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Modified paper envelope method for storage of moths: A solution for curtailing the storage space

Aditi Sunil Shere Kharwar, Supriya Singh Gupta*
Assistant Professor, Department of Zoology, HPT Arts and RYK Science College, Nashik, Maharashtra, India
* Corresponding Author: singhguptasupriya@gmail.com

Abstract
In the near future, space limitation would be a major deterrent in carrying out taxonomic studies in moths as the vouchered specimens require a lot of space. The present study suggests a modified paper envelope method for moth storage as a solution. Apart from reducing the space needed for storage, this modified method also reduces the time to voucher the specimen. It gives quick and easy access to the specimen and lessens the handling of the entire specimen. Thus, this method is quite effective in reducing the requirement of space and time while increasing the longevity of the preserved sample.

Keywords: moth, storage, voucher, preservation

Introduction

Insects are known to be omnipresent and are found in all types of habitats around the world. There are the principal four super radiations of insects in which Lepidoptera species occupy the second position [1]. The enormous numbers of Lepidopterans are extremely competitive, accounting for 10% of Animal Kingdom[1]. Further, 85% of lepidopterans are moths, and the remaining are skippers and butterflies. Like other Lepidoptera, moths have plant-feeding caterpillars. Adults may feed on fruits, nectar or don't feed at all. Many moth species are major agricultural pests. These are an indispensable element of terrestrial ecosystems as their larval forms are herbaceous, prey to many other organisms, and are known to be excellent pollinators [2, 3]. Thus, moths are an essential part of the food chain and are also economically important, further emphasising the importance of their studies. Moths have been reported to be a good indicator of biodiversity and environmental quality [4]. Moths are found on all continents except Antarctica and are known to be bountiful [5]. Hence, they are studied extensively throughout the world. One of the standard practices while moth study is collection of moth specimen and its preservation. There are several specimens throughout the world where these collected specimens are submitted. The collected specimen is initially killed and is spread out on an insect spreading board.

Further, it is dried and then transferred to insect storage boxes. These boxes are further kept in insect storing cabinets with no light or moisture so that the specimens retain their original colour and condition. However, with the ever-increasing pace of taxonomic studies, storage of the specimens is becoming difficult due to space limitations. It is obvious to expect that this would become an arduous problem to solve in the coming time. In the present study, a modified method for storage was compared with the traditional approach to devise a solution for this given problem.

Material methods

Moths were collected from RNC Arts, JDB Commerce and NSC Science College, Nashik, Maharashtra, India, during the rainy season between 2014 and 2017. The moths were found from the walls near lights. These were represented by six prominent moth families Arctiidae, Crambidae, Erebidae, Geometridae, Noctuidae, and Sphingidae. The collected specimens were killed using ethyl acetate in the killing jars [6].

The collected moth specimens were stored in two ways: classical method and modified paper envelope method of moth storage. In the classical method, the killed specimens were spread on insect spreading boards and oven-dried for 3 to 5 days depending upon the size of the moths. The dried moths were stored directly in the insect storage boxes.

The paper envelope method is a commonly used method for storing butterflies [7].

In this method, the entire butterfly is pressed in a piece of paper or butter paper. Modified paper envelope method of moth involves storing only wings of one side of moth. In this method, the forewing and the hind wings were carefully clipped from one side of the moth. These clipped wings were carefully placed in butter paper and tagged correctly. The remaining moth specimen was also labelled and was oven-dried.

The oven-dried moth specimens were transferred and stored in insect storage boxes, while the wings were stored separately in simple plastic boxes.

The amount of space required in both the methods was compared to check the effectiveness of this method.

Conclusion

There was an average 66% decrease in the required space when the modified paper envelope method of moth storage was used. Figure 1 depicts the decrease in space required when the modified paper envelope method of moth storage is employed.

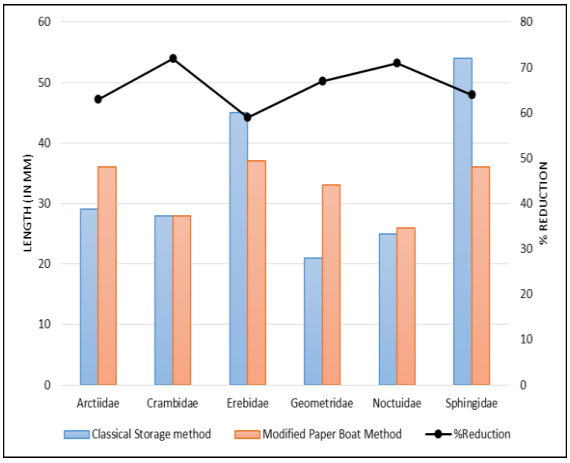

Fig 1: Comparison of space requirement storage methods

With the limiting amount of infrastructural facilities and space availability, storage of moth specimens would become a great hassle in the coming time. As a solution, this article recommends the use of the modified paper envelope method for moth storage. Apart from reducing the required storage space, there are few more advantages of this modified method. It takes a great deal of time to spread the delicate wings of moths on the insect spreading board in the classical method (Figure 2). On the contrary, it takes substantially less time to process the specimen when this modified method is employed as it does not involve spreading the specimen.

Fig 2: Moth specimen stored by Classical Method

Moreover, most of the observations in the case of moths involve observation of wings, and the clipped wings give quick and easy access. The entire box has to be taken out to observe the wings in classically stored specimens. It exposes the stored specimens to light and air, which can cause contamination and deterioration of the specimen. Thus, the clipped wings give quick and easy access without disturbing and damaging the stored specimen. The entire specimen has to be unpinned and handled to observe the underwing in case of a classically

Fig 3: Moth with spread out wing at resting position

Fig 4: Moth with a folded wing at resting position

preserved specimen. The unnecessary exposure and handling can be entirely avoided by the modified method. A wing vouchering method has been described by Cho *et al*., 2016 where the rest of the specimen is stored in a cryogenic freezer for molecular processing.

The % reduction in space depended upon the resting position of wings. In some moths, wings are completely spread out in the resting position (Figure 3), while in others, the wings are in folded position completely attached to the body surface (Figure 4). So, the moths which have wings in folded position at rest have more % reduction in space.

Thus, the modified paper envelope method of moth storage not only reduces the space significantly but is also quite beneficial for speedy access and limits the handling of the entire specimen.

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