

## Museum Fumigation

Ahmet Guray FERIZLI\*, Mevlut EMEKCI  
Ankara University, Faculty of Agriculture, Department of Plant Protection 06110  
Ankara, Turkey

### ABSTRACT

Historical buildings, which served as museums in Turkey, are heavily infested with wood boring insects such as common furniture beetle, *Anobium punctatum*. Disinfestations of museums in Turkey had been based on using Methyl bromide (MBr) at a concentration of 60 g/m<sup>3</sup>. Due to the lack of a registered fumigant in Turkey that has no adverse effects to ozone layer, in this study, fumigation practice was concentrated on the use of lowered concentration of Methyl bromide at a dosage of 20-25 g/m<sup>3</sup>. Lowered MBr concentrations were applied by a re-circulating system. The museum was constructed from a mix of wood and stone in Istanbul (Turkey). Valuable old sculptures of wood, paintings on wood or with wooden frames, as well as parquet floor material were all heavily damaged by wood boring insects.

Before fumigation, all sensitive and precious objects were kept in specially designed cubes in the building to disinfest using modified atmosphere application.

The building was fumigated for two days of exposure. Pieces of heavily infested wooden samples were kept inside the building during the fumigation. After aeration of the building, wooden samples were kept in glass cabinets for 3 months without any insect activity.

**Key words:** The furniture beetle, *Anobium punctatum*, wooden artifacts, museum fumigation, methyl bromide

### INTRODUCTION

There are many historical buildings & palaces, which serve as museums in Istanbul (Turkey). The common furniture beetle is a widespread pest of historical buildings in Istanbul, favored by high levels of relative humidity. Wooden and wood containing structures often suffer from extensive damage caused by wood-boring insects larvae that feed and grow within the wood creating a network of tunnels closely packed with frass (fine dust).

Wood-infesting beetles are difficult to control because their immature stages feed within wood, and usually remain undetected by conventional inspection methods. The main sign of activity is fine dust of wood under the wooden objects, which was common in the museums. Methyl bromide had been the most frequently used fumigant in the museums and many safe and effective treatments had been carried out all over the world (Bond, 1984). The importance of the damage caused by the pests to museums has led to fumigate the structure of the building using methyl bromide at a lowered concentration. Below given fumigation was the last fumigation in Turkey for the museum disinfestations using methyl bromide.

## **MATERIALS AND METHODS**

The museum, an Ottoman palace, which has two floors and a basement were constructed from a mix of wood and stone in Istanbul (Turkey). The main pest in the museum was the furniture beetle. Damage was very serious on the wooden parts.

Fumigation of the building was combined with modified atmosphere application due to the harmful effects of MBr (98% MBr + 2% Chlorpicrin) to precious materials. All wooden artifacts and textile materials were confined in PVC cubes of 30-m<sup>3</sup> volumes to apply with modified atmospheres composed of conditioned high nitrogen ( $\geq 98,5\%$ ). For the MBr fumigation, doors and windows were sealed with methyl bromide proof polyethylene sheeting and tape. Particular attention was devoted to sealing of the building.

To eliminate any fire risk of fan electricity inside the building, re-circulation fans serving as gas introducing, sucking, distributing and also aeration were set up outside of the building. Re-circulation fans sucks inside air and introduces it into the evaporation chamber, then extends mixed air to inside the building using PVC ductwork. Methyl bromide was released into the evaporation chamber using copper pipe connections. Before fumigation, gas distribution to everywhere inside the building was secured. Fumigant gas was not introduced to the basement, due to the fact that methyl bromide heavier than air and naturally goes into the basement. There were only sucking pipe in the basement to prevent accumulation of the fumigant. For the effectiveness tests, heavily infected wood pieces collected from exchanged parts in carpenter's workshop were placed different locations of the building.

After preparation of the system, fumigation was started with methyl bromide and the gas level were tried to maintain at 20-25 g/m<sup>3</sup> for two days of exposure. Whenever gas concentration decrease, additional gases were introduced to keep desired concentration during fumigation. Re-circulation system were kept working during gas introduction and equalization inside the building. When the concentration of fumigant inside the building equalize after introduction, system were kept switched off till to another gas introduction.

After 48-hour exposure period, sucking pipes separated from re-circulation system to aerate the building. MBr gas in the museum was evacuated by means of pushing outside air to the building through the gas introducing pipes. MBr gas in the building thus came out of the building through the sucking pipes. System were kept working for 24 hours, then windows and door opened for the aeration, then building was checked and secured to re-entry.

## **RESULTS AND DISCUSSION**

In this study, it was observed that gas introduction into the structure was very quick, and gas concentration between each storey in the building was similar due to unique recirculation. The temperature during fumigation was around 20°C. In the present

study, concentrations reached to the highest level in the first 6-h of the treatment while gas introduction proceeded.

After the fumigation, heavily infested wooden pieces were kept in a ventilated glass cabinet for 3 months in the laboratory. Visual inspections showed there was no fine dust of wood under the wooden pieces. Moreover, mortality was also determined by cutting the wood into pieces to find larvae. Both indications showed that fumigation was successful.

During the last decades Methyl bromide was used worldwide to eradicate pests in artifacts in museums. In some countries, sulphuryl fluoride is used for the control of wood boring insects (Bess and Ota, 1960; Meikle and Stewart, 1962; Binker, 1993). But, available registered fumigants on the market were only methyl bromide and phosphine during our study in Turkey. Thus, we aimed at using methyl bromide at lowered gas concentrations for the structural fumigations of the historical buildings.

#### **ACKNOWLEDGEMENTS**

Financially supported by SPO (Turkish Republic Prime Ministry State Planning Organization) and coordinated by Ankara University Research Foundation through the project entitled “Control of wood-boring pests occurred in National Palaces under the auspices of the Grand National Assembly of Turkey”.

#### **REFERENCES**

- Binker, G. 1993: Fumigation as a means of wood pest control. Conference Proceedings – Restoration Studios of the Bavarian State Conservation Office, Munich, October 22, 1993, Pp: 90-100.
- Bond 1984. Manual of Fumigation for Insect Control. E. J. Bond. FAO Plant Production and Protection. Paper 54.
- Bess and Ota 1960. Fumigation of Buildings to Control the Dry-Wood Termite, *Cryptotermes brevis*. H.A. Bess and A.K. Ota. Journal of Economic Entomology. Volume 53, Number 4, pp. 503-510.
- Meikle and Stewart 1962. Structural Fumigants, the Residue Potential of Sulfuryl Fluoride, Methyl Bromide, and Methane-Sulfonyl Fluoride in Structural Fumigations. Journal of Agriculture and Food Chemistry. Volume 12, p 464-467.