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Plants and aromatics for embalming in Late Middle Ages and modern period: A synthesis of written sources and archaeobotanical data (France, Italy)

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**Abstract:** Occasionally mentioned in written sources since the Early Middle Ages, embalming with evisceration considerably spreads and becomes quite usual practice for aristocratic elites from the late 13th century to the early 19th century. Apothecaries prepare

aromatic powders including many plant organs and exudates supposed to preserve the body. Numerous encyclopaedias and treatises of medicine list these ingredients and show that the recipes are very diverse. Moreover, several studies of embalmed bodies have demonstrated the potential of archaeobotanical analyses coupling pollen and macro-remains to identify this material. This paper aims to compile a synthesis of written and archaeological sources, in France and in Italy, and assess the relevance of an interdisciplinary approach for a better understanding of this aristocratic burial practice. It demonstrates that both types of sources and approaches are strongly complementary and highlights their inherent advantages and methodological limitations. In order to understand which criteria were determinant in the composition of the embalming powders, their medicinal, odoriferous and symbolic properties are discussed. Finally, this work proposes some methodological perspectives and triggers new research avenues on the history of pharmacy in Late Medieval and modern Europe.

**Keywords:** embalming; archaeobotany; written sources; Late Middle Ages; modern period; France; Italy

## 1. Introduction

In Western Europe, funerary cosmetic treatments are attested from the Roman period. As part of prestigious funerals, corpses were washed then anointed with fragrant aromatic substances (Chioffi 1998; Ciuffarella 1998; Poux 2009). However, as far as we are aware, the practice of embalming with evisceration was not in use in the Western Roman Empire. During the Early Middle Ages, the bodies of the Merovingian aristocrats were still treated with aromatics (“*aromatibus conditum*”, for example in Grégoire de Tours, *Libri septem miraculorum* 7:35, 6th c.) but it is unclear if they were opened or not (Giesey 1960). Since the 9th century, embalming with evisceration is clearly mentioned for emperors, kings, ecclesiastics and some members of the nobility, but the available documentation do not allow to determine which techniques and substances were involved (Georges 2007; Corbineau 2014), apart from a few exceptions (Charlier et al. 2013). Technical aspects of embalming are more accurately documented by written and archaeological sources from the late 13th century and throughout the modern period. At the same time, embalming considerably spreads and becomes quite usual practice for aristocratic elites (Giesey 1960; Ariès 1977; Gaude-Ferragu 2005; Perez 2006; Bande 2009; Chrościcki et al. 2012; Carol 2015).

During this period, embalming does not exist as a profession. Surgical procedures are performed by surgeons and aromatics are prepared by apothecaries. According to written sources and anthropological studies, the operations appear to be quite standardized (Fornaciari and Capasso 1996; Fornaciari 1998; Georges 1999, 2006; Marinozzi and Fornaciari 2005; Corbineau 2014; Colleter et al. 2016). The body is eviscerated by thoracotomy and/or laparotomy, the brain is removed by craniotomy, and veins and arteries are incised to let blood escape. An aromatic powder (sometimes called “balm”) is used to fill the internal cavities and anoint the skin. Finally, the body is wrapped in a shroud and dressed before being placed in a lead coffin. Internal organs are embalmed separately (Mokrane et al. 2016). This procedure lasts until the early 19th century and the development of contemporary techniques using arterial injection of conservative fluids (Gannal 1838).

Today surgical aspects of embalming become quite well-known, but the composition of the aromatic powders has still to be reconstructed in order to understand which properties were expected to slow down or stop the decay process and honor the deceased (Georges 2009; Corbineau and Georges-Zimmermann 2015). During the Late Middle Ages and the modern period, numerous medical encyclopaedias and treatises provide recipes and lists of ingredients for apothecaries in charge of embalming. Moreover, several studies of embalmed bodies have demonstrated the potential of archaeobotanical analyses (pollen and/or macro-remains) for this purpose, in particular in France and in Italy (see below). This paper aims to propose a first synthesis of plants recorded by written and archaeological sources in these two countries, and assess the relevance of this interdisciplinary approach for a better understanding of aristocratic burial practices in the Late Middle Ages and the modern period.

## **2. Material**

### **2.1. Written sources**

We have compiled a corpus of French and Italian written sources collected in encyclopaedias and treatises of medicine, surgery, pharmacy and anatomy dated from the late 13th to the early 19th centuries. It includes 17 embalming recipes written in French, Italian and Latin (Table 1). Some of their authors are famous in the history of medicine. For example, Henri de Mondeville (1260-1320) served as personal surgeon to French kings Philip the Fair and Louis X, and Ambroise Paré (1510-1590), one of the most notable surgeons of the European Renaissance, also served four French monarchs: Henry II, Francis II, Charles IX and Henry III.

On the basis of this corpus we have recorded 533 occurrences of 134 identified ingredients used to prepare aromatic powders. These ingredients include 74 plant organs (flowers, leaves, fruits, seeds, wood/bark and roots), 39 plant extracts (natural exudates such as oils, resins and gums, and manufactured products such as turpentine), 8 mineral products (e.g. potassium alum, plaster and salt), 5 animal products (e.g. castoreum, wax, honey and eggs) and 8 unclassified products (e.g. *eau de vie*, bitumen of Judea and mercury). The number of ingredients per recipe varies from 13 to 55.

Here we have specifically paid attention to plant organs in order to confront literary data with archaeobotanical results. French, Italian and Latin ante-Linnaean names of plants have been linked with possible Linnaean taxa (family and genus) by way of hypothesis (Table 2). According to this transposition, 28 families occur in the corpus. Only 10 are mentioned in more than half of the recipes<sup>1</sup> and 3 of them are largely represented: Apiaceae, Asteraceae and Lamiaceae families are frequently used (respectively in 15, 9 and 16 cases) and include numerous plants (at least 9, 8 and 19 species). Other plants are also particularly recommended, such as iris (Iridaceae), gentians (Gentianaceae) and roses (Rosaceae). Most of them spontaneously grow in Western Europe but several exotic imported plants are also listed, e.g. cinnamon (Lauraceae), clove (Myrtaceae) and nutmeg (Myristicaceae). The recipes do not provide detailed instructions for dosing and preparing the ingredients other than they have to be crushed and mixed together. However, in certain cases they precise which organ of the plants should be used. It appears, for example, that most Asteraceae and Lamiaceae are chosen for their leaves or flowers, whereas Apiaceae are almost chosen for their seeds/fruits. Some other plants are selected for their roots (e.g. angelica, gentian and iris), fruits (e.g. lime, orange, juniper and cypress) and wood or bark (e.g. cinnamon).

Plant extracts have also been recorded (Table 3) and hypotheses have been proposed to identify their botanical origins on the basis of ethnobotanical knowledge (e.g. Jacob de Cordemoy 1911; Langenheim 2003; Norri 2016) and modern encyclopaedias such as *Commentarii* (Mattioli 1579), *Dictionnaire universel de commerce* (Savary 1726) and *Histoire naturelle des drogues simples* (Guibourt 1876). Some of these products could have been produced locally (e.g. essential oils of Lamiaceae plants, turpentine) but the most commonly used are imported from the Orient: myrrh, frankincense, benzoin, styrax and aloes could have been extracted from several trees, shrubs and plants respectively belonging to

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<sup>1</sup> Apiaceae, Asteraceae, Gentianaceae, Iridaceae, Lamiaceae, Lauraceae, Myristicaceae, Myrtaceae, Rosaceae and Santalaceae.

Burseraceae (*Commiphora* and *Boswellia*), Styracaceae (*Styrax*) and Xanthorrhoeaceae (*Aloe*) families. Nevertheless, these hypotheses cannot be confirmed since these words are sometimes used as generic terms for other odoriferous exudates.

## 2.2. Archaeobotanical data

Thirteen studies have analysed embalmed bodies dated from the 15th to the 18th centuries for pollen and/or plant macro-remains (Table 4 and Fig. 1). In Italy, the bodies discovered in Spoleto, Siena, Naples and Florence have been examined by the Division of Paleopathology of the University of Pisa under the supervision of Professor G. Fornaciari. In France, the bodies of Anne d'Alègre in Laval, Thomas Craven in Saint-Maurice, and the tombs excavated in Rennes and in Flers<sup>2</sup> (Fig. 2) have been analysed by one or more members of our team. Finally, the analysis of the embalmed heart of Anne de Lens in Douai is available in the literature.

These data have been compiled in two tables (Table 5 and Table 6). Table 5 lists all the taxa identified by archaeobotanical macro- and micro-remains (pollen, seeds, fruits, flowers, leaves, pedicels, wood, fibres). Many of them probably do not reflect the composition of the aromatic powders and correspond more likely to a “pollution” occurred in raw materials (during harvesting, handling and storing), during the embalming process and/or during funerals, in particular some anemophilous and/or anemochore taxa whose pollen and/or achenes are wind-dispersed (such as *Pinus*, *Alnus*, *Betula*, *Crepis*, *Hypochaeris*, and many species of Poaceae). Moreover, some materials could be used for washing the body and cleaning the embalming room (e.g. straw), or placed in the coffin as litters (e.g. twigs, leaves and straw) or as floral offerings (e.g. bunches and wreaths). In Table 6 we propose a synthesis of taxa suspected to have been intentionally introduced by apothecaries (plant organs, and exudates that may trap pollen), according to the authors of the publications on the basis of written sources and the concentrations of macro- and micro-remains measured in the samples. This synthesis records 74 taxa from 19 plant families determined at different levels of taxonomic precision (family, genus, species, subspecies, and seed or pollen types). In certain cases, different taxa may thus identify the same plant, nevertheless these archaeobotanical assemblages are very diverse from one site to another. Different recipes have been used even in the same site, e.g. in Rennes and in Flers where 3 cardiophages and 2 lead coffins were

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<sup>2</sup> The excavations in Rennes and in Flers have been operated by INRAP. The two embalmed bodies discovered in Flers have been autopsied in partnership with CRAHAM at the University of Caen. These studies are still in progress.

analysed, respectively (Barbier-Pain and Ruas in Le Cloirec 2016; Barbier-Pain et al. 2016; Corbineau and Ruas in Dupont and Lefebvre 2016). Despite these differences, Lamiaceae, Asteraceae, Apiaceae and Myrtaceae families are predominant in terms of number of taxa and/or frequency of use, whereas other families do not occur in more than 3 case studies. These studies highlight the necessity to use a multiproxy approach coupling pollen and plant macro-remains. In many cases, these markers identify different taxa depending on which organs of plants were used.

### **3. Results and discussion**

Written sources provide a comprehensive insight into the composition of aromatic powders used for embalming. They clearly show the diversity of the recipes and of the origin of the ingredients, even if plant organs are always predominant in association with plant extracts. At this stage, however, there is not enough data to evidence significant differences between French and Italian recipes, and chronological evolutions from Late Middle Ages to the early 19th century, except the occurrence of American products (e.g. copaiba, balsam of Peru and quina) since the 16th-17th centuries. Written sources also present some inherent limits. On the one hand, they refer to ante-Linnaean names of plants which are difficult to connect to the modern taxonomy. On the other hand, they are encyclopaedic prescriptions and they may not exactly reflect the reality. In other ways, they show what was supposed to be done and maybe not what was actually done. It appears therefore necessary to consider also archaeological sources and archaeobotanical data in particular to go one step further.

Regarding plant organs, written and archaeobotanical sources are strongly complementary. The most common plant families are recorded by both types of sources, such as Asteraceae, Lamiaceae, Apiaceae, Lauraceae and Myrtaceae. Nevertheless, many plants mentioned in written sources do not occur in significant amounts in archaeobotanical assemblages, which can be explained by several reasons. First of all we can assume that apothecaries did not follow the recipes exactly as prescribed since some ingredients were sometimes too expensive or not available. Otherwise, taphonomic biases must be considered: in many cases, several elements are not preserved or too degraded to be identified. Finally, our methods are not able to determine some micro- and macro-remains, pieces of roots and stems or grinded leaves for example. Despite these limits, archaeobotany is very helpful to link old vernacular names of plants cited by written sources with Linnaean taxonomy. Pollen and macro-remains provide precious information on the techniques for preparing plant material (which can be cut, grinded or crushed, according to the state and the type of the seed and fruit fragmentation, and the size

of the fragments) and indicate the stage of development of the plants used (e.g. plants in bloom, withered flowers, ripe fruits more or less rich in aromatic oil/resin) (Ruas in Hadjouis et al. 2011; Barbier-Pain *et al.* 2016) (Fig. 3). Analyses also reveal some taxa which are not mentioned by the recipes (such as undifferentiated Amaranthaceae and Scrophulariaceae, or *Daucus carota*), strengthening the hypothesis that the recipes can be adjusted. In certain cases, however, we are not able to clearly distinguish plants which have been deliberately selected by apothecaries from possible intrusive material accidentally introduced to the aromatic powder. Impurities in raw materials can be suspected, such as in the Thomas Craven's embalming powder in which isolated anemophilous achene of *Crepis* sp. and leaf fragment of *Quercus coccifera* have been determined (Ruas in Hadjouis et al. 2011). We can also assume that some pollen taxa may have been indirectly introduced by surgeons using beeswax, as mentioned by several recipes. Finally, evaluating the quantities and the proportions of raw materials remains a challenge due to the fragmentation of the components and the numerous taphonomic processes involved.

This review clearly shows that macro- and microscopic analyses are not suitable to determine plant extracts. Indeed, none of the main exudates listed by written sources (e.g. myrrh, frankincense, benzoin and styrax) have been identified, and we can easily assume that such products do not contain significant quantities of pollen and/or macro-remains. Bioanalytical chemistry appears as a promising methodological perspective to detect some of their molecular markers (Buckley and Evershed 2001; Mathe et al. 2004; Hamm et al. 2005; Modugno et al. 2006). For examples, in Flers, some markers identified by GC-MS analysis may reveal the presence of a resinous material close to benzoin (Garnier, work in progress, in Dupont and Lefebvre 2016).

At this stage we can wonder which criteria were determinant in the composition of the embalming powders. Apothecaries pick their ingredients from a large "polypharmacy" and the recipes are very diverse. Nevertheless, all the preparations share similar properties. On the one hand, according to the humoralist system of medicine based on the *Hippocratic Corpus* and commonly admitted until the 19th century, "warm and dry" plants and resins were supposed to fight against putrefaction which was considered as "cold and moist". Actually, most of them have antiseptic properties such as wormwood and camomile (Asteraceae), lavender, thyme, marjoram, sage, rosemary and mint (Lamiaceae), myrrh (Burseraceae) and benzoin (Styracaceae) (Lieutaghi 1996; Langenheim 2006). It would be now interesting to establish if they were really efficient to slow down the decay process. On the other hand,



embalming powders are very similar to the mixtures recommended for cosmetic purposes during the modern period. According to several treatises of perfumery such as *Remedes souverains et secrets esperimentez* (Digby 1689), *Le parfumeur François* (Barbe 1693), and *Traité des odeurs* (Dejean 1764), many fragrances and soaps include the same ingredients: e.g. numerous Lamiaceae (lavender, thyme, marjoram, sage, rosemary, hyssop and savory), exotic plants (cinnamon and nutmeg) and resins (benzoin and styrax). It seems obvious that these aromatics were expected to confer a pleasant scent to the deceased. Note also that certain strongly scented plants such as wormwood and costus are used as insect repellent in different cultures (Mattioli 1579; Lieutaghi 1996; Duke et al. 2008); they could be thus introduced to keep necrophagous insects away. Finally, some of these substances have a biblical meaning: Frankincense and myrrh are offered to Jesus by the Three Wise Men (*Matthew* 2:11); later, myrrh and aloes are among the spices used by Nicodemus and Joseph of Arimathea to anoint Jesus' body (*John* 19:38-40). One may thus wonder whether some plants or combination of ingredients might give a symbolic power to the embalming powders, depending on age, sex and confession. In any case, the bunch of wormwood placed over the Thomas Craven's body (Hadjouis et al. 2011) and the laurel branches found inside a tomb at the Couvent des Jacobins (Thomas in Le Cloirec et al. 2016) show that embalming takes part of a ritual process in which plants play an important role.

## **5. Conclusions and further perspectives**

This review has demonstrated the relevance of an interdisciplinary approach coupling written and archaeological sources to collect information about the use of plants and aromatics for embalming. Now further multi-proxy studies integrating archaeobotany (pollen and macroremains) and bioanalytical chemistry are necessary for a comprehensive understanding of *material medica* used by apothecaries to prepare the body for eternity. At this stage, neither chronological evolution nor regional particularism have been highlighted, for example, between France and Italy. There is no doubt that a more robust dataset could allow to investigate these parameters. The survey should also be extended to other countries where previous works have already provided similar results, as in the Netherlands (Vermeeren and Van Haaster 2002) or in the Czech Republic (Beneš et al. 2012), in order to shed light on the mobility of naturalist and medical knowledge in Europe.

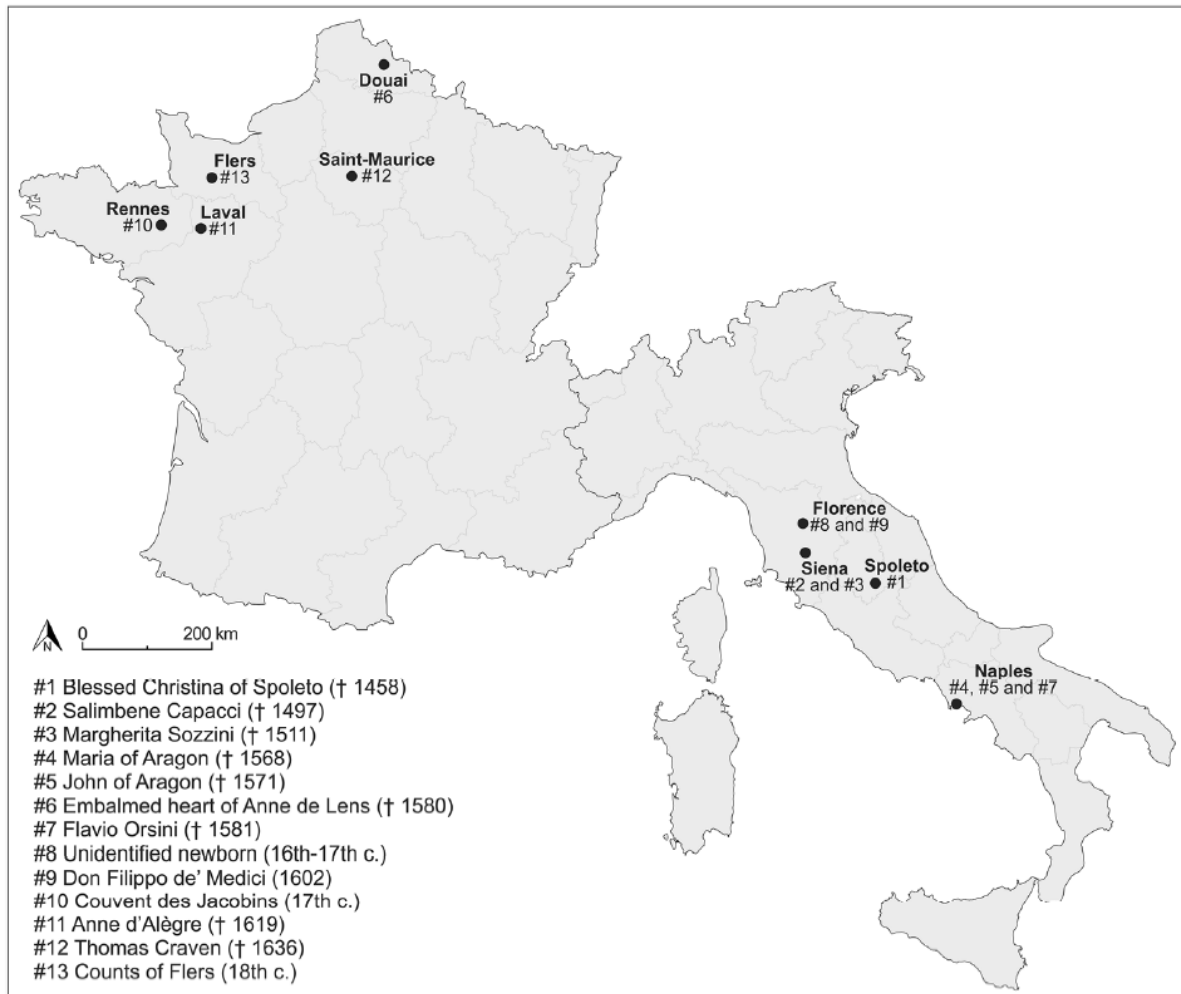
This study will provide a new insight into the circulation and the trade of plants and aromatics from the Orient and the New World to Western Europe. An attentive examination of the archaeobotanical assemblages, focused in particular on underrepresented taxa as regional

markers, may also reveal that certain European species were not gathered or produced next to the place of use (e.g. Western and Northern France) but rather in Mediterranean area. Furthermore, we will have to consider the botanical composition of apothecary gardens where some exotic species could have been domesticated and multiplied. In addition, beside the necrophagous insects that infest embalmed bodies (Huchet 2010), investigations on the entomofauna accompanying the plant material could define the geographical and ecological origin of these products, and clarify their storage (Kislev 1991). Such study is thus closely related to the history of pharmacy and triggers new research avenues on *materia medica* in use during the Late Middle Ages and the modern period.

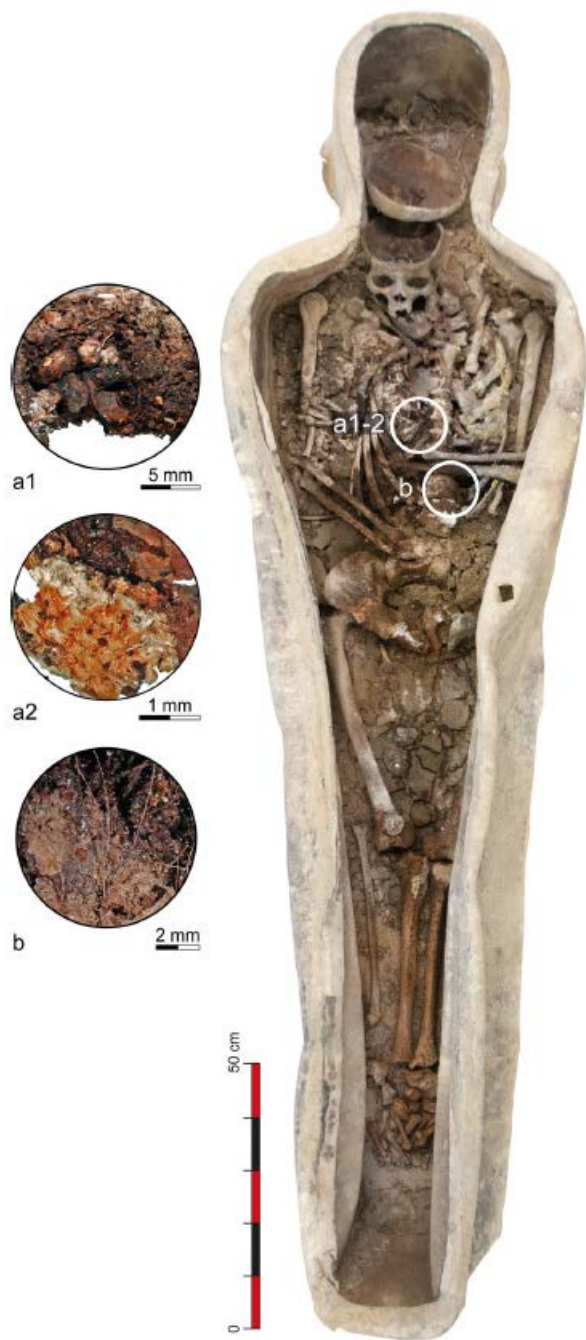
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## Figure captions



**Fig. 1** Map showing the distribution of the archaeobotanical studies (pollen and/or plant macro-remains) of French and Italian embalmed bodies presented in the literature (see Table 4). For the moment, studies are concentrated in North-Western France, in Central Italy and in Naples. This repartition depends on scientific strategies and opportunities and does not reflect historical reality



**Fig. 2** Lead coffin (SP 4019) excavated at Flers/Saint-Germain in 2014 by INRAP (dir. H. Dupont and R. Lefebvre). This picture was taken during the autopsy achieved in partnership with CRAHAM at the University of Caen. This embalmed body has been identified as Philippe René de la Motte Ango, count of Flers buried in the church of Saint Germain on 15th April 1737, according to church records and the anthropological analysis (Dupont and Lefebvre 2016). This case study presents the characteristic features of most of the Late Medieval and modern embalmed bodies discovered in archaeological context: lead coffin, osteological evidences of craniotomy and thoracotomy, abundant organic materials (human

tissues and hair, textiles, plant and insect remains). Macroscopic images show (a1) crushed female cone and seeds of *Juniperus* embedded in the balm, (a2) piece of textile with a fragment of a female cone pericarp of *Juniperus*, and (b) hair remains (general view: E. Broine; macroscopic images: M.-P. Ruas)



**Fig. 3** Some desiccated plant macro-remains from Flers/Saint-Germain (a-c) and Rennes/Les Jacobins (d-l) at different stages of fragmentation: (a) crushed female berry-like cone of *Juniperus communis/oxycedrus*; (b) two seeds of *J. communis/oxycedrus* inside a whole female berry-like cone, some fragments of epicarp (coating) are preserved; (c) two whole seeds of *J. communis/oxycedrus*, a resinous gland is visible; (d) fragments of pericarp of a female berry-like cone of *Juniperus*; (e) triangular scales of a female berry-like cone of *Juniperus*; (f) fragmented seeds of *J. communis/oxycedrus* (left: archaeological specimen; right: modern specimen of *J. communis*); (g) fragments of leaves of *Rosmarinus officinalis*; (h) calyx of *Origanum vulgare* containing two achenes; (i) half mericarps of *Foeniculum vulgare*; (j-m) fragments of cloves (*Syzygium aromaticum*): (j) sagittal fragment of a flower bud (external and internal faces), (k) triangular sepal of the calyx, (l) base of the hypanthium; (m) modern specimen of a clove (macroscopic images: M.-P. Ruas, CNRS-MNHN-SU)

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Table 1 Corpus of written sources

| Text   | Date         | Country | Language     | Source   |
|--|--------------|---------|--------------|--|
| Recipe prescribed by Henri de Monderville                        | 13th-14th c. | France  | French       | Monderville Henri (de) (1893) <i>Chirurgie de maître Henri de Monderville, chirurgien de Philippe le Bel, roi de France, composée de 1306 à 1320</i> (translated from Latin to French by E. Nicaise), Félix Alcan Paris  |
| Recipe prescribed by Guy de Chauliac                             | 14th c.      | France  | French       | Chauliac Guy (de) (1890) <i>La grande chirurgie de Guy de Chauliac, chirurgien, maître en médecine de l'université de Montpellier, composée en l'an 1363</i> (translated from Latin to French by E. Nicaise), Alcan, Paris   |
| Embalming of Pope Alexander V                                    | 1410         | Italy   | Latin        | Foresti Pieter (van) (1653) <i>Observationum et curatum medicinalium, libri duodecim ultimi, in quibus omnium et singularium affectionum corporis humani causa, signa, prognoses &amp; curationes graphice depinguntur</i> , tome V, Berthelin, Rothomagi  |
| Recipe prescribed by Giovanni da Vigo                            | 15th-16th c. | Italy   | Italian      | Document edited by Marinuzzi and Formaciari (2005)   |
| Embalming of Pope Alexander VI                                   | 1503         | Italy   | French       | Giannal Jean-Nicolas (1841) <i>Histoire des embaumements et de la préparation des pièces d'anatomie normale, d'anatomie pathologique et d'histoire naturelle, suivie de procédés nouveaux</i> , Desloges, Paris  |
| Recipe prescribed by Ambroise Paré                               | 16th c.      | France  | French       | Malgaigne J-F (1841) <i>Œuvres complètes d'Ambroise Paré</i> , revues et collationnées sur toutes les éditions, tome 3, Baillière, Paris   |
| Recipe prescribed by Ulisse Aldrovandi                           | 16th-17th c. | Italy   | French       | Giannal Jean-Nicolas (1841) <i>Histoire des embaumements et de la préparation des pièces d'anatomie normale, d'anatomie pathologique et d'histoire naturelle, suivie de procédés nouveaux</i> , Desloges, Paris  |
| Recipe prescribed by Jacques Guillemeau                          | 16th-17th c. | France  | French       | Gaullier Jean Jacques (1612) <i>Les œuvres de chirurgie de Jacques Guillemeau, chirurgien ordinaire du roy et tnye à Paris</i> , Buon, Paris   |
| Recipe prescribed by Ciriaco d'Amato                             | 17th c.      | Italy   | Italian      | Document edited by Marinuzzi and Formaciari (2005)   |
| Recipe prescribed by Moïse Charas                                | 17th c.      | France  | Latin        | Charas Moïse (1676) <i>Pharmacopée royale galénique et élymque</i> , chez l'Auteur, Paris  |
| Recipe prescribed by Phillibert Guybert                          | 17th c.      | France  | French       | Guybert Phillibert (1667) <i>Le medecin charitable, enseignant la manière de faire &amp; prescrire en la maison avec facilité &amp; peu de frais, les remèdes propres à toutes maladies, selon l'avis du Medecin ordinaire</i> , Benjollin, Lyon   |
| Recipe prescribed by Jean Vigier                                 | 17th c.      | France  | Latin/French | Vigier Jean (1657) <i>La grande chirurgie des tumeurs, en laquelle, selon les anciens Grecs, Latins, Arabes &amp; modernes approuvez, est contenue la Theorie &amp; Pratique très parfaite de toutes les maladies externes, qui surviennent au corps humain</i> , Champion et Fourmy, Lyon   |
| Embalming of Maria Anna Victoria of Bavaria (Dauphine of France) | 1690         | France  | French       | Pénicher Louis (1699) <i>Traité des embaumements selon les anciens et les modernes avec la description de quelques compositions balsamiques &amp; odorantes</i> , Girtin, Paris  |
| Recipe prescribed by Nicolas Lemery                              | 17th-18th c. | France  | French       | Lemery Nicolas (1714) <i>Traité universel des drogues simples mises en ordre alphabétique où l'on retrouve leurs différents noms, leur origine, leur choix, les principes qui elles renferment, leurs qualités, leur étimologie, &amp; tout ce qu'il y a de particulier dans les Animaux, dans les Végétaux &amp; dans les Minéraux</i> , Houry, Paris |
| Embalming of King Louis XIV                                      | 1715         | France  | French       | Collective book (1835) <i>Dictionnaire de médecine ou répertoire général des sciences médicales considérées sous les rapports théorique et pratique</i> , tome XI, Librairie de la Faculté de médecine, Paris  |
| Recipe prescribed by Jean-Joseph Sue                             | 18th c.      | France  | French       | Sue Jean-Joseph (1765) <i>Anthropotonie ou l'art d'injecter, de disséquer, d'embaumer et de conserver les parties du corps humain</i> , Cavelier, Paris  |
| Recipe prescribed by Gaspard Murat                               | 19th c.      | France  | French       | Collective book (1835) <i>Dictionnaire de médecine ou répertoire général des sciences médicales considérées sous les rapports théorique et pratique</i> , tome XI, Librairie de la Faculté de médecine, Paris  |

**Table 2** List of plants used as “plant organs” for embalming according to written sources

| Taxonomic hypotheses |  |                         | Primary terms transcribed from written sources  |                          |  |    |
|----------------------|--|-------------------------|---|--------------------------|--|----|
| Family               | Genus / Species                        | Organ Used <sup>a</sup> | French  | Italian                  | Latin                                    | n  |
| Acoraceae            | <i>Acorus</i> (cf. <i>calamus</i> )    | Le / Ro                 | <i>Jonc odorant</i>                             | <i>Calamo aromatico</i>  | <i>Acorus verus / Calamus aromaticus</i> | 8  |
| Apiaceae             | <i>Anethum graveolens</i>              |                         | <i>Aneth</i>                                    |                          | <i>Anethum</i>                           | 4  |
|                      | <i>Angelica</i>                        | Ro                      | <i>Angélique / angélique de Bobène</i>          |                          | <i>Angelica</i>                          | 5  |
|                      | <i>Carum</i>                           | Se                      | <i>Carvi</i>                                    |                          |  | 1  |
|                      | <i>Coriandrum</i>                      | Se                      | <i>Coriandre</i>                                | <i>Coriandolo</i>        |  | 3  |
|                      | <i>Cuminum</i>                         | Se                      | <i>Cumin</i>                                    | <i>Civino</i>            | <i>Cuminum</i>                           | 6  |
|                      | <i>Foeniculum</i>                      | Se                      | <i>Asa fetida / aso fetida</i>                  |                          |  | 2  |
|                      | <i>Foeniculum</i>                      | Se                      | <i>Fenouil</i>                                  |                          |  | 1  |
|                      | <i>Imperatoria</i>                     | Ro                      | <i>Imperatoraire</i>                            |                          | <i>Radix imperatoriae</i>                | 5  |
|                      | <i>Pimpinella</i>                      | Se                      | <i>Ans</i>                                      |                          |  | 3  |
| Aristolochiaceae     | <i>Aristolochia</i>                    | Ro                      | <i>Aristolochie / aristolochie ronde</i>        |                          | <i>Aristolochia rotunda</i>              | 6  |
| Asteraceae           | <i>Anacyclus / Tanacetum</i>           |                         | <i>Pyréthre</i>                                 |                          |  | 1  |
|                      | <i>Artemisia</i>                       | Le / Fl                 | <i>Artemise</i>                                 | <i>Azenzio</i>           | <i>Absteinum</i>                         | 11 |
|                      | <i>Artemisia</i>                       | Le                      | <i>Aurose</i>                                   |                          |  | 1  |
|                      | <i>Carlina</i>                         | Ro                      | <i>Carlina</i>                                  |                          | <i>Carlina</i>                           | 1  |
|                      | <i>Centaurea</i>                       | Fl                      | <i>Centauree grande / centauree majeure</i>     |                          |  | 2  |
|                      | <i>Chamaecrista</i>                    | Fl                      | <i>Camomille</i>                                |                          | <i>Camomilla</i>                         | 6  |
|                      | <i>Matricaria</i>                      |                         | <i>Matricaire</i>                               |                          |  | 1  |
|                      | <i>Tanacetum</i>                       |                         | <i>Balaustie / menthe-cuq</i>                   |                          | <i>Cosus hortensis</i>                   | 2  |
| Caprifoliaceae       | <i>Valeriana</i>                       | Ro                      | <i>Valériane</i>                                |                          |  | 3  |
| Costaceae            | <i>Costus</i>                          |                         | <i>Costus</i>                                   |                          |  | 1  |
| Cucurbitaceae        | <i>Cucurbita</i>                       |                         | <i>Coloquinte / pomme de coloquinte</i>         |                          | <i>Colocynthis</i>                       | 5  |
| Cupressaceae         | <i>Cupressus</i>                       | Fr                      | <i>Cyparis (noce)</i>                           | <i>Cypresso (noce)</i>   | <i>Nux cupressi</i>                      | 6  |
|                      | <i>Juniperus</i>                       | Fr                      | <i>Genévre</i>                                  |                          |  | 3  |
| Cyperaceae           | <i>Cyperus</i>                         | Ro                      | <i>Soacher</i>                                  |                          | <i>Cyperus</i>                           | 6  |
| Euphorbiaceae        | <i>Crotus</i>                          | Wo                      | <i>Cascarille</i>                               |                          |  | 1  |
| Fabaceae             | <i>Melilotus</i>                       | Fl                      | <i>Mélilot</i>                                  |                          | <i>Melilotus</i>                         | 6  |
| Fagaceae             | <i>Quercus</i>                         | Wo                      | <i>Tau</i>                                      |                          |  | 4  |
| Gentianaceae         | <i>Centaurea</i>                       |                         | <i>Centauree petite / centauree mineure</i>     |                          | <i>Centaurea minor</i>                   | 4  |
|                      | <i>Gentiana</i> (undef.)               | Ro                      | <i>Gentiane</i>                                 |                          | <i>Gentiana / Radix gentianae</i>        | 9  |
| Iridaceae            | <i>Iris</i>                            | Ro                      | <i>Iris / iris de Florence</i>                  |                          | <i>Ireas Florentiae</i>                  | 10 |
|                      | <i>Crocus</i>                          |                         | <i>Safran</i>                                   | <i>Zaffrana</i>          |  | 1  |
| Lamiaceae            | <i>Cladopodium</i>                     | Le                      | <i>Calameau</i>                                 |                          | <i>Calamentus</i>                        | 3  |
|                      | <i>Mentha</i>                          | Le                      | <i>Baume / herbe à baume</i>                    |                          | <i>Balsamum / Mentha hortensis</i>       | 8  |
|                      | <i>Ocimum</i>                          | Le                      | <i>Basilic</i>                                  |                          |  | 2  |
|                      | <i>Origanum</i>                        | Le / Fl                 | <i>Marjolaine</i>                               |                          | <i>Majorana</i>                          | 10 |
|                      | <i>Origanum</i>                        | Le                      | <i>Origan</i>                                   |                          |  | 3  |
|                      | <i>Hyssopus</i>                        | Le                      | <i>Hysope</i>                                   |                          |  | 5  |
|                      | <i>Lavandula</i>                       | Fl / Fl                 | <i>Lavande</i>                                  | <i>Lavendola</i>         | <i>Lavandula</i>                         | 10 |
|                      | <i>Marrubium</i>                       | Le                      | <i>Marrube blanc</i>                            |                          |  | 2  |
|                      | <i>Melissa</i>                         | Le                      | <i>Mélisse</i>                                  |                          |  | 4  |
|                      | <i>Mentha</i>                          |                         | <i>Mentastre</i>                                |                          |  | 1  |
|                      | <i>Mentha</i>                          | Le                      | <i>Menthe</i>                                   |                          | <i>Mentha</i>                            | 7  |
|                      | <i>Mentha</i>                          |                         | <i>Menthe d'eau</i>                             |                          |  | 1  |
|                      | <i>Mentha</i> (cf. <i>pulegiatum</i> ) | Fl                      | <i>Ponilot / ponilot de montagne</i>            |                          | <i>Pulegium</i>                          | 5  |
|                      | <i>Rosmarinus</i>                      | Le / Fl                 | <i>Rosmarin</i>                                 | <i>Rosmarino</i>         | <i>Rosmarinus</i>                        | 9  |
|                      | <i>Salvia</i>                          | Le                      | <i>Sauge</i>                                    | <i>Salvia</i>            | <i>Salvia</i>                            | 8  |
|                      | <i>Satureia</i>                        | Le                      | <i>Sarriette</i>                                |                          |  | 3  |
|                      | <i>Tenentium</i>                       | Le / Fl                 | <i>Scordium</i>                                 |                          | <i>Scordium</i>                          | 6  |
|                      | <i>Thymus</i>                          | Le                      | <i>Serpillet</i>                                | <i>Serpillo</i>          |  | 3  |
|                      | <i>Thymus</i>                          | Le / Fl                 | <i>Thym</i>                                     |                          | <i>Thymus</i>                            | 9  |
| Lauraceae            | <i>Cinnamomum</i>                      | Wo                      | <i>Cannelle / cinnamome</i>                     | <i>Cinnamomo</i>         | <i>Cinnamomum</i>                        | 10 |
|                      | <i>Cinnamomum</i>                      |                         | <i>Casse lignée</i>                             |                          | <i>Cassa lignea</i>                      | 2  |
|                      | <i>Cinnamomum</i>                      |                         |   |                          | <i>Cassia caryophyllata</i>              | 1  |
|                      | <i>Laurus</i>                          | Le                      | <i>Laurier</i>                                  |                          | <i>Laurus</i>                            | 3  |
| Lythraceae           | <i>Punica</i>                          | Fr                      | <i>Ecorce de grenade</i>                        |                          |  | 1  |
| Myristicaceae        | <i>Myristica</i>                       | Se                      | <i>Macis</i>                                    | <i>Mace</i>              |  | 2  |
| Myrtaceae            | <i>Myristica</i>                       | Se                      | <i>Noix de muscade</i>                          | <i>Noce muscata</i>      | <i>Nux moschata</i>                      | 9  |
|                      | <i>Myrtus</i>                          | Le / Fr                 | <i>Myrte / myrtille</i>                         | <i>Mirtillo rosso</i>    |  | 2  |
|                      | <i>Syzygium</i>                        | Fl                      | <i>Clou de girofle / girofle</i>                | <i>Garofalo</i>          | <i>Caryophyllus / Garyophyllus</i>       | 12 |
| Piperaceae           | <i>Piper</i>                           |                         | <i>Poivre / poivre blanc / poivre noir</i>      |                          | <i>Piper nigrum</i>                      | 6  |
| Poaceae              | undefined                              |                         | <i>Farine</i>                                   |                          |  | 1  |
| Rosaceae             | <i>Rosa</i>                            | Fl                      | <i>Rose / rose rouge</i>                        | <i>Rosa / rosa rossa</i> | <i>Rosa rubra</i>                        | 10 |
| Rubiaceae            | <i>Cinchona</i>                        |                         | <i>Quinquina</i>                                |                          |  | 1  |
| Rutaceae             | <i>Citrus</i>                          | Fr                      | <i>Citrus (écorce)</i>                          |                          | <i>Citrus</i>                            | 4  |
|                      | <i>Citrus</i>                          | Fr                      | <i>Orange séchée</i>                            |                          |  | 6  |
|                      | <i>Citrus</i>                          | Fr                      | <i>Ecorce d'orange</i>                          |                          | <i>Cortex aurantiorum</i>                | 1  |
|                      | <i>Ruta</i>                            | Le                      | <i>Rue</i>                                      |                          | <i>Ruta</i>                              | 4  |
| Santalaceae          | <i>Santalum</i>                        | Wo                      | <i>Bois de santal / sandaux / santal citrin</i> | <i>Sandalo</i>           | <i>Santalum</i>                          | 9  |
| Violaceae            | <i>Viola</i>                           |                         | <i>Violette</i>                                 |                          |  | 1  |
| Vitaceae             | <i>Vitis</i>                           |                         | <i>Cendre de sarment</i>                        |                          |  | 1  |
| Zingiberaceae        | <i>Eleutheria</i>                      | Se                      | <i>Cardamome / petit cardamum</i>               |                          | <i>Cardamomum vulgare</i>                | 4  |
|                      | <i>Zingiber</i>                        | Ro                      | <i>Gingembre</i>                                |                          | <i>Zingiberis</i>                        | 6  |
| Indeterminate        |  |                         | <i>Noix de galle / galle muscade / ramich</i>   |                          | <i>Gallia muscata</i>                    | 3  |

**Table 3** List of “plant extracts” used for embalming according to written sources

| Taxonomic hypotheses |   | Primary terms transcribed from written sources          |                        |                              | n  |
|----------------------|---|---|------------------------|------------------------------|----|
| Family               | Genus/Species   | French  | Italian                | Latin                        |    |
| Anacardiaceae        | <i>Pistacia</i>   | <i>mastic</i> (cf. also <i>térébenthine</i> , Pinaceae) | <i>mastiche</i>        |                              | 3  |
| Asteraceae           | <i>Chamaemelum</i>  | <i>huile de camomille</i>                               |                        | <i>camomilla</i>             | 2  |
| Burseraceae          | <i>Boswellia</i>  | <i>encens/oliban</i>                                    | <i>incenso</i>         |                              | 8  |
|                      | <i>Commiphora</i>   | <i>gomme élémi</i>                                      |                        |                              | 1  |
|                      | <i>Commiphora</i>   | <i>myrrhe</i>   | <i>mirra</i>           | <i>myrrha</i>                | 15 |
| Cistaceae            | <i>Cistus</i>   | <i>labdanum</i>   |                        | <i>labdanum</i>              | 2  |
| Cupressaceae         | <i>Tetraclinis articulata</i>                                       | <i>sandaraque</i>                                       |                        |                              | 2  |
| Fabaceae             | <i>Acacia</i>   | <i>acacia</i>   | <i>acacia</i>          | <i>acacia</i>                | 3  |
|                      | <i>Acacia</i>   | <i>gomme arabique</i>                                   |                        |                              | 1  |
|                      | <i>Astragalus</i>   | <i>adragant /dragacanth</i>                             |                        |                              | 1  |
|                      | <i>Copaifera</i>  | <i>baume de Copahu</i>                                  |                        |                              | 3  |
|                      | <i>Myroxylon</i>  | <i>baume du Pérou</i>                                   |                        |                              | 5  |
| Hypericaceae         | <i>Hypericum</i>  | <i>huile d'hypericum</i>                                |                        |                              | 1  |
| Lamiaceae            | <i>Lavandula</i>  | <i>huile d'aspic/huile de spica</i>                     | <i>spica germana</i>   | <i>olei de spica</i>         | 4  |
|                      | <i>Lavandula</i>  | <i>huile lavande</i>                                    | <i>lavendola</i>       | <i>oleum lavendulae</i>      | 3  |
|                      | <i>Thymus</i>   | <i>huile de thym</i>                                    |                        |                              | 1  |
| Lauraceae            | <i>Aniba</i>  | <i>bois de rose</i>                                     |                        | <i>lignum rhodii</i>         | 4  |
|                      | <i>Cinnamomum</i>   | <i>camphre</i>  |                        |                              | 3  |
|                      | <i>Laurus</i>   | <i>huile de laurier</i>                                 |                        | <i>laurus</i>                | 1  |
| Myristicaceae        | <i>Myristica</i>  | <i>huile de muscade</i>                                 |                        | <i>oleum nucis moschatae</i> | 2  |
| Oleaceae             | <i>Olea</i>   | <i>huile d'olive</i>                                    |                        |                              | 1  |
| Papaveraceae         | <i>Papaver</i>  | <i>laudanum</i>   |                        |                              | 1  |
| Pinaceae             | <i>Abies/Larix/Pinus</i> (cf. also Anacardiaceae, <i>Pistacia</i> ) | <i>térébenthine/térébenthine de Venise</i>              |                        | <i>terebenthina Veneta</i>   | 8  |
|                      | <i>Cedrus</i>   | <i>bois de cèdre</i>                                    |                        |                              | 1  |
|                      | <i>Pinus</i>  | <i>résine de pin</i>                                    | <i>resina di pino</i>  |                              | 1  |
|                      | <i>Pinus</i> and other Coniferae                                    | <i>colophane/résine colophanie</i>                      |                        |                              | 1  |
| Rosaceae             | <i>Rosa</i>   | <i>eau de rose</i>                                      |                        |                              | 2  |
|                      | <i>Rosa</i>   | <i>huile de rose</i>                                    |                        |                              | 2  |
| Rutaceae             | <i>Citrus</i>   | <i>fleur d'oranger</i>                                  |                        | <i>florum arantiorum</i>     | 3  |
| Styracaceae          | <i>Styrax</i>   | <i>benjoin</i>  |                        | <i>assa odorata/benioin</i>  | 11 |
|                      | <i>Styrax</i>   | <i>styrax/styrax calamite/styrax liquide</i>            | <i>storace liquida</i> | <i>storax calamitos</i>      | 12 |
| Xanthorrhoeaceae     | <i>Aloe</i>   | <i>aloès</i>  | <i>aloe</i>            | <i>aloe</i>                  | 13 |
|                      | <i>Aloe</i>   | <i>aloès caballin</i>                                   |                        | <i>aloes cabillinae</i>      | 2  |
|                      | <i>Aloe</i>   | <i>aloès hépatique</i>                                  |                        |                              | 1  |
|                      | <i>Aloe</i>   | <i>aloès succotrin</i>                                  |                        | <i>aloes succotrinae</i>     | 3  |
| Indeterminate        |   | <i>bois d'aloès/calembour</i>                           |                        | <i>lignum aloes</i>          | 4  |
|                      |   | <i>gomme tacamahaca/tomatata</i>                        |                        | <i>tacamahaca odorata</i>    | 3  |
|                      |   | <i>poix/poix noire/alkitran</i>                         | <i>pece/pece negra</i> |                              | 3  |
|                      |   | <i>sang-dragon</i>                                      |                        | <i>sanguis draconis</i>      | 3  |

**Table 4** Archaeobotanical studies (pollen and/or plant macro-remains) of French and Italian embalmed bodies presented in the literature

| Code | Individual  | Date      | Location   | Reference  |
|------|---|-----------|--|--|
| #1   | Blessed Christina of Spoleto  | 1458      | Basilica of San Gregorio Maggiore (Spoleto, Umbria, Italy)     | Fornaciari et al. (2008)   |
| #2   | Salimbene Capacci (Rector of the Hospital of Santa Maria della Scala) | 1497      | Hospital of Santa Maria della Scala (Siena, Tuscany, Italy)    | Giuffra et al. (2008, 2011a)   |
| #3   | Margherita Sozzini (Salimbene Capacci's wife)                         | 1511      | Hospital of Santa Maria della Scala (Siena, Tuscany, Italy)    | Giuffra et al. (2008, 2011a)   |
| #4   | Maria of Aragon   | 1568      | Basilica of San Domenico Maggiore (Naples, Campania, Italy)    | Marinozzi and Fornaciari (2005)  |
| #5   | John of Aragon  | 1571      | Basilica of San Domenico Maggiore (Naples, Campania, Italy)    | Marinozzi and Fornaciari (2005)  |
| #6   | Embalmed heart of Anne de Lens  | 1580      | Church of Saint Jacques (Douai, Nord, France)                  | Devriendt et al. (2012)  |
| #7   | Flavio Orsini (cardinal)  | 1581      | Basilica of San Domenico Maggiore (Naples, Campania, Italy)    | Marinozzi and Fornaciari (2005)  |
| #8   | Unidentified newborn  | 16–17th c | Basilica of San Lorenzo (Florence, Tuscany, Italy)             | Giuffra et al. (2011b)   |
| #9   | Don Filippo (son of Ferdinando I de' Medici, Grand Duke of Tuscany)   | 1602      | Basilica of San Lorenzo (Florence, Tuscany, Italy)             | Giuffra et al. (2011b)   |
| #10  | Cardiotaphs from the Couvent des Jacobins                             | 17th c    | Couvent des Jacobins (Rennes, Brittany, France)                | Barbier-Pain, Ruas and Thomas in Le Cloirec (2016), Barbier-Pain et al. (2016) |
| #11  | Anne d'Alègre (countess of Laval)                                     | 1619      | Old Castle of Laval (Laval, Pays de la Loire, France)          | Marguerie (1992), Ruas (1992)  |
| #12  | Thomas Craven   | 1636      | Old Protestant cemetery (Saint-Maurice, Île-de-France, France) | Hadjouis and Corbineau (2009), Hadjouis et al. (2011)                          |
| #13  | Lead coffins of the counts of Flers                                   | 18th c    | Excavation in Place Saint-Germain (Flers, Normandy, France)    | Corbineau and Ruas in Dupont and Lefebvre (2016)                               |

**Table 5** Exhaustive list of taxa identified by archaeobotanical macro- and micro-remains (pollen, seeds, fruits, flowers, leaves, pedicels, wood, fibres) at the 13 sites of the corpus (see Table 4)

| Taxa                              |                                     |                                  |                                   |
|-----------------------------------|-------------------------------------|----------------------------------|-----------------------------------|
| Amaranthaceae                     | Brassicaceae                        | Juglandaceae                     | <i>Pinus</i> sp.                  |
| Amaranthaceae indif.              | Brassicaceae indif.                 | <i>Juglans regia</i>             | Plantaginaceae                    |
| Beta-type                         | <i>Hesperis matronalis</i>          | <i>Juglans</i> sp.               | <i>Plantago lanceolata</i> -type  |
| <i>Chenopodium</i>                | <i>Sinapis</i> sp.                  | Juncaceae                        | <i>P. major/media</i> -type       |
| <i>ambrosioides</i>               | <i>Sinapis</i> -type                | <i>Juncus</i> -type              | Poaceae                           |
| <i>Chenopodium</i> cf.            | Campanulaceae                       | Lamiaceae                        | <i>Alopecurus</i> sp.             |
| Anacardiaceae                     | Campanulaceae indif.                | <i>Ajuga</i> sp.                 | <i>Anthoxanthum odoratum</i>      |
| <i>Pistacia</i> -type             | Cannabaceae                         | <i>Clinopodium nepeta</i>        | <i>Avena/Triticum</i> -type       |
| Apiaceae                          | <i>Cannabis/Humulus</i> -type       | Lamiaceae indif.                 | Cerealia-type                     |
| <i>Anethum graveolens</i>         | <i>Cannabis sativa</i>              | <i>Lamium</i> sp.                | <i>Festuca</i> -type              |
| <i>Angelica sylvestris/</i>       | <i>Humulus lupulus</i>              | <i>Lavandula</i> cf.             | <i>Hordeum</i> -type              |
| <i>archangelica</i>               | Capparaceae                         | <i>Marrubium/Mentha</i> -type    | <i>Panicum miliaceum</i>          |
| Apiaceae indif.                   | <i>Capparis rupestris</i> cf.       | <i>Melittis</i> sp.              | Poaceae indif.                    |
| <i>Coriandrum sativum</i>         | <i>Capparis</i> sp.                 | <i>Mentha longifolia</i>         | <i>Secale</i> -type               |
| <i>Daucus carota</i>              | Caprifoliaceae                      | <i>Mentha</i> sp.                | <i>Triticum</i> sp.               |
| <i>Foeniculum vulgare</i>         | <i>Scabiosa columbaria</i> -type    | <i>Mentha</i> -type              | Polygonaceae                      |
| <i>Myrrhis odorata</i>            | <i>Succisa</i> cf.                  | <i>Origanum</i> cf.              | <i>Fagopyrum tataricum</i> -type  |
| <i>Pimpinella anisum</i>          | Caryophyllaceae                     | <i>O. majorana/vulgare</i> -type | Polygonaceae indif.               |
| <i>P. anisum</i> -type            | <i>Arenaria serpyllifolia</i>       | <i>Origanum vulgare</i>          | <i>Polygonum arviculare</i> -type |
| <i>P. anisum/saxifraga</i>        | Caryophyllaceae indif.              | <i>Phlomis</i> sp.               | <i>Polygonum</i> sp.              |
| Araliaceae                        | <i>Silene dioica</i> -type          | <i>Rosmarinus</i> cf.            | <i>Rumex acetosa</i> -type        |
| <i>Hedera helix</i>               | <i>Silene</i> sp.                   | <i>Rosmarinus officinalis</i>    | <i>Rumex aquaticus</i> -type      |
| Asteraceae                        | <i>Stellaria media</i>              | <i>Salvia pratensis</i> -type    | <i>Rumex</i> sp.                  |
| <i>Anthemis</i> -type             | Cistaceae                           | <i>Salvia</i> sp.                | Ranunculaceae                     |
| <i>Artemisia absinthium</i> cf.   | <i>Cistus albidus</i> -type         | <i>Teucrium scorodium</i>        | <i>Helleborus foetidus</i> -type  |
| <i>Artemisia</i> sp.              | <i>Cistus salvifolius</i> -type     | <i>Teucrium scorodonia</i> cf.   | Ranunculaceae indif.              |
| <i>Artemisia vulgaris</i>         | <i>Cistus</i> sp.                   | <i>Teucrium</i> sp.              | <i>Ranunculus acris</i> -type     |
| <i>Artemisia vulgaris</i> cf.     | Cupressaceae                        | <i>Thymus</i> cf.                | Rosaceae                          |
| <i>Artemisia vulgaris</i> -type   | Cupressaceae indif.                 | <i>Thymus serpyllum</i>          | <i>Prunus</i> -type               |
| <i>Artemisia/Matricaria</i> -type | <i>Juniperus</i> cf.                | <i>Thymus vulgaris</i>           | <i>Rosa</i> sp.                   |
| <i>Aster</i> -type                | <i>Juniperus</i>                    | <i>Thymus vulgaris</i> cf.       | Rosaceae indif.                   |
| Asteraceae indif.                 | <i>communis/oxycedrus</i>           | Lauraceae                        | <i>Sanguisorba minor</i> -type    |
| Asteroidae                        | Cyperaceae                          | <i>Laurus nobilis</i>            | Rubiaceae                         |
| Carduaceae                        | Cyperaceae indif.                   | Liliaceae                        | <i>Galium palustre</i>            |
| <i>Carduus</i> -type              | <i>Scirpus</i> sp.                  | Liliaceae indif.                 | <i>Galium</i> -type               |
| <i>Centaurea cyanus</i>           | Ericaceae                           | Linaceae                         | Rubiaceae indif.                  |
| <i>Centaurea jacea</i> -type      | <i>Erica</i> sp.                    | <i>Linum usitatissimum</i> cf.   | Rutaceae                          |
| <i>Centaurea</i> sp.              | <i>Rhododendron</i> -type           | Malvaceae                        | <i>Ruta</i> sp.                   |
| <i>Chamaemelum nobile</i>         | Euphorbiaceae                       | Malvaceae indif.                 | Salicaceae                        |
| Cichorioideae                     | <i>Mercurialis annua</i>            | <i>Tilia</i> sp.                 | <i>Salix</i> sp.                  |
| Cirsium-type                      | Fabaceae                            | Magnoliaceae                     | Scrophulariaceae                  |
| <i>Crepis capillaris</i>          | <i>Astragalus</i> -type             | <i>Magnolia grandiflora</i> cf.  | Scrophulariaceae indif.           |
| <i>Crepis</i> -type               | Fabaceae indif.                     | Myrtaceae                        | Typhaceae                         |
| <i>Hypochaeris glabra</i>         | <i>Cytisus/Genista</i> -type        | <i>Myrtus communis</i>           | <i>Sparganium</i> sp.             |
| <i>Leontodon</i>                  | <i>Melilotus albus</i>              | <i>M. communis</i> ssp.          | Verbenaceae                       |
| <i>autumnalis/medicinalis</i>     | <i>Melilotus</i> sp.                | <i>tarentina</i>                 | <i>Verbena officinalis</i>        |
| <i>Leucanthemum vulgare</i>       | <i>Onobrychis</i> -type             | <i>Myrtus</i> -type              | Vitaceae                          |
| <i>Matricaria</i> cf.             | <i>Trifolium</i> -type              | <i>Syzygium aromaticum</i>       | <i>Vitis vinifera</i>             |
| <i>Matricaria chamomilla</i>      | Fagaceae                            | Nymphaeaceae                     | Ulmaceae                          |
| <i>Taraxacum</i> -type            | <i>Castanea sativa</i>              | <i>Nymphaea</i> sp.              | <i>Ulmus</i> sp.                  |
| Betulaceae                        | <i>Fagus</i> sp.                    | Oleaceae                         | Urticaceae                        |
| <i>Alnus</i> sp.                  | <i>Quercus coccifera/ilex</i> -type | <i>Fraxinus</i> sp.              | <i>Urtica dioica</i> -type        |
| <i>Betula</i> sp.                 | <i>Quercus deciduous</i> -type      | <i>Olea europaea</i>             | <i>U. pilulifera</i> -type        |
| <i>Corylus avellana</i>           | <i>Quercus robur</i> -type          | Papaveraceae                     | Violaceae                         |
| <i>Corylus</i> sp.                | Gentianaceae                        | <i>Papaver</i> -type             | <i>Viola tricolor</i> -type       |
| Boraginaceae                      | <i>Centaureum erythraea</i> cf.     | Pinaceae                         | Xanthorrhoeaceae                  |
| Boraginaceae indif.               | <i>Centaureum</i> -type             | <i>Abies</i> sp.                 | <i>Aloe vera</i> cf.              |
| <i>Borago officinalis</i>         |                                     | <i>Cedrus</i> sp.                |                                   |



**Table 6** Synthesis of archaeobotanical data [macro-remains (seeds, fruits, floral fragments, pedicels, leaves, fibres): MR; pollen: P] from French and Italian embalmed bodies (see Table 4)

| Code (see Table 4) |  | #1   | #2   | #3 | #4 | #5 | #6 | #7 | #8 | #9 | #10  | #11  | #12  | #13 |
|--------------------|--|------|------|----|----|----|----|----|----|----|------|------|------|-----|
| Country            |  | It   | It   | It | It | It | Fr | It | It | It | Fr   | Fr   | Fr   | Fr  |
| Amaranthaceae      | Amaranthaceae indif.                         |      | P    | P  |    |    |    |    |    |    |      |      |      |     |
|                    | <i>Chenopodium</i> cf.                       |      | P    |    |    |    |    |    |    |    |      |      |      |     |
| Apiaceae           | Apiaceae indif.                              |      | P    |    |    |    |    |    |    |    | P    |      |      |     |
|                    | <i>Anethum graveolens</i>                    |      | P    |    |    |    |    |    |    |    |      |      |      |     |
|                    | <i>Angelica archangelica/sylvestris</i>      |      |      |    |    |    | P  |    |    |    |      |      |      |     |
|                    | <i>Coriandrum sativum</i>                    |      |      |    |    |    |    |    |    |    |      |      |      | MR  |
|                    | <i>Daucus carota</i>                         |      |      |    |    |    |    |    |    |    |      |      |      | MR  |
|                    | <i>Foeniculum vulgare</i>                    |      | P    |    |    |    |    |    |    |    | MR   |      |      |     |
|                    | <i>Myrrhis odorata</i>                       |      |      |    |    |    | P  |    |    |    |      |      |      |     |
|                    | <i>Pimpinella anisum</i>                     |      |      |    |    |    | P  |    |    |    |      |      |      |     |
|                    | <i>Pimpinella anisum/sacifraga</i>           |      |      |    |    |    |    |    |    |    |      | MR   |      |     |
| Asteraceae         | Asteraceae indif.                            |      |      |    |    |    |    |    |    |    | MR   | P    |      | MR  |
|                    | <i>Artemisia</i> type                        |      |      |    |    |    |    |    |    |    | P    |      |      |     |
|                    | <i>Artemisia</i> sp.                         |      |      |    | MR |    | P  |    |    |    | P    | P    | P    | P   |
|                    | <i>Artemisia absinthium</i> cf.              |      |      |    |    |    | P  |    |    |    |      |      | MR   | MR  |
|                    | <i>Artemisia absinthium</i>                  |      |      |    |    |    |    |    |    |    | MR   |      |      |     |
|                    | <i>Artemisia vulgaris</i> type               |      | P    |    |    |    |    |    |    |    |      |      |      |     |
|                    | <i>Artemisia vulgaris</i>                    |      |      |    |    |    |    |    |    |    | MR   |      |      |     |
|                    | <i>Chamaemelum nobile</i>                    |      |      |    |    |    | P  |    |    |    |      |      |      |     |
|                    | <i>Leucanthemum vulgare</i>                  |      |      |    |    |    |    |    |    |    | MR   |      |      |     |
|                    | <i>Matricaria</i> cf.                        |      | P    | P  |    |    |    |    |    |    |      |      |      |     |
|                    | <i>Matricaria chamomilla</i>                 |      |      |    |    |    |    |    | P  |    | MR   |      |      |     |
| Cannabaceae        | <i>Cannabis sativa</i>                       | MR/P |      |    |    |    |    |    |    |    |      |      |      |     |
|                    | <i>Humulus lupulus</i>                       |      |      |    |    |    |    |    |    |    | MR   |      |      |     |
| Caryophyllaceae    | Caryophyllaceae indif.                       |      |      |    |    |    |    |    |    |    |      | P    |      |     |
|                    | <i>Arenaria</i> cf. <i>serpyllifolia</i>     |      |      |    |    |    |    |    |    |    |      | MR   |      |     |
|                    | <i>Silene</i> sp.                            |      |      |    |    |    |    |    |    |    |      | MR   |      |     |
|                    | <i>Stellaria media</i>                       |      |      |    |    |    |    |    |    |    |      | MR   | MR   |     |
| Cistaceae          | <i>Cistus</i> sp.                            |      |      |    |    |    |    |    |    | P  |      |      |      |     |
| Cupressaceae       | <i>Juniperus communis/oxycedrus</i>          |      |      |    |    |    |    |    |    |    | MR   | MR   |      | MR  |
| Fabaceae           | Cytisus/Genista type                         |      |      |    |    |    | P  |    |    |    | P    |      |      |     |
|                    | <i>Melilotus</i> sp.                         |      |      |    |    |    |    |    |    |    | MR   |      |      |     |
|                    | <i>Melilotus albus</i>                       |      |      |    |    |    | P  |    |    |    |      |      |      |     |
| Fagaceae           | <i>Quercus coccifera</i>                     |      |      |    |    |    |    |    |    |    |      |      |      | MR  |
|                    | <i>Quercus deciduous</i> type                |      |      |    |    |    |    |    |    | P  |      |      |      |     |
| Gentianaceae       | <i>Centaurium erythraea</i> cf.              |      |      |    |    |    |    |    |    |    |      |      |      | P   |
| Lamiaceae          | Lamiaceae indif.                             |      |      |    |    |    | P  |    |    |    | MR/P | MR/P | P    | MR  |
|                    | <i>Ajuga reptans</i>                         |      |      |    |    |    |    |    |    |    |      | MR   |      |     |
|                    | <i>Clisopodium nepeta</i>                    |      |      |    |    |    |    |    |    |    | MR   |      |      | MR  |
|                    | <i>Laminum</i> sp.                           |      |      |    |    |    | P  |    |    | P  |      |      |      |     |
|                    | <i>Lavandula</i> cf.                         |      |      |    |    |    |    |    |    |    | MR   |      |      |     |
|                    | <i>Lavandula</i> sp.                         | MR   |      |    |    |    |    |    |    |    |      |      |      |     |
|                    | <i>Marrubium/Mentha</i> type                 |      |      |    |    |    |    |    |    |    | MR   |      |      |     |
|                    | <i>Melissa</i> sp.                           |      |      |    |    |    |    |    |    | P  |      |      |      |     |
|                    | <i>Mentha</i> type                           |      | P    | P  |    |    |    |    |    | P  |      | MR   |      | P   |
|                    | <i>Mentha longifolia</i>                     |      |      |    |    |    |    |    |    |    | MR   |      |      |     |
|                    | <i>Origanum majorana/vulgare</i> type        |      |      |    |    |    |    |    |    |    |      |      |      | MR  |
|                    | <i>Origanum vulgare</i>                      |      |      |    |    |    |    |    |    |    | MR   | MR   |      |     |
|                    | <i>Phlomis</i> sp.                           |      |      |    |    |    |    |    |    | P  |      |      |      |     |
|                    | <i>Rosmarinus</i> cf.                        |      | MR/P | P  |    |    |    |    |    |    |      |      |      |     |
|                    | <i>Rosmarinus officinalis</i>                | MR   |      |    | MR | MR |    | MR |    |    | MR   |      |      |     |
|                    | <i>Sabia</i> sp.                             |      | MR/P | MR |    |    |    |    |    | P  |      |      |      |     |
|                    | <i>Sabia pratensis</i> type                  |      |      |    |    |    |    |    |    |    |      |      |      | P   |
|                    | <i>Tenacium</i> sp.                          |      |      |    |    |    |    |    | P  | P  |      |      |      |     |
|                    | <i>Tenacium chamaedrys</i>                   |      |      |    |    |    |    |    | P  |    |      |      |      |     |
|                    | <i>Tenacium scorodonia</i> cf.               |      |      |    |    |    |    |    |    |    | MR   |      |      |     |
|                    | <i>Thymus</i> cf.                            |      |      | P  |    |    |    |    |    |    |      |      |      |     |
|                    | <i>Thymus serpyllum</i>                      |      |      |    |    |    |    |    |    |    |      |      |      |     |
|                    | <i>Thymus vulgaris</i>                       |      |      |    |    |    |    |    |    |    | MR   | MR   |      |     |
| Lauraceae          | <i>Laurus nobilis</i>                        |      |      |    | MR | MR |    | MR |    |    |      |      |      |     |
| Linaceae           | <i>Linum usitatissimum</i> cf.               |      | MR/P | MR |    |    |    |    |    |    | MR   |      |      |     |
| Myrtaceae          | <i>Myrtus</i> type                           |      |      |    |    |    |    |    |    |    | P    |      |      |     |
|                    | <i>Myrtus communis</i>                       | P    |      |    |    |    | P  |    |    |    |      |      |      |     |
|                    | <i>Myrtus communis</i> ssp. <i>tarentina</i> |      |      |    | MR | MR |    |    |    |    |      |      |      |     |
|                    | <i>Syzygium aromaticum</i>                   |      |      |    |    |    |    |    |    |    | MR   |      |      |     |
| Oleaceae           | <i>Olea europaea</i>                         |      | P    | P  |    |    |    |    | P  | P  |      |      |      |     |
| Poaceae            | Poaceae indif.                               |      | MR   | MR |    |    |    |    |    |    |      |      | MR/P |     |
|                    | Poaceae type                                 |      |      |    |    |    |    |    |    |    | MR   |      |      |     |
|                    | <i>Alopecurus</i> sp.                        |      | MR   |    |    |    |    |    |    |    |      |      |      |     |
|                    | <i>Festuca</i> sp.                           |      |      |    |    |    |    |    |    |    |      |      | MR   |     |
|                    | <i>Panicum millicerum</i>                    |      |      |    |    |    |    |    |    |    |      |      | MR   |     |
| Rosaceae           | <i>Rosa</i> sp.                              |      |      |    |    |    | P  |    |    |    |      |      |      |     |
| Scrophulariaceae   | Scrophulariaceae indif.                      |      |      |    |    |    |    |    |    |    |      |      |      | P   |
| Xanthorrhoeaceae   | <i>Aloe vera</i> cf.                         |      | P    |    |    |    |    |    |    |    |      |      |      |     |

