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Palyno–morphological and isotopic characterization of monofloral and multifloral honeys from Lucknow, India

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ABSTRACT

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We describe and illustrate the detailed palyno–morphological attributes, based on light microscopy (LM) and field emission scanning electron microscopy (FESEM), as well as characterize the carbon stable isotopic ($\delta^{13}C$) values of filtered and unfiltered natural and commercial honey samples from Lucknow, India. The principal objective behind conducting the melissopalynological investigation is to gather relevant information about the pollen and nectar sources, foraged by honey bees in an area, which is a decade–old expansion of the city on an arable land. The pollen assemblages revealed one monofloral and two multifloral honey samples, ultimately provide insights into the variety of plants foraged by honey bees in an urban set–up, and is a potential archive for observing decadal changes in plant diversity. The carbon stable isotopic ($\delta^{13}C$) values of all the natural honeys varied from ~ –25 to –26‰, which relates to the regional vegetation types and environmental conditions. The difference between the filtered (without pollen) and unfiltered honey is ≤ 1.00‰. The $\delta^{13}C$ values of the three commercial honey, which are filtered /without pollen are same, i.e. –27‰. Hence, it is suggested that honey with pollen of diverse flora of the study area should be preferred by the consumers as a pure and also as a clinically safe food product.

Key–words—Melissopalynology, Microscopy techniques, Carbon stable isotope, Botany & Geography, Lucknow, India.

INTRODUCTION

MELISSOPALYNOLOGY, one of the applied branches of palynology dealing with the study of pollen grains and spores present in honey, provides significant information about the plants preferred by honey bees as sources of pollen and nectar for the production of honey in and around the area in question, ultimately determine the geographical and botanical origin of the honey (Louveaux *et al*., 1978; Barth, 2004; Von der Ohe *et al*., 2004; Cotte *et al*., 2004; Chauhan & Quamar, 2010; Ponnuchamy *et al*., 2014; Chauhan *et al*., 2017). The botanical and geographical origin of honey is associated with the floral sources, soil, environmental conditions, and mode of extraction and processing (El–Metwally, 2015; Varga *et al*., 2020; Sajtos *et al.,* 2022). In fact, bees store pollen in the combs or in hives (Santos, 1961) when honey is extracted and that stored food can be observed in the combs/hives (Barth & Melhem, 1988). Bees, in return, benefit plants by pollination (entomophily), hence, a profitable relationship exists between them (Pirani & Cortopassi–Laurino, 1993). Honey is a natural carbohydrate (especially fructose and glucose) –rich product produced by honey bees from the nectar of plants and utilised as a source of energy (Esti *et al*., 1997), however, proteins are provided by the pollen in honey (Turner, 1984; Lin *et al*., 1993). Moreover, fatty substances, minerals and vitamins are also present in honey (Gary, 1975), which act as the essential foods for raising the brood and for the longevity of the colony (Dietz, 1975; Schmidt *et al*., 1987). Honey possesses valuable nutritive, healing and prophylactic properties too (Pereira *et al*., 1995). Melissopalynological analyses provide knowledge