagh caves. Around 1600 years ago, the Bagh caverns were discovered. The gallery has a collection of organic materials. The first publications from the first quarter of the 20th century AD provide information on these caverns. The archaeological division of the former Gwalior state preserved these paintings. Replicas of the Bagh paintings were prepared beginning in 1920 and continued until 1939–1940. Flowers, birds, and animals are just a few of the things depicted in the mural paintings. The Bagh caves contain statues of Buddha, Bodhisattvas, the Royal Court, musical settings, and floral scrolls. Buddha is portrayed holding the Dharmachakrapravartana position. In one instance, a scenario from Kapilvastu was portrayed. A Naika is shown playing a musical instrument in another instance. The mural paintings at Bagh are composed of human sensation and consciousness as well as religious motifs, similar to those in Ajanta. The Bagh caves are a magnificent treasure from ancient India's golden age.

## Excavation Gallery:-

The material that was discovered during the excavation is on exhibit in the gallery. In Madhya Pradesh, prehistoric culture dates back to the Chalcolithic, when humans first began to harvest. Along with this, copper use was established. Besnagar, Mandsaur, Kayatha, Maheshwara-Navadatoli, Modi, Awara, Eran, Nagda, Pipalyalorka, Azadnagar (Indor), Dangvada, etc. are some locations where this culture may be seen in evidence. The excavations at these locations provide us a look into this people's way of life. This time period's lovely ceramics has important paintings. The modern population once resided in huts, but they also managed their colony. The gallery's collection includes both organic and non-organic items.

In this gallery showcases the antiquities displayed in unearthed from the excavations at Runiza (Ujjain), Dangawada (Ujjain), Sarangpur (Rajgarh), Atutdakhas (Khandwa), Pipalyalorka (Raisen), Besnagar (Vidisha), Pitnagar(Khargon), Sawatpur (Sehore), Gangakheri (Bhopal), Ninnor (Sehore), Mandsaur, Pawaya (Gwalior) and Mohen-jo-daro.

## Gallery of the Freedom Movement:-

The Bundella Uprising (1842), The Great Revolution (1857), and the Freedom Movement (1920–1947) are all included in the gallery. This gallery contains the inscriptions from the famous Bundella insurrection of 1842 and the first war of 1857. Information about Nawab Sikandarjahan Begum's escape from Sehore to Bhopal with the assistance of traders (1857), Sujat Khan's attack on Barashiya with 70 of his followers (1857), the British capture of Gwalior Fort (1857), the declaration of a reward to capture Nana Saheb (1857), Narayan Singh's escape from prison (1857), a letter written by Raja Mardan Singh in the name of Tatyia Tope (1857 (1858). Inorganic materials are kept in the gallery's collection.

### **Fossil and Ancient Gallery:-**

The District Archaeological Association in Mandala made the discovery of a significant treasure of fossils from Ghugwa and Silthar in 1978. The gallery has a collection of organic materials. Elephant teeth discovered in the Narmada River close to Hoshangabad and other fossilised bones from the Mandla area are on display here. Stone tools from the lower palaeolithic, middle palaeolithic, upper palaeolithic, mesolithic, and neolithic epochs are displayed in the gallery to provide knowledge about that time period. Here you can see handaxes, cleavers, scrappers, blades, burins, and other stone tools.

### **Gallery of Sculpture:-**

This gallery contains sculptures from the Sunga, Gupta, Rastrakuta, Pratihara, Parmara, Chandella, Kalchuri, and Kachchhapaghata periods that were unearthed at various Madhya Pradesh sites. The gallery has a collection of organic materials. The significant sculptures include those of Ganesha, Shiva, Uma-Maheshwara, Lakulisha, Vishnu, Lakshmi-Narayana, Saraswati, Gajasurasamhara, Trivikrama, Lajja-Gauri, Lakshmi, Mahisasurmardini, and Jain Tirthankara, among others. On the Chandella, Kachchhapaghat, and Kalchuri statues, the artist placed an emphasis on physical beauty, whereas the Parmara sculptures are precisely proportioned and defined.

### **Gallery of the Royal Collection:-**

The antiques in the gallery were either gifts or purchases made by the Nawabs of Bhopal. The Nawabs make use of some of the items in this gallery. The Nawabs of Bhopal have a history that dates back around 250 years. The gallery has a collection of organic materials. Following the Mughals, the Bhopal-Nawabs supported this region's cultural traditions. Since the beginning of time, Bhopal has been known for its antiquities and culture. The items on display in this gallery include decorated surahi, hukka, surmadani, decorated objects made of China clay like flower stands and hilly scenes with flora and fauna, ivory objects like deygun, sticks, pen stands decorated with net designs, paper cutters, lotus-styled cups, gulab pash, decorated rounded boxes, etc., silver objects like coated hukkkas, etc, silver objects like flower stand, chariot, dey-gun, decorated dish, peacock shaped perfume- bottle , jewellery box, silver shoes, gold coated silver tomb & cup. Additionally, metal representations of Padmapani, Avalokitesvara, carpet sellers, mirrors with golden embellishments, agate-stone teapots, flower pots, and onix plaza have been elegantly exhibited in the displays to show the Bhopal-Nawabs' artistic approach. The Scindhia family's washbasins and lamps, wooden and metal boxes, flower pots, marble pots, paintings, and china and metal dishes have all been presented in this gallery.

**Costume Collection:-**

The costumes on show in this collection pay homage to both local customs and the Royal families. The gallery has a collection of organic materials. This gallery features displays of turbans from the Holkar, Bundela, and Scindia families, as well as carpets from the Holkar dynasty. The outfits of Nawab Sahjahan Begum include the sarara, dupatta, shoes, and long coat (sherwani). The rich and elegant cultural history of the 250-year reign of the Nawab of Bhopal is reflected in a fan with an ivory handle embellished with embroidery work, comb-case, and the Zujdan of the holy Koran. The outstanding examples include the Nawab Kudusia Begum-embroidered figure and the peacock with embroidery pattern. India has a remarkable tradition of weaving. Maheshwari and Chanderi sarees are displayed in this collection as a nod to earlier weaving customs. The examples of Bagh and Chanderi print are such wonderful works of human creativity. Traditional Bagh prints include Chameli, Amri, and Gadwali, among others, and fan displays on fabric. They used plants to get their hues. The patterns on Chanderi and Maheshwari sarees are also conventional. The regional traditions are represented by the turbans of Bundelkhand, Malwa, and Bhopal in this collection. One of the best examples of Baghel art is the glass curtain.

**Gallery of Archives:-**

The archives from the states of Gwalior, Indore, Bhopal, and Central India are housed in the gallery. Significant Archives Important treaties and agreements are showcased here. Among these, the 16-foot-long Burhanpur Treaty of 1804 between Maharaja Scindhia and the British Government, the 1890 Railway Treaty between Nawab Sahjahan Begum and the British Government, the 1918 Raisen Treaty between the Nawab of Bhopal and the British Government, and the 1949 Treaty between the Nawab of Bhopal and the Indian Government are noteworthy. The documents of Gwalior, Indore and Bhopal States are also been shown here. The epithet known as “Diler-a-Jang” given by Farrukhsiyar to his friend Dost Muhammad Khan in Hizri 1093 (1715AD), Nawab Shajahan Begum was provided the epithet of “Star of India”(1872), the royal declaration of British King George Vth(1919), letters by Lord Akland, Lord Canning, and Lord Dalhousie to Maharaja Holkar, letter to Viceroy Lord Irwin by the Nawab Hamidullah, regarding death ceremony of Devi Ahilyabai Holkar(August, 1927, 1933), letter of Prithviraj Kapoor regarding his plays(1949). The gallery have organic materials in collection.

**Gallery of Postal Stamps and Autographs:-**

Postal stamp and autograph collections are displayed in the gallery. The gallery has a collection of organic materials. The world's first postal stamp, produced by Britain in 140, is preserved in this collection. Additionally, this gallery has stamps from Great Britain, Gibraltar, Malta, China, Hong Kong, and Ceylon that were issued prior to 1947. Additionally, there are stamps from many Indian settlements housed here, including Jammu & Kashmir, Chamba, Nabha, Sirmor, Patiyala, Alwar, Jaipur, Jhalawar, Kishangarh, Kochin, Hyderabad, Barwani, Dhar, Indore, Bhopal, Gwalior, Datia, and Orcha.

## Signatures on autographs:-

Some of the greatest personalities' letters and autographs are on show in the gallery. Spiritual people, social reformers, politicians, historians, writers, and artists are all represented among these notable individuals. The first President of India, Dr. Rajendra Prasad, Purusottamdas Tandon, Pandit Madan Mohan Malviya, Mahadev Desai, and Pyarelal, as well as Gandhi's personal secretaries, are significant figures in politics. Dr. Gaurisankar Ojha, Suniti Kumar Chatterji, Radhakumud Mukharji, Radhakamal Mukharji, Lochnaprasad Pandey, and Dr. Bhagwatsaran Upadhyaya are notable historians and archaeologists. Avandranath Tagore, Ramanand Chatterji, Asit Kumar Haldar, Lalit Mohan Sen, Shripad Damodar Satvlaker, Hanuman Prasad Potdar, Acharya Shriram Sharma, Anagrik Dharmapal, Ramdas Gaur, Dr. Kamil Bulkey, and others are well-known figures in the fields of religion and culture.

## Policy :-

Pests can seriously harm precious and irreplaceable objects in a museum, library, or archive setting. One of the top nations with the most extensive collections of natural history is India. Since the components of natural history collections are also organic in nature, they are also highly prone to deterioration by biodeteriogens including insects, fungi, algae, and rodents, among others. We must be able to evaluate the risk of pests to collections in order to incorporate pests and integrated pest management into a larger framework of risk management. Creating a "risk scenario" that details what is anticipated to occur is the first step in the risk assessment process. It explains how a threat originates from a specific source, travels along a specific pathway to specific things, impacts those objects, and has an impact on value loss. The insect scenario system, a method that creates potential scenarios for insect pests in collections, is introduced in this work. There is growing demand now to abandon hazardous, long-lasting insecticides in favour of more organic, local approaches to pest management. Therefore, it is crucial to incorporate both conventional and organic pest management techniques into museums' Integrated Pest Management (IPM). 2

## Insect Pests Found in Museums:-

### Insect pests found in books, records, and paper include:-

Some insects damaging materials can be found on historic books and paper. In historic libraries, the paper, book covers (bindings) using leather, parchment, cardboard, wood or wooden shelves can be infested by a few species of insect pests: cockroaches, termites, flies, mosquitoes, red ants, bees, flea, louse, bed bugs, silverfish etc . Another important group of pests on books and paper are the silverfish and book lice. Different species of silverfish are found inside of buildings (usually identified all as Silverfish): Silverfish (*Lepisma saccharina*), paperfish (*Ctenolepisma longicaudatum*), firebrat (*Thermobia domestica*) and four-lined silverfish (*Ctenolepisma quadriseriata*) all feed mainly on detritus, mould, human skin or hair (textiles, cotton, silk), but can also damage paper, bookbindings, wallpaper, papier-mâché, starch glue and cellulosic materials.

If there are humid circumstances, book lice (Psocoptera) can also be found in large numbers. Even while species like *Liposcelis* sp. can harm paper, bookbindings, herbal specimens, wallpaper, and even stuffed animals, they typically eat mould and starch. Both silverfish and book lice require high humidity, and they are only prevalent in large numbers in buildings where the relative humidity is at least 60%. The final two groups of pests can be prevented in part by controlling the environment and cleaning to remove dust, microscopic fungus, and other organic debris. Every building has a few people who should be tolerated in moderation.

## Insect Pests on Wood:-

### House longhorn beetle(*Hylotrupes bajulus*)



Figure 2: House longhorn beetle (Google Image)

#### Appearance

- Adult beetles range in size from 8 to 25 mm and are black or brown in colour with grey hairs and two black dots on the thorax that mimic eyes.

#### Lifecycle

- Larvae tunnel between 3 to 11 years before emerging.

#### Habits

- Infests seasoned and partially seasoned softwoods; pine, spruce, and fir are most vulnerable; flight holes between 3mm and 7mm.
- Infested timbers are typically those used in the roof space.
- Timbers around the chimney can frequently sustain major damage. The larvae make a lot of cylindrical pellet-containing bore-dust, also known as frass. This can sometimes be seen in the surface wood's "blistered" appearance. In hot, bright weather, longhorn beetles may fly freely, allowing them to transmit an infestation from one building to the next.



## Powder post beetle(*Lyctus brunneus*)



**Figure 3: Powder post beetle (Google Image)**

### Appearance

- The adult beetle is flattened, elongated, and ranges in colour from reddish to dark brown.
- The larva is white in colour, slightly curled, and grows to a maximum size of 5mm.
- The newly hatched larva is less than 1 mm long, straight, and incredibly thin.

### Life Cycle

- It takes 9 to 12 months for it to fully develop under ideal circumstances.
- Adults have 1-3 month lifespans.

### Habits

- Usually targets starch-rich, dry wood that hasn't been chemically treated, such as Rubberwood, Ramin, Jelutong, Penarahan, Merbau, and Kempas.

### Wood boring weevil



**Figure 4: Wood boring weevil (Google Image)**

### Appearance

- Adults are 2.5 to 5mm in length.
- The weevils are reddish brown to black. They have a long snout, a cylindrical body and short legs.
- The larvae are a creamy white C-shaped, wrinkled and legless

## Life Cycle

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- The weevils are reddish brown to black. They have a long snout, a cylindrical body and short legs.
- The larvae are a creamy white C-shaped, wrinkled and legless

## Habits

- Damage is associated with damp and decaying wood, particularly timber already rotted by cellar fungus. Infestations can spread to adjacent healthy wood.

## Common furniture beetle(*Anobium punctatum*)



Figure 5: Common furniture beetle (Google Image)

## Appearance

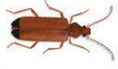
- Adult beetle is 3 – 4mm in length.

## Life Cycle

- Larva will live for 3 - 5 years boring through timber before emerging to breed.

## Habits

- They actively fly in warm sunny weather.
- Within homes and other buildings the furniture beetle is an exceedingly common pest.
- Despite its name this beetle can invade more than just furniture.
- Infestations can damage decorative woodwork, musical instruments, wooden tools and on a more serious scale wood flooring, joinery and structural timbers.
- These wood boring beetles consume hardwoods and softwoods.



**Figure 6: Wharfborer (Google Image)**

### Appearance

- 7–14mm in length.
- Yellow brown with tips of elytra (wing case) black.
- 3 ridges along the length of the elytra.

### Lifecycle

- Eggs are laid on damp, decaying timber.
- Larvae bore through wood for about 9 months then emerge in Summer

### Habits

- Larvae require wood to be constantly wetted so that fungi break down the wood fibres.
- Two main sources of infestation in buildings — structural timbers where rainwater leakage occurs, and pieces of timber buried below concrete foundations, paths and pedestrian precincts.<sup>5</sup>

### Pest on Fabric :-

Fabric pests, particularly carpet beetles, are a major problem in India's homes and textile sector. Numerous insects consume a variety of meals. Some insects, like clothing moths and carpet beetles, obtain their nutrition by eating organic things.

Among the materials that are most commonly targeted are wool, silk, fur, feathers, and animal hair. Your fabrics, rugs, and other products can be protected against infestations by knowing what fabric pests look like, where to find them, and how to prevent or monitor infestations.

Two separate insect species' larvae wreak havoc on textiles. These are clothing moths and carpet beetles (Dermestidae) (Tineidae) Few insects, including carpet beetles and clothing moths, have an enzyme in their digestive tract, making them unusual among insects.

They use the enzyme keratinase to digest the protein keratin, which is present in animal hair.

Woollen materials are almost always damaged by carpet beetles. This is because these beetles do well in the cooler climates and lower levels of humidity present in northern states. Although they do it seldom, other insects like termites, silverfish, cockroaches, and crickets may eat cloth. 6

## Carpet Beetles



**Figure 7: Carpet Beetles (Google Image)**

As their name suggests, carpet beetles occasionally infest carpets. Similar to clothing moths, carpet beetles consume wool, hair, felt, silk, feathers, skins, and leather.

Keratin, an animal protein that is found in some materials and is fibrous, will be digested by carpet beetle larvae. Attacks on cotton and synthetic materials like rayon and polyester are uncommon.

Infestations of carpet beetles can harm delicate items for a long period while going undiscovered.

Although it doesn't include keratin, carpet bugs are a severe threat to silk, particularly the hide beetle, black pantry beetle, and furniture carpet beetle. The residual fur and feathers from pets will also be eaten by carpet beetles. Families with indoor pets may be more concerned about them.

- While the carpet beetle is a general feeder, it is largely responsible for economic harm to household fabrics. The larval stage is the one that causes problems.
- They are known to eat big, irregular holes in any food that is suitable to them.
- They like to eat the top of wool goods or the underside of furs, leaving bald spots on the hide.
- Carpet beetles can also be a pest of stored goods as they infest cereal, nut, and grain storage containers.

## Clothes Moths

There are two species of clothes moths that damage fabrics.

### Webbing Clothes Moth



**Figure 8: Webbing Clothes Moth (Google Image)**

The larva of the webbing clothes moth spins silk webbing on the fabric and feeds under it. It pupates and becomes an adult moth after going through many molts. The adult moth is about 1/2 inch long, creamy white, and has a golden tuft of hairs on the top of its head. The moths themselves are solitary creatures that are barely seen.<sup>7</sup>

### Casemaking Clothes Moth

The larva of the casemaking clothes moth lives in a tubular case made of silk and fiber. When the larva eats, it drags the case along with it and will die if it is removed from it. A fully grown larva will pupate and turn into a small white moth.

- Hidden damage can be found under fabric collars or cuffs, in upholstered furniture crevices, and in carpeted areas under furniture.<sup>8</sup>

### Pest Management in Museum:-

Silverfish, webbing clothes moths, carpet beetles, and beetles are the pest species that are most prevalent in housing collections. All are common pest species found in museums that prey on textiles manufactured with fur, feathers, or felt from animals. Only the biscuit beetles mostly consume materials that are starchy, like bookbindings. Many pests rely on dust and corpse flies as a source of food, so they should be avoided. Long-term treatments are sometimes expensive and challenging to implement since large historic structures are frequently difficult to seal and continue to be vulnerable to infestations. <sup>9</sup>

**Insect surveillance in museums:-**

IPM relies heavily on insect pest monitoring to find active infestations. The right species can be identified by specimen collection, which also aids in locating the infested items or issues within the structure. These all call for a trained individual: This individual organises the IPM project, data gathering, treatment coordination, and establishes priorities for further activities. The primary tools used to get the necessary information for the monitoring are sticky blunder traps and pheromone lures (for webbing clothes moths, for instance). Maps of the building's floors show traps and outcomes, making it easier to detect infested items or find building-related issues. Insect activity is also observed using UV light traps and bait traps (larval food monitoring). Visual inspections are a crucial part of gathering information on pest activity.

**Chemical methods for insect pest control:-**

In the past, chemical techniques were preferred to treat active infestations, much like in the food business. The use of DDT, methyl bromide, and hydrogen cyanide has been banned, so today only a small number of museums in Europe regularly use pesticides to control insect infestations. Pyrethroid fumigations are not recommended because not all insect life stages are killed by them (for example, inside of the objects). Toxic gases can be used to kill with 100% success at all stages, but they too have their limitations when utilised in museums. For instance, phosphine cannot be utilised due to the possibility of corrosion with metals like gold and silver. The only harmful gas occasionally used in museums is sulfuryl fluoride, but it is expensive and can only be used in cities and in close proximity to residential areas, which restricts its use. In museums, CO<sub>2</sub>, another chemical disinfectant, is occasionally used, and it's safe for the artefacts. The majority of museums will make an effort to avoid using chemicals in their collections and will instead turn to the non-chemical techniques outlined below. Sulfuryl fluoride is occasionally employed, for instance, when no other option is available. 10

**Chemical-Free Techniques:-**

Different non-chemical techniques can be used to kill insect pests (at all life stages), and these techniques are preferred in museums, libraries, and historic buildings because they don't harm the items being protected and kill insects at all life stages without endangering the environment or the health of museum staff. The freezing, controlled heating, microwave radiation, or gamma radiation of the objects results in physical therapy. Not all materials and artefacts, however, can be treated using these techniques; anoxic treatments are preferable for more delicate objects and mixed materials. Nitrogen, argon, or anoxia treatments with oxygen scavengers in tiny bags are used to create low oxygen environments. The biological technique application using parasitoid wasps, for instance, against biscuit beetles, webbing clothes moths, or furniture beetles, is still fairly new and under development. 11

**Common prevention practice to avoid pests:-**

- **Vacuuming:** In addition to eradicating fabric pests, vacuuming can get rid of hair, decomposing larvae, and other material that these insects feed on. vacuuming the carpets, baseboards, space between dressers and boxes, cushions under chairs, and the area behind and beneath beds. Oriental rugs need to be vacuumed on all sides.
  - **Dry Cleaning or Laundry:** Before being stored, clothing should be dry cleaned or laundered. Dry cleaning kills fabric pests at all life stages.
  - **Pheromone Traps:** For the webbing clothing moth, case-making clothes moth, variegated carpet beetle, and black carpet beetles, pheromone traps are available. Pheromone traps are helpful for monitoring pests in food storage, particularly moths and warehouse beetles (such as Indian meal moths). The majority of pheromone traps are used found in meat manufacturers and processing industries.
  - **Mild Fumigants (Naphthalene):** Carpet beetles are not controlled by the release of high amounts of naphthalene, but clothing moths are. When balls or flakes are dispersed all over clothing, it works wonderfully. It should be positioned such that it does not come into touch with the material because it can fade fabrics when exposed to moisture. The use of naphtha in or on sheets might be beneficial. Naphthalene has little effect on plastics, however it corrodes metal. • **Plastic Shade for Open Courtyard Coverage:** Plastic Shade is used to cover the courtyard for open-air sculpture galleries in museums. Birds and bats won't land on the surface because of the shade.
  - **Net on window:** The net on windows that keeps flies, reptiles, and other pests out of museums while allowing proper ventilation.
- Insecticides:** Fabric pests can be challenging to control because of all the potential feeding sources found inside homes. Since these species frequently live in crevices and empty areas, treatments for cracks and crevices might be used. Make contact with a pest control business that specialises in this method. 13



**Figure 9: Plastic Shade for covering the Sculpture**

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