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Scientific note

Scientific note: often quoted, but not factual data about propolis composition

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Abstract – Data about gross composition of propolis (resins and balsams 50%, wax 30%, pollen 5%, essential oils 10%) have been often quoted in propolis literature. The present paper provides evidence that these data are misleading and unsubstantiated.

Apis mellifera **/ flavonoids / phenolic substances / wax / resin / pollen**

1. INTRODUCTION

Propolis is a product from *Apis mellifera* hives, containing plant resins, beeswax, and minor constituents, including pollen and minerals (Ghisalberti 1979). Two types of studies of propolis composition may be recognized: (a) gross composition (contents of major classes of constituents) and (b) detailed composition (identification of individual constituents). To date, most published studies about propolis correspond to the latter type, which commonly report phenolic compounds (flavonoids, phenylpropanoids) and terpenoids (volatiles, di-, and triterpenes) as relevant constituents (Santos et al. 2019). Gross composition usually refers to contents of total phenolic compounds, total flavonoids, waxes, ashes, moisture, and insoluble residue in propolis. Such parameters are useful for propolis quality control (Woisky and Salatino 1998) and standardization. In several countries, limits for several gross parameters have been officially recognized. For example, in Brazil maximum limits were established for ashes (5%), moisture (8%), methanol insoluble residue (40%), and wax (25%); minimum limits exist for total phenols (5%) and flavonoids (0.5%) (BRASIL 2001).

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2. OFTEN QUOTED DATA ABOUT PROPOLIS COMPOSITION

Commonly cited lists of gross propolis composition are "resins and vegetable balsam 50%, bee wax 30%, pollen 5%, and essential and aromatic oils 10%" (e.g., Anjum et al. 2019). At least seven relevant reviews about propolis published in the last two decades contain such data or slight variations around. Identical or similar lists of gross propolis composition appear also in a long list of original articles.

Contents of 50% of resins plus balsams in propolis, as have been repeatedly quoted from several decades ago to the present, are questionable. To our knowledge, the only quantification of resins and balsams of propolis was done by Papotti et al. (2012), referring to twenty samples of Italian propolis. Instead of typically quoted content (50%), most values reported by the authors exceeded 70%.

Regarding propolis wax, several papers have reported contents below 10%, as in Brazilian green propolis (Woisky and Salatino 1998; Funari and Ferro 2006). Usually, poplar propolis also has low wax content, rarely reaching 25% (Hogendoorn et al. 2013). Similar comment applies to Ethiopian propolis (Jobir and Belay 2020). In fact, the international propolis market rejects products with wax contents above 25% (e.g., BRASIL 2001). However, depending on location and availability of plant sources of resin, wax contents in propolis may attain high values, for example, 34% (Brazilian propolis; Kunrath et al. 2017), 38% (propolis from Guinea-Bissau; Falcão et al. 2019), 41% (Italian

propolis; Papotti et al. 2012), and 87% (Moroccan propolis; Popova et al. 2015). Thus, the 30% content of wax, allegedly characteristic of any propolis, is misleading. Facts have revealed that wax contents are highly variable in propolis.

Propolis usually contains volatile substances (Bankova et al. 2014). However, reported contents have remained far below 10%, rarely exceeding 1% (v/w). Higher contents, such as 3.5% in a sample of Indian propolis (Naik et al. 2013) or 8.5% in a propolis from southern Brazil (Mayworm et al. 2017), are exceptional. Regarding pollen, we are unaware of methods aiming to evaluate the mass of pollen in propolis. Instead, in palynology, quantification procedures are commonly aim to evaluate percentages of each pollen type (Barth and Luz 2009).

The earliest of the reviews containing commented typical lists of gross propolis components (Burdock 1998) cites two supporting references: Cirasino et al. (1987) and Monti et al. (1983). However, these papers refer to the same list provided in earlier supporting references. The former paper cites Wanscher (1976) and the latter Metzner and Scheidenwind (1978). Wanscher's paper also has no information on how the data were obtained and cites earlier papers: B.R.A. (1973), Villanueva et al. (1964, 1970), and Umansky (1934). Metzner and Schneidenwind's paper, to our surprise, says nothing about the subject it was supposed to support. B.R.A. (1973) is a short paper with general information to apiculturists, with no methodological information. The papers by Villanueva et al. (1964, 1970) are important in the history of propolis research, the former reporting the isolation of galangin and the latter, of pinocembrin. However, surprisingly, neither of them refers to contents of resin, wax, essential oil, and pollen in propolis. We had no access to the paper by Umansky (1934). Given the theme it deals with (contact dermatitis), it is highly improbable that it might describe procedures to raise data about propolis gross composition. Probably, it cites earlier reference(s). Thus, the first mention of the typical list of gross composition was published before 1934. Undoubtedly, it referred to European propolis, although recent lists so often quoted imply that the data hold for propolis from any part of the world.

3. CONCLUSION

The origin of lists of contents of gross components of propolis dates from a time when little was known about propolis chemistry. They are misleading, mentioning data far outside limits officially established in apiculture. In the absence of detailed procedures used to raise these old data, they should be disconsidered. It is important that propolis researchers be aware of this information. It is hoped that henceforth data about gross composition of propolis are backed up by real rather than unsubstantiated data.

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AUTHORS' CONTRIBUTIONS

AS and MLFS raised the literature data contained in the manuscript. AS wrote the first draft of the paper. Both authors participated in the revisions of it. They read and approved the final version.

DATA AVAILABILITY

The present paper is a scientific note, with no original data. There is no data availability.

Note scientifique : souvent citée, mais pas de données factuelles sur la composition de la propolis

***Apis mellifera* / flavonoïdes / substances phénoliques / cire / résine / pollen**

Eine wissenschaftliche Notiz: oft zitierte, aber keine faktischen Daten über die Zusammensetzung von Propolis

***Apis mellifera* / Flavonoide / phenolische Substanzen / Wachs / Harz / Pollen**

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