"The Ethnocultural significance for the use of plants in Ancient Funerary Rituals and its possible implications with pollens found on the Shroud of Turin".

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On the occasion of the exposition of the Holy Shroud of Turin in 2010, and after visiting the 'Museo de la Sindone' (Turin), I was interested in the palynological investigations that had been realized, supposing that they had come to unquestionable conclusions.

After reviewing them, I noticed that the pollen identifications had not been studied with the greatest rigor and the ethnocultural meaning that was pointing to their presence was not well understood.

Knowing that the observation of the adhesive tapes collected by Max Frei in the years 1973 and 1978 or other original material was unavailable at the moment, I made my study through observation of published pollen photos on the Shroud and the comparison with my own samples.

My doctoral research has treated about the description of more than one hundred types of pollens of endemic plants from the Balearic Islands (Spain), giving me the opportunity to reveal that among the pollen of the Shroud, there is a copy, difficult to classify and recognize, which belongs to the Asteraceae family that may have been key in preparing the body during the funeral ritual. Other described pollens on the Shroud, which appear in counts with significant values, would also confirm the practiced ritual.

The plants used in the funeral rites have witnessed, through pollen, the moment of death, which have been ethno culturally significant, reflecting the time in which the story begins of that funeral attire. The presence of these pollen guides on the fabric reveal the application of oils, balms and ointments, also explaining why it has been kept in excellent condition to this day. These small remnants, trapped for centuries, now become valuable items that may provide clues to the moments that occurred more than two thousand years and which are still shrouded in mystery.

1. From the Bible and other sources: what kind of plants were used 2000 years ago in funeral and grave rites?

The Bible cites around 130 plant species and more than 500 citations of essential oils and fragrances and medicinal plants, although it does not detail botanical formulas, particularly against incantations or magical practices.

The medical oils of the Bible are: aloe, balsam, laurel, bdellium, coriander, cumin, frankincense, galbanum (*Ferula galbanifera*), henna (*Lawsonia alba*), juniper, myrrh, onycha, rue, shittin (acacia), and spikenard.

The oils of seeds are: anise, coriander, cumin, dill (*Anethum graveolens*) and mustard. The antiseptic oils Biblical are: anise, sweet cane or calamus (*Acorus calamus*), cassia, cedar, cinnamon, cypress, dill, hyssop (*Hyssopus*), mint, mustard seed (*Brassica nigra*), pine, terebinth, and wormwood (*Artemisia*).

The incenses, in general sense, were used in the preparation of the bodies for the grave, for its purification, and its aromas removing the carrion-eating insects of the sanctuary. The Biblical texts report that the body of the kings in the burials were adorned and covered with myrrh and bdellium.

In these times the various types of incense were very important in all the religious rituals, valued as much as the precious metals present in the altars, the purifications, the embalms or the funeral incinerations and this burning was accompanying with offerings of oils, fruits, wines and other substances.

Frankincense (Boswellia Thurifera) appears on inscriptions of the populations of the Sumerian and Assyrians, testifying that the fragrant plants were cultivated and used at least three thousand years B.C. The frankincense, considered a symbol of divinity and purity, is one of the gifts that the child Jesus received from the three Wise Men; the myrrh, another offering that they delivered to him, symbolizes a future suffering and a death for sacrifice. The Bible describes the fragrance of myrrh as a sign of luxury and simultaneously of beauty, a perfume with cosmetic and medical use, for embalming corpses and as oil of extreme unction. ". The oil of unction is liquid and consists, in addition to the myrrh, of cinnamon, sugar cane and cassia (Ex.30, 23-25).

The Exodus (Ex. 30, 34-38) comments that the sacred incenses are constituted by several herbs that are: incense, sweet pepper, estacte, onycha and galbanum. In Ex. 30, 34-35, it is reported that the incenses consist of 'estacte' (oil of myrrh, according to Theophrastus), onycha, galbanum and pure incense in composition and proportion that should be modified, but with the myrrh always present in each religious event. Yavhe said unto Moses: 'Take the spices of frankincense, stacte (myrrh), onycha and aromatic galbanum, all in equal weight and do it incense, a perfume well mixed, will be holy and pure'.

In Syria, incenses composed of the spices: myrtle, galbanum, tamarisk, pine, cypres, Phoenician juniper, bdellium, frankincense, cedar, frankincense tree, terebinth, laudanum, nard, myrrh, sweet cane (*Calamus odoratus*), incense balsam or opobalsam, aroma, aromatic shell or cress and other resins or rubbers (*Pistacia* - mastic) are documented.

The pure incense was the principal ingredient of the burnt incenses (Ex. 30, 7-8) and it is obtained from the perforations of the bark of the tree *Boswellia sacra*, of Bursaceae's botanical family, which exudations of the sap produce aromas when burned. The most prized frankincense was being produced in southern Arabia, where old trees grew secretly that produce a more fragrant, hid in plantations and extraction methods. This spice is also cultivated in Somaliland and in India, in many parts has been the main ingredient of the fragrance of incense smoke.

The pure incense (in Hebrew LĔBŌNÂ), from the French 'franc encens' or 'pure incense', was an essential ingredient of the sacred incenses that consisted of two parts: one of frankincense and the other a minimum of three other spices that, sometimes, were forged adding resins of Coniferous (raggia), camphor or turpentine.

The myrrh (in Hebrew MŌR), is also called 'estacte' and is another ingredient of the incenses and ointments, and belongs to another kind (*Commiphora molmol*) of Bursaceae's family. The meaning of the word extract is 'distil' or 'drip gradually'; it is used in very old rituals of cults (Amarna's tables, 1400 B.C.). According to Ptolemy, king of Egypt (305-285 B.C.), the zone Eastern of Arabia, was an excellent producer of the pure incense, while the Western zone was a producer of myrrh, wild and cultivated. The better quality grows in Arabia, though also it is present in Eritrea and Somalia. The

resin (rubber) is transparent or reddish, bitter and very aromatic and a lone bud without tearing the bark of the tree.

For thousands of years, in the altars of the temples there are burned dry plants and oils that generally are called incenses, meaning "to burn", from the Greek ‘thumiama’ and the Latin ‘*incendere*’. These substances have been important in the religious offerings, to frighten evil spirits and disease away; the perfumes, with the prayers, were grateful and communicating with god.

In Jerusalem about 600 B.C., they began to celebrate offerings and purifications using incenses, with mixed rites between the religious and the profane, while, in the magic rituals, the spices were added in the wine or medicines.

In the altars of Palestine burned many types of incense with henna (*Lawsonia alba*), saffron (family Iridaceae) and laudanum in olive oil and imported many others, while in Mesopotamia the perfumed incense burned in oil of sesame.

The first Christians 2000 years ago lost the religious rituals of Judaism, but on the altars remained lit incense, representing the cross, the sacrifice and the Lamb of God for the sin of man. At the altar the priest filled a pot of incense, with embers and perfumes, offering the smoke as symbol of the prayer, while the people were praying, in the temple that out of it (Luke 1, 10). “Let my prayer be set forth as incense before thee. The lifting up of my hands as the evening sacrifice”. Psalm 141, 2. (American Standard Version) In the routes of the trade of the myrrh and frankincense, 2000 years ago, many people cross Mesopotamia towards the north of the Asia Minor. The incenses were transported in camel for several days through Gaza, Alexandria and arriving in Greece or Rome, where are consumed in big quantities with other spices (Nielsen, 1986). The Romans, who recognize the adulterations of the spices, were benefiting from the trade of other medicinal plants from Syria, Egypt, Arabia, Persia, India, and Ethiopia (Mengotti, 1821). Pliny the Elder, in his work ‘Historia Naturalis’ (Book XII), for example, make mentions to the myrrh as ‘estacte’ and informs that there is forged with mastic (*Pistacia lentiscus*), juice of watermelon (*Citrullus*) or bdellium.

2. Other Spices on Rituals

Of the different spices and aromas related with the funeral rites of 2000 year ago, the frankincense and the myrrh are the most known; there exist many others, of which information has been getting lost, its exact species, usefulness and use. Some of them, it has been possible to recover the information checking the manuscript of the writers of this time, as Dioscorides and Pliny the Elder, which comment the uses in ancient times.

Aloe: appears in Egypt in the paintings of same sepulchers of 5000 years ago, has been an ointments of embalming for the corpse and symbol of the spiritual power. The medical uses have been described in the slats Sumerians of 2000 B.C. and they appear also in Ebers’s Egyptian papyrus (1550 B.C.), the first treatise medical known, in which are commented remedies based on aloe.

Aloe is one of the most important Biblical perfumes (Prov. 7, 17; Cant. 4, 14; Jn. 19, 39; Psal. 45; 44, 9); the term ‘migma’ refers to the aromatic mixture of myrrh and aloe, referring surely to the species *Aquilaria agallocha*. In fact, the Bible defines two types of aloes under the same name of ‘ahaloth’, translated as ‘aloe’ and that, in occasions do not correspond to the plant that nowadays is known as such. A type of aloe refers to *Aquilaria agallocha* (family Thymeleaceae), abundant in India and Tibet, a woody resinous and aromatic tree that burned produces tranquilizing fragrances and of which an

ointment is obtained also. The other more known species is *Aloe* spp. (Family Liliaceae) is not a fragrant plant and cannot be used to perfume beds, sheets and clothes.

Flavius Josephus, between 79 and 94 A.D., writes the history of the Jews 'Jewish antiquities', in which mentions Jesus in two occasions. Confirm that the Biblical aloe is not the bitter plant applied to the wounds (*Aloe* spp.), but it is the one that comes from India (*Aquilaria agallocha*) call 'agollochon', 'agaloco' or 'stick of aloe', with an exquisite perfume. He assures that Jesus was smeared with 'stick of aloe', a resinous and perfumed wood of the same variety used by the Sumerian and in the carpentry: "… the body is washed by water of nards, frankincense, clove and stick of aloe, but not that one that results to crush the leaves of the plant, but that one that comes from the India and that the Greeks call 'agaloco' of exquisite perfume".

Hippocrates, considered the father of the Greek medicine (460-375 B.C.), it does not mention this plant, while Dioscorides in the book 'De Materia Medica', written about 74 A.D. in Asia Minor, proposes it to heal wounds, as laxative, against abscesses, contusions and fall of the hair, besides other uses, alluding, almost with complete certainty to *Aloe* spp. Dioscorides refers to *Aquilaria* as a plant of which a rare perfume was obtained; the Muslims which call 'oud', utilized it like a precious wood, and like component of the incenses with other resins to make aromas (Stevens, 2006). Pliny the Elder, in 'Historia Natural', describes the same ones that the contemporary Dioscorides and comments that the boiling of the roots treats the sores of the lepers. In the book XXIX, he compares the aloe with a plant of onion, with thicker and fluted leaves, of tender branches, with an alone root of intense smell and with bitter flavor, referring to *Aloe* spp. The best, said, comes from India and is used to treat wounds, referring in this case, to the species *Aquilaria agallocha*.

Bdellium: is obtained from a tree of the kind *Balsamodendron* (family Bursaceae) of the Himalayas, which produces a brilliant and transparent resin, similar to the wax, which bring of Arabia, India and Babylonia. This aromatic resin is used to adulterate the myrrh, and it is also called the 'Indian myrrh' forged with oil of almonds (Pliny the Elder).

Cardamom: is obtained from the seeds of the plant *Elettaria cardamomum* with properties similar to the nard; it grows in India and it is forged with leaves of pomegranate.

Cedar: was used in Egypt for preserving the corpses. The exudations are obtained from the wood in warm. The juice of the cedar preserves the corpses incorrupt, but corrupts the living and its smell numbed the sick people (Pliny the Elder).

Cassia and **cinnamon:** are spices of doubtful origin that can refer to several species simultaneously, from the most common basil, of which exploited the oil of the leaves, to the aromatic bark of the tree *Cinnamomum cassia* (family Lauraceae), originally of India.

In Arabia does not produce the cassia or cinnamon. It can also refer to a certain bitter, very expensive, balm of a tree of Ethiopia which is forged with styrax (*Styrax officinale*) (Pliny the Elder).

The plants of **Cistus** (rose of the rock) of Cistaceae's family are a shrub presents in the basin of the Mediterranean that content resin, similar to myrrh resin present in all parts of the plant, include the capsules of the fruits. The oil of *Cistus* was used as a fixative and to preserve the fragrances mixed with myrrh and other spices. The mixture with other unknown spices, was using in the whole Arabia under the name of 'estrobo' (Pliny the Elder). The laudanum appears in the Bible as ladano (Gen. 43, 11), and there is obtained from the species *Cistus ladanifer* (Sharon's rose). It is a resinous substance collected

directly of the beard of the goats, which still when eaten his stems. Have a strong smell and burn mixed with myrrh, explodes; it is forged with the fruits of the myrtle (Pliny the Elder).

The word laudanum seemed to the Hebrew 'lebona', which means incense; it may have been translated erroneously in the Bible. So that, all the incenses that are mentioned in the Bible, might refer not to the pure incense, but to resins aromatic like the galbanum, onycha, *Cistus* or shittin (Arabic rubber) or *Cistus ladanifer* (Steward, 2003).

Estoraque: (*Styrax officinale*) is a yellow resin brought from Syria that was exchanged with the Arabic incense. Used to make perfumes with myrrh and frankincense, when burned produces a strong odour.

Erba savina: or 'grass sabina', employed in the purifications, was called by the Greeks 'brati' is a similar type of tamarind or cypress (Pliny the Elder).

Galbanum aromatic: is a resin that is obtains of the stem and the roots of the plant (*Ferula galbanifera,* Apiaceae) native of Persia and Syria. His juice distilled 'stagonite', is burned in the sacred temples to produce a strong smell (Pliny the Elder).

Myraballum: is extracted from the fruits of the tree *Prunus cerasifera* and in Arabia is used as ointment (Pliny the Elder).

Nard: is extracted from the leaves and roots of the plants of Amaryllidaceae family that are dried in the sun and there is obtained the appreciated ointment which in Syria call 'bacchari' (Pliny the Elder).

Opobalsam: 'balsam' of the smells' or 'xilobalsam', is obtained of a tree which sap serves to ointments. It is forged with myrtle, mastic, turpentine, galbanum, wax, and raggia.

Pistacia: mastic, according to the Bible, is a resin of the altars, composed by *Pistacia terebinthus* (terebinth, turpentine) or *Pistacia lentiscus* 'lacryma arbons'. In Egypt using the resins of three types of *Pistacia* (*P. khinjuk, P. terebinthus* and *P. atlantic*) although imported incenses of Syria, Somalia or Palestine. The Armenians used the resin of burnt terebinth to mask the smell of corpse in the sepulchers (Conder, 1830).

Pliny the Elder (book XIII), comments that from the species *Pistacia terebinthus* is obtained the turpentine, while in Greece, in Chios island, another turpentine very valuable, it is obtained by *P. lentiscus* and is forged by the 'raggia'. The mastic produces a resin, called tear or rubber (book XII 36 and XIV 25) and oil (skinclaion) that is obtained in the form similar to the terebinth, from the mature fruits. Also the leaves, fruits, bark and root are boiled in water to obtaining an astringent juice with consistency of honey. The final product is a resin, which distilled produces volatile sweet oils, which are component of balsams, ointments and plasters. The juice of the leaves is applied to eliminate the sores and ulcers (Pliny the Elder).

Onycha: is extracted from the shell of a marine snail native to the Red Sea and burned produces a perfumed smell (Pliny the Elder).

3. Funeral Rites

The Egyptians domain the art of embalming the corpses from 3500 B.C. to 700 A.D. (Forts Rocañín *et al*., 2007), a technique which returned on the rise in Europe in the Middle Ages. The Bible indicates

that it was a custom of the times of Abraham, that Biblical Joseph was embalmed according to the Egyptian use (Gen. 50, 26), and according to the references of Moses, the practice of preparation of the body it lasted 40 days (Gen. 2, 2-3).

Herodotus, a Greek historian (484-425 B.C.) describes three types of embalming. The most expensive consists of emptying the brain from the nose, of extracting the entrails of the abdominal cavity and of washing the body with wine of palm. Then the body is dried with aromas mashed, fills with myrrh, cassia (probably cinnamon) and other spices, excepting the frankincense. The body is signed and is left in brine in soda for seventy days; it returns to wash and finally it is wrapped in a wet fabric with resin of cedar and other ointments, and preserved in boxes of wood. In the second practice, the body is filled with oil of liquid cedar leaving it in brine in soda for seventy days. Later the entrails are extracted leaving the body in alone skin and bones. The last practice, the least expensive, uses spices and drugs that are placed in the entrails and the dried the body in salt for sixty days. The essential oils used are: cedar, rosemary, juniper, cinnamon, aloes, and others funeral oils (Jn. 19:39) and the coffin also was fulfilling with aromatic fragrances, as the cedar of the Lebanon, frankincense and myrrh.

The embalming was used also by the Greeks, and consisting in the emptying of the brain, the filling of the cavities with a mix of aromas crushed, myrrh, cassia, a washed with wine and the closure of the body with fabrics impregnated in phoenician wine during seventy days. Finish this process, the body was smeared with resins of trees that preserving it from the drying. The spice of the frankincense cannot be used for the conservation because it does not allow the desiccation. Another practice, less costly, consists in cleaning the entrails in water and the boiling of cedar bark and the preserving of the body for seventy days in salt. The humblest practice was a simple wash in salty water for seventy days (Pérez Fadrique, 1666).

In the Roman Empire entire fortunes also were becoming exhausted to honor the dead. During the First Punic war (264-241 B.C.) the aromas, ointments, perfumes, balsams and drugs are brought from East (Mengotti, 1821). It is documented that, in the time of Nero (37-68 A.D.), Arabia not producing sufficient incenses for all the funerals of the emperors and Adriano spread aromas to your people. The emperors swam in pools of essences and balsams; the body, the hairs were smearing with aromas and nard, and the skin and the clothes with aromatic oils. The incenses, ever were smoking in the altars of the Roman Empire, like a symbol of the luxury that coming from Asia and the corpses of the rich burnt in the aromas after being smeared with balsams. The exclusive spices were: cinnamon, myrrh, nard, cardamom, clove, cassia, sweet cane, myraballum, laudanum, cost (*Tanacetum balsamita*), isocinnamo (*Daphne*), and others of uncertain origin as: mazir, carcamo, gizir, and cancamo. There were many other resins, fragrant tears and barks which produced ointments, although perfumes were used only to mask the bad smell, of which have been lost completely its origin and interest (Brun, 2000).

The use of the spices has served essentially for the cult of the body, for the gods and to honor the corpses in his funeral and grave. Pliny the Elder in 'Historia Naturalis', book XIII, 'Acervatim congesta honori cadaverum' writes: 'the corpses smear with delicious liniments and fragrant balsams are dispersed in his ashes, while aromas and incenses are flanged in the fire'.

In the New Testament of the Bible John, Marc and Matthew reveal limited information about the funeral ritual practiced to Jesus. Juan reports that: 'Nicodemus brought a mixture of myrrh and aloe of approximately hundred pounds, and wrapped the body of Jesus in a fabrics of linen with the spices (oil) aromatic, like the burial custom of the Jews' (19, 39-40). Marc write that: 'being the day of rest (Saturday), Mary Magdalene, Mary of Jacobs and Salome bought spices (oil) aromatic to anoint Jesus' (16, 1). The Facts (9, 37) clarify that 'the body is washed' and Matthew (26, 12) who "spilled ointment

to anoint him". Lucas writes that: 'the women prepared the balsams and perfumes (23, 56) and that, the first day of the week (Sunday), to the dawn, went to the sepulcher with the perfumes that had prepared' (24, 1).

Following the Jewish traditions of the epoch, it is possible that Jesus had a burial ritual with range of king, and a decorous grave for having lived nobly. Before the burial, the family prepare the corpse: it wash ritually with warm water, smears itself and aromatizes with creams based on essential oils, dressed and brushed, the eyes are closed, is cut the corporal hair and nails, and then tied the hands and the feet with strips of fabric. The aromas anointed help to the elevation of the soul and also neutralize the glow of putrefaction. The head is sheathed in a cloth tied to the chin, while the body is shrouded with linen (Shroud), sewed to big stitches. The body finally is settled on a stone with the head placed on a pillow of sand. For sanitary questions the funeral ritual is realized the same day of the death, conscious of the danger that it can cause the contact with rotten corpses. The mourning in the Jewish rituals continues for seven days (shiv'ah) and another month more.

The Jewish people do not admit the embalming, the mummification or other technique of preservation, as indicates the Talmud: 'the spices serve to remove the stink', as healthy treatment for the dry and warm climate. The Talmud, which describes all the laws and Jewish traditions, does not accept that in a corpse, with signs of violence (the case of Jesus), the blood being cleaned, considering that it is part of the body and has to go united with the body in the grave.

The body that has been wrapped in the Holy Shroud of Turin has been symbolically cleaned, but not washed; he has suffered a violent death and as they assure the forensic observations, present signs of blood are pre- and post-mortem, like confirmation of a Jewish rituals of the Talmud. The Shroud can have smeared with oils and ointments, as well as the parts of the body without blood contributing to a better protection against the rapid decomposition, in addition to purify the soul.

The oils and ointments according to the ethnocultural uses applied during the funeral and grave rituals have been of several types. They have left traces, between the fibers of the linen, like pollen of the same products utilized. This practice can facilitated the capture of others of the environment and a particularly and exceptional protection of the fabric for the important antiseptic properties and optimal preservatives.

4. Considerations

Many plants of India, Egypt, Persia or Syria, have been the protagonists of the religious ceremonies and the rituals of passage, like births, weddings and burials, but the medicinal formulas and the ethno botanical uses of some of them, have got lost with the time. Thanks to ancient texts Greek and Roman have remained written the traditional customs, contributing to the knowledge of how there was realized the preparation of the corpses that was wrapped in the Holy Shroud of Turin.

In the funeral rituals of more than 2000 years, appears the use of the myrrh and of the incense in general, and more types of spices are not specified; in the burial rites the myrrh, oil of nard and other oils are utilized for the anointment of the corpses (Nielsen, 1986).

The perfume has been also used; it comes from the Latin word '*per fumum'* (for smoke), composed by a mixture of resins, wood, seeds or dry flowers that burn to produce smoke with aromas. The liquid perfumes, known since 3500 years before, have been the result of mixtures of oils, fats and essences.

The essences of the plants were obtained in form of liquid fragrances pressing the raw material, macerating it in water, or boiling it in oil. Many plants of the Mediterranean basin contents essential oils that are greatly appreciated volatile compounds.

The embalming that defines the treatment applied to the corpses to delay the decomposition have his etymological origin relates to the application of aromatic substances (ointment) and perfumes, practice used in the history for many civilizations. In the contexts of preparation of the body for the funeral, oils and ointments have been applied like fragrant oils and incenses, but never dried herbs directly.

The products applied in the corpses, are originate from plants, and are essentially oils, ointments, or derivatives of the burning bark, dry woods, rubbers and resins added to the myrrh. All these, have the function to preserve the corpse against the rot, because they kept the insects and realized purification and disinfection of the environment. This ointment have been necessary for questions of hygiene, used as perfumes in the clothing of the rich and kings who, especially in the day of the wedding, or death, using myrrh, aloe and cassia.

During the funeral aromas were burned, especially the frankincense and other plants against infections.

The frankincense, joined the religious offerings begins to drive away evil spirits and communicate with god why the perfumes and aromas were pleasing to the divinities.

To produce more penetrating aromas, the frankincense was mixed by other substances. As many other spices, it was very costly with the myrrh, the terebinth (resin) and others ointments produced from shrubs (Catholic Encyclopedia, 1999; Diccionario de Ciencias Ocultas, 1974).

The ointments applied to the corpses that have been in touch with the Holy Shroud have not been detailed in the Gospels, probably for not being a motive of the principal explanation. When it commented that Jesus was covered with incense of myrrh and aloe, it is necessary to extend the knowledge and analysis on the use of all the spices during the funeral rites in the Mediterranean and, in a special way, those of Asia Minor. To the historical contributions consulted, are evident that the corpse never enters direct contact with the vegetable parts, like barks or branches but only with oils and ointment that had the function to help the passage to a new life.

The botanical knowledge of the Greeks and Romans, of 2000 year ago, has intermingled with those of the Jews. The precious spices that compound any oil, balsam and ointment may have been adulterated, reason of which, in the Holy Scriptures the words ‘aloe, frankincense and myrrh’, can have be used in wide sense, for being type of very popular spices. In addition, several translations of the Hebrew Bible can have caused modifications of words as ‘aromas, spices and oils’ and they may refer to different botanical species that have not been revealed. So the identification, today, it may be possible through the remains of pollen that they can find.

5. Results

Realize a meticulous investigation of the pollen that appear in the relic, allows to discover the details of the funeral ritual of the man most known about the history, Jesus of Nazareth, that is the exact moment in which begin the history of the Holy Shroud of Turin. The pollen guarded between the fibers, has been waiting to be interpreted and it was the hidden witness of an event that does not leave to be mysterious, as well as extraordinary.

The identification of the pollen, the types and its quantities, can collaborate in the general investigations and help to answering to the questions on the place (Where?), the time (When?) and the usages (How?) from the moment in which these imperceptible particles have been deposited in the Shroud. So the pollen can reveal information of a concrete moment, in which the relic enters in touch with the body, during the funeral rite, as witnesses of the ancient scene.

The pollen is the most ubiquitous elements of the terrestrial plants; however they are in a certain surface only if there is a cause, such as the direct contact with the floral parts, in case of the entomophilous pollen (that are transported mainly by insects), or contact through the air, for the anemophilous type (that are transported by the air). Each type of pollen, according to his evolution, has especially, exclusive and unique structures, which allow him to get caught and stay attached, especially in the fibers of fabrics, in addition to facilitate its microscopic identification.

Pollens recognized on the Holy Shroud of Turin, can clarify the funeral ritual applied to the body wrapped inside, like witnesses and describers of the surrounding and the practices of that time. Considering that the body and the funeral cloth have been treated with oils and ointments, according to the ceremonial rite and preparation of the 2000 year ago, it is possible that these greasy products have allowed to the pollen, like an invisible traces, should persist and they remain attached to the fabric until our time.

Cistus and Cistaceae with a total of 8.2 %, Apiaceae (*Ferula*) with 4.2 %, and *Pistacia* spp. with 0.6 % are between the most abundant pollen registered by Danin *et al*. (1999). Pollen identified as *Cistus* and Cistaceae, *Pistacia* and Apiaceae can bring over to theorizing that are present from the moment in which the funeral ritual was realized, applied like oils and resins of these plants directly on the body and the Shroud, products that have also facilitated the pollen may be treasured between the fibers of the fabric. The products of these plants, in fact, were used in the funeral rituals.

The laudanum, resin of *Cistus ladanifer*, was mixed with myrrh to produce ointment and his name, seemed to 'lebona' (incense in Jew), and it can have caused a mistake in the transcriptions of the Biblical texts identifying it erroneously as incense. The oil perfumed was mixed with the myrrh recollected by others *Cistaceae* y *Cistus* spp. (**Fig. 1**).

The aromatic galbanum of the species *Ferula* spp. (**Fig. 2**), representative of Apiaceae, is another important resin of strong smell that can have burned in the temple.

From *Pistacia* (mastic) (**Fig. 3**) (family of Anacardiaceae) producing an ointment of the boiling of several parts of the plant and his resin was burning to mask the smells during the grave. The resin is producing with incisions of trunks and burned to mask odors during the burial. Mastic, terebinth (resin) and turpentine are other products known.

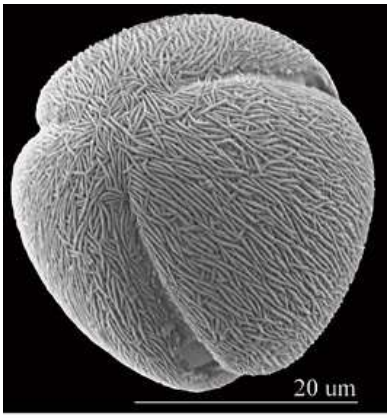

Fig. 1 *Cistus* spp.

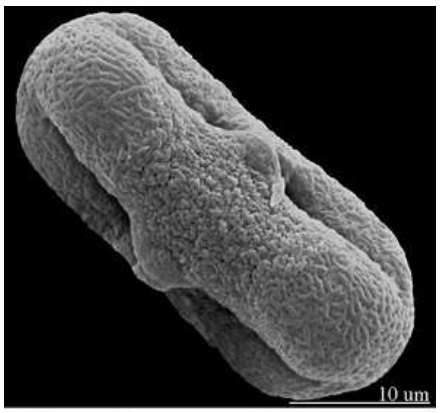

Fig. 2 *Ferula* spp.

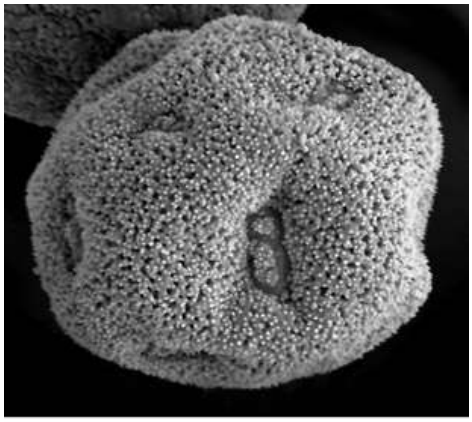

Fig. 3 *Pistacia lentiscus*

These pollen presences, although are not very high, give us an indication of the plants that were in use in the rite. The families of Cistaceae and Apiaceae are plants pollinated by insects; *Pistacia* use the insects and the wind to carry their pollen. These pollen species mentioned produce ointments from many parts of the plants but not exclusively by the inflorescences, and this fact would explain that they should not appear in high quantities, but it is significant.

The most represented taxon (species) on the Shroud is *Gundelia tournefortii*, with a 29.1% of pollen total counted (Danin *et al*., 1999), does not seem to match with the identifications and checks that are presented in this study.

There exists an important essential oil of a Mediterranean plant, which is very valued and is obtained exclusively of the pressing of the fresh flowers used as ointment since more than 2000 years, in the same epoch in which there have happened the historical facts that relate to the Holy Shroud of Turin. This pollen is the most represented in the Shroud and belong to another species of the same family of *Gundelia tournefortii*. The new identification is very important for the investigation, because clarify the funeral ritual, and makes visible the possible scenario allows to strength and link the plant and their pollen to the concrete moment of the preparation of the corpse. The application of this oil and its use in the ritual of burial preparation, also would explain why this type of pollen is represented in very high levels in all the samples analyzed in previous works.

6. *Gundelia* and considerations

If we allude to the conclusions carried out up to the moment, the great number of pollens identified in the samples collected by Frei and identified by him itself (1983) and confirmed in a second moment by Danin *et al*. (1999), belong to *Gundelia tournefortii*. This pollen represents the 29.1 % of the 313 pollens that have controlled in 23 tapes (22 of 1978 and 1 of 1973). This result, with the other identifications of botanical species, explain that the relic has been somewhere in Asia Minor, but perhaps has not understood the meaning that these remains were trying to give.

What does mean to found this pollen type in high quantities with regard to others? Specifying that the pollen always have an explanation for stay in a certain place, there are two possible alternatives: the first one relates to a very ancient presence in the fabric, probably represented better in still higher amounts in the initially moment, and after part of the pollen can be detached during the centuries (e.g. for the expositions). The second option suppose that it could be a subsequent contamination, most

recently, and it can only link to a subsequent manipulations later to the moment of the funeral ritual. The first option is which is held, why, as we shall see later, *Gundelia* does not have any interest to cultural level and is unlikely that may have come into contact in the following centuries in others environments.

Gundelia is a plant of the desert, with flowers small and inconspicuous with entomophilous pollination: how can arrive in contact with the Shroud? *Gundelia*'s pollen difficultly could have reached the fabric transported by the wind; they do not disperse for the air, are entomophilous pollen, too heavy and with other mechanisms of pollination. On the other hand, others pollen identified are dispersed for the air, like *Corylus*, *Pinus* or Poaceae; therefore there has to be another explanation justifying this high presence.

Is there an ethnobotanic meaning to consider this pollen type as authentic? *Gundelia tournefortii*, (tumbleweed) belongs to the family of the Asteraceae, with a distribution area in Egypt, Turkey, Syria, Lebanon, Palestine, Jordan, Israel, Iraq, Iran, Azerbaijan, Turkmenistan, Armenia and Cyprus, of full habitat of deserts of mountain as a whole with other three species of the same kind (Matthäus *et al*., 2011). His name in Arab is "A'kub" or "Ka'ub"; it is a spiny grass that germinates in October - November and that it blooms from February until April. The symbolism on *Gundelia* in magic or medicinal rituals does not exist, but it possesses other usefulness ethnocultural. In Palestine and Israel the tender plants have a food use and before the flowering is collected and cooked, practice that actually is taking a drastic decrease of the populations (Lev-Yadun *et al*., 1999). The food use is very ancient, of more than 2000 years, being in the Talmud of Babylonia (Beitza 34 a) and in the Biblical writings (Feliks, 1968). In certain parts of Israel's desert, the mature plants are used as food for camels, habit also of the Anatolia region where it is collected as forage for animals. A different use in the Kurdistan, utilize the dry parts mixed with straw and manure, for the preparation of building blocks (Bailey *et al*., 1981; Feinbrun-Dothan, 1978).

After this knowledge, it is necessary to ask:
Is it possible that *Gundelia* entry in the funeral rite or that it had a contact in a later moment with the relic? Danin *et al*. (1999) proposed that, if there are so many pollen of this species, it is possible that the crown of thorns was composed by *Gundelia*'s leaves. If the crown had been prepared with its spiny leaves, pollen should not be in high quantities because the pollen guards inside the inflorescences and not in the leaves. If the crown had been prepared by the spiny leaves, the pollen should not have found in so high quantities. If, on the other hand, the crown had been formed with the thorns of the bracts that surround the inflorescences, these, between March and April, would not be attractive to create a crown, these pieces still are very tender, little pointy and not resistant.

Supposing that the crown was formed by *Gundelia*'s leaves, as affirms Danin *et al*. (1999), why this pollen has been found in all the collected tapes? The crown of thorns is surely removing from the head in the moment to proceed to the preparation of the body, before that the body was wrapped on the Holy Shroud; in this case it would not have any meaning to find this pollen in all the samples from the head to the feet in such high quantities.

If some *Gundelia*'s fresh part had been in touch with the fabric, had to find samples of his latex, the colloidal emulsion that there exude his stems and leaves (Katinas *et al*., 2008), at least in the top part of the relic, in the zone of the head, although the crown has been removed during the preparation of funeral rite.

The pollen that appears in the relic belongs to this species? How is it possible that *Gundelia* has entered

in touch with the Holy Shroud 2000 years ago or later if it does not have any meaning in other contexts, except the food one? I continue believing that this so abundant pollen cannot belong to this plant of the desert.

The identification of the pollen to level of species is not an easy task; the family, to which *Gundelia* belongs, Compositae or Asteraceae, assembles more than 23.000 species in the world. They have a high biological diversity and the richest floristic of all the Angiosperms. Without a doubt, under the Frei's adhesive tapes, there are present a few pollen that belong to this family of plants and the probability of falling in mistake in the identification to level of species is very high since, especially those of this family, they seem to be them. All palynologist, knows that, for a correct identification, it is necessary the observation through the electron microscope (SEM), because is not sufficient the observation with only the optical microscope (MO). In Frei's last work, presented in 'II Convegno Nazionale di Sindonologia -1981', published in 1983 after his death, were published images with electron microscope of some pollen of the Shroud.

Examining them, I discover mistakes of identification in the tables: *Anemone coronaria* (**Fig. 4**) does not correspond with the species of the photo, which corresponds to the taxon *Pistacia lentiscus* (**Fig. 3**); in the same table there appears *Ridolfia segetum* (**Fig. 5**), that does not belong to the pollen of Apiaceae's family, but to an Asteraceae.

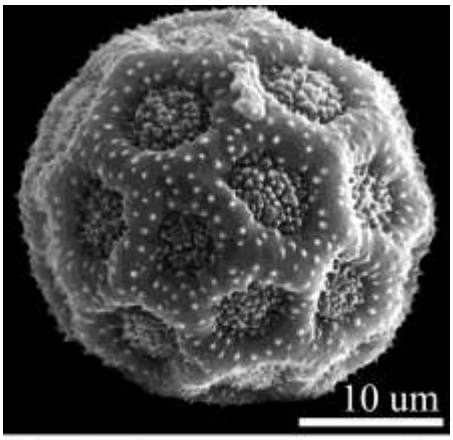

Fig. 4 *Anemone coronaria*

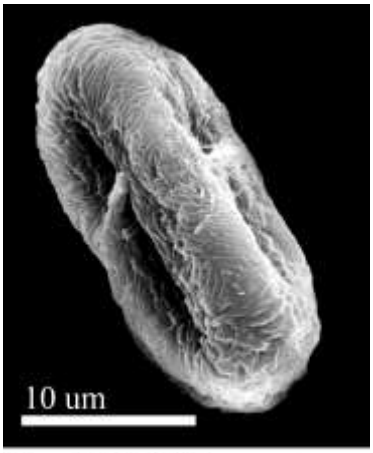

Fig. 5 *Ridolfia segetum*


Fig. 6 *Helichrysum* spp.

This Asteraceae seems to me very familiar, I recognize it instantly: it is a kind of the genus *Helichrysum* (**Fig. 6**) and I examine it with observations detailed also with the optical and electronic microscope. I suppose that there has been a mistake in the tables, but in the palynological investigations there has not been identified the Asteraceae that I see photographed. The only Asteraceae who have identified up to the moment are: *Artemisia* spp., *Carduus* spp., *Echinops* spp., and *Gundelia tournefortii* (Danin *et al*. 1999); these pollen characters are not similar to the pollen illustrated in the image.

I prepared a microscope slide with *Helichrysum* pollen with the same technique used in Frei's study and obtained several photos with the optical microscope (**Figs. 7, 8**), to compare them with the published photos of *Gundelia*. In addition I make photos with the electronic microscopy (**Figs. 9, 10, 11**); the large scale do not leave place to doubt that the represented taxon is *Helichrysum*. Overlapping the images of microscopy optics with the previously released photos and the control the type of spiny and apertures, confirm that the pollen is *Helichrysum* and not *Gundelia*. Unfortunately *Helichrysum*

have a pollen steno-palynous, a feature that gives a similarity in the morphological between several species, so it is difficult to reach to level of species, but allows recognize the type. In my doctoral thesis (Boi and Llorens, 2006), I have compared with the electronic and optical microscope six species of the genus *Helichrysum*, present in the Balearic Islands, and I have not found significant differences in morphological characteristics that allow to reach a recognition at the species level.

Fig. 7 *Helichrysum* spp.

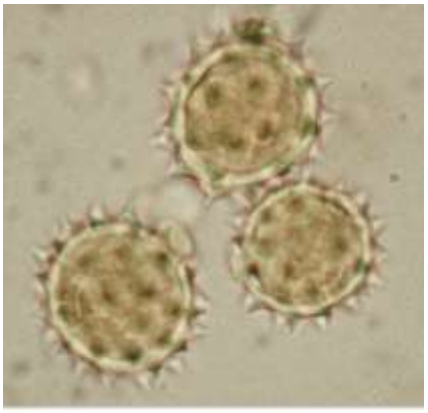

Fig. 8 *Helichrysum* spp.

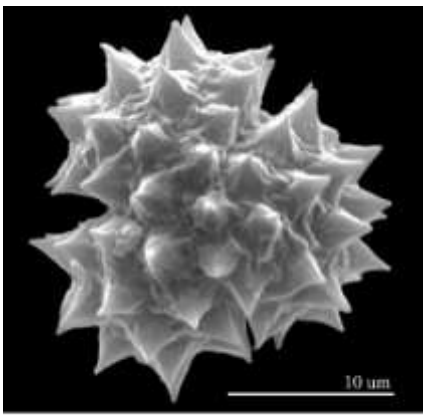

Fig. 9 *Helichrysum* spp.

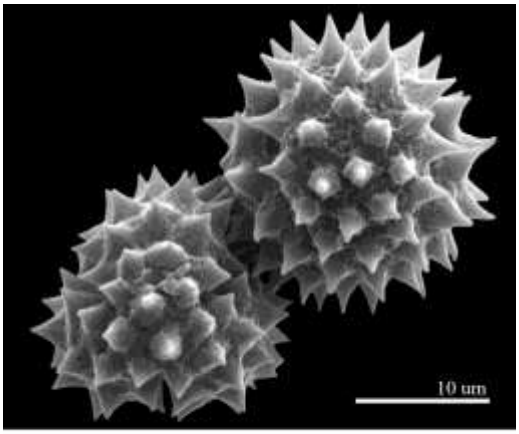

Fig. 10 *Helichrysum* spp.

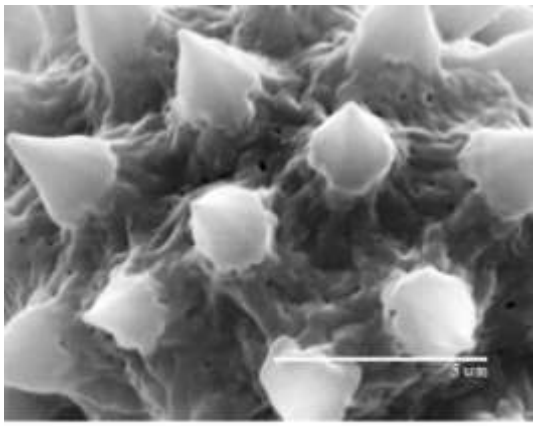

Fig. 11 *Helichrysum* spp.

7. *Helichrysum* and considerations

The pollen more abundant that I recognize belongs to Asteraceae family, like *Gundelia tournefortii*, and it is some species of the kind *Helichrysum*. It is a plant very used in the funeral rituals and of grave about 2000 year ago. It is probable that *Helichrysum* has been present during the preparation of the body wrapped in the Holy Shroud of Turin, because in those times its precious essential oil was used to protect the linens, for protecting the body and with its flowers, the head of the deceased was crowned. These uses have been written by Theocrites, Dioscorides and Pliny the Elder, between others, which affirm that it is a plant which idols are crowned, as maximum emblem for a corpse. Dioscorides and Pliny the Elder, contemporary of the times of Jesus, indicate many other botanical species, his uses ethnocultural and its symbolism. In many popular cultures, as those of Africa, Europe and America, *Helichrysum* has used for spiritual, medical, ornamental and food uses, being a fragrant plant.

Helichrysum comes from the Greek 'helios' (sun) and of 'chrysos' (gold), have a flower known from the antiquity, estimated for their healing properties. Many species of *Helichrysum* have raised veneration, for having a mythical meaning, related to the cult of the sun and symbol of the eternity; their inflorescences, consisting in floral buds, especially of golden yellow color, are preserved for a long time, gave the name of 'evergreen' or everlasting. In many popular cultures such as Africa, Europe and America, Helichrysum has been used for spiritual purposes, medicinal, ornamental and even food, being a very aromatic plant.

Theophrastus, whose original study has got lost and in part compiled for Pliny the Elder, writes in 'Historiae Plantarum'(VI: 8,1) that *Helichrysum* was very used in the coronation of images. Also Theocrites says that it was use during the Ptolemy dynasty (Egypt; 330-305 B.C.): 'the plant comes from the metamorphosis of a nymph and is used for making crowns and garlands'. It is uses dissolved in wine against snake bites, to plaster with his ashes mixed with honey for magical uses for amulets and other uses that are not of interest at this time. Pliny the Elder confirmed the same uses and properties diuretic, anti-inflammatory and different another (Historia Naturalis XXI, 96,168- 169).

Dioscorides (Asia Minor, 40-90 A.D.) doctor, pharmacologist, physicist and botanist of the ancient Greece, writes the Pharmacopoeia manual 'De Materia Medica' that reaches a wide diffusion and becomes the main valid until the Middle Ages and the Renaissance. His work registers approximately 600 plants with names, habitat, preparations, medicinal formulae and aromatic uses. In the IV (58) defines: "The Elicriso called by a few Chrysanthemom (*Chrysanthemum*) and by other Amaranton (*Amaranthus*), it is a certain plant which is usually crowned the idols. Called also amaranth because their flowers last infinitely without corruption and without loses smell, which indicates this name amaranth. There are two species of ordinary amaranth: the yellow one, which the barbarians call 'sticados citrina' and another purple so called 'flower amoris' or flower of the love". Dioscorides mentions *Helichrysum sanguineum*, like 'bākkaris', with aspect of grass, used for crowns and with rough leaves. In III (46), comment that his smell causes dream. Amaranth is not withering, is a symbol of immortality and consecrates the deceased.

Pliny the Elder (Como, Italy, 23-79 A.D.), was an important Latin writer, scientific, naturalistic and military Roman. It assembled the knowledge of more than one hundred of Latin authors and than three hundred Greeks, as well as the same Theophrastus's original work, in his Encyclopedia 'Historia Naturalis'.

Pliny in the book XXIX comments: "of Heliocriso there refers Dioscorides (4.57), the yellow everlasting (helikhryson). Golden flower (khrysanthemon) and a different that does not withered (amaranths). With this one the images are crowned also". In the book XXI (47) mentions: "We cannot rival certainly with the amaranth. It is a purple stem with more than one flower and is itself odorless". Here he speaks about *Amaranthus*. Both authors speak about two species that do not wither; one is of the family Asteraceae and other one of Amaranthaceae.

Pliny the Elder (Historia Naturalis, XXI, 132) and Dioscorides (De Materia Medica, 46) coincide in identifying *Helichrysum*, and especially *H. sanguineum* between the hypnotic, sedative, narcotic, and psychotropic plants. "Helicriso, flower that it does not withered, called immortal, which crowned their gods, as says Ptolemy, king of Egypt. This plant believed that it contributed to the fame and glory who was crowned with her the three Wise Men too. It is a flower like gold, which garlands and ointments give benevolence and glory, stored in golden glasses that call apiron". In 'Historia Naturalis' XXI (Historiarum Mundi book XXXVII), writes "Eliocriso, some call as chrysanthemum: it have white stems, whitish leaves seemed to the 'abrotino' (*Santolina*-Asteraceae), when it reached for the sun

comes shine as gold and they never fade. For this reason, the gods are crowned, and protecting the clothes with his smell".

The book XIII of Pliny the Elder reports on ointments and odoriferous essences; compiling the knowledge of all the Asia Minor. Documents dozens of formulas for ointments and precious oils that are inherited as an object of luxury, of various ingredients, among which there are many spices mixed to create smells. Knowledge on substances using in adulteration, the consistency and colors also add to the recipes. He comments that in the times of Troy (about the III century B.C.), there were not used incenses, which were discovered by the Persian as a fragrant juice of many substances with the name of 'stimmati'. Also the 'raggia' and resins were used to perfume the body. To the 'balanino', an Egypt bitter almond oil, was added 'omphacio' (grape juice), cardamom, rush, calamus, apples, myrrh, wine, seeds, galbanum and resin of turpentine. The oil of 'mortine' was mixed with calamus, cypress, mastic, and grenade. Rhodino's ointment consisted of roses, crocuses, apples, wines and *Anchusa*. The oil of myrtle are mixed by laurel, lily, fenugreek, myrrh, cassia, nard, rush, and cinnamon. Ciprino's ointment is composed by 'omphacio', cardamom, calamus, asphalto, abrotino, myrrh, and panace. They are other types of oils, although *Helichrysum* does not appear, but in the same work mentions that 'Gnaphalium stoechas' (*Helichrysum*) can be confused with 'abrotino'.

The interesting writings from 2000 years ago have names of plants that nowadays are difficult to identify, but they make us understand the importance of botanical species in the medicine and in the rituals.

7.1 Modern Uses

Helichrysum Mill, includes around of 500-600 aromatic shrubs perennials, distributed from the Mediterranean basin, to West Asia, central Asia, and Southern Africa (Jafri *et al*., 1980; Tutin *et al*., 1980; Hilliard, 1983; Anderberg, 1991). This genus is relatively common both in mountain and coastal regions from Spain through Italy, to Palestine and Israel. Is common in Asia Minor; is represented by 27 taxons, which 15 are endemic in Turkey and in Iran for 19, of which 8 are endemic (Davis, 1975; Georgidou *et al*. 1980; Davis *et al*., 1988; Guner *et al*., 2000; Sumbul *et al*., 2003). There are species of then with a wide distribution, such as *Helichrysum conglobatum conglobatum* from South Italy, Balkans, Syria, Lebanon, Cyprus to North Africa; *Helichrysum plicatum plicatum*, from the Balkans, Syria, Lebanon Turkey, Iraq until Iran and *Helichrysum sanguineum* with distribution from Syria, to Lebanon, Jordan, and Palestine.

There are herbal remedies prepared with essential oil of *Helichrysum*; it is colorless or light yellow and has gained popularity as a natural antibacterial, because they contain antioxidant agents, antiviral, anti-fungical, antimicrobial and anti-inflammatory properties (Sala *et al*., 2002, 2003; Van Vurren, 2006; Sobhy *et al*., 2007).

In several Mediterranean countries, the use of this aromatic plant, in particular of its flowers, had a role hygienic in the body before the embalming in funeral rituals, against odor, like Arabia, Greece, Empire Roman, since England (Seaton, 1995). In Iraq and Iran the flowers were used to prevent that the smell of rot will reach the livings (Drowe, 1962). In Palestine *Helichrysum conglobatum conglobatum* was used in the decoration of the temples. The oil of *Helichrysum angustifolium*, known as immortal burned with other species during the rituals of incense.

Helichrysum, aside from the spiritual and ornamental use, has entered into the popular natural medicine because prevents and heals sunburn and other skin conditions, contains antioxidants counteracts the

microbial activity, properties, known in Turkey as in other parts of the world (Czinner *et al*., 2001; Sala *et al.*, 2003; Sagdic *et al*., 2003; Tepe *et al*., 2005). Currently, throughout Europe, is used for its properties in eczemas, hepatic stimulating, healing, balsamic, with interest in cosmetics and as flavoring, 'curry plant' food (Albayrak *et al*. 2010).

Helichrysum has been used in the folk medicine for over 2000 years for conditions of bile, kidney and like diuretic for the high content of flavonoids; the components of *Helichrysum aureunitens* as galangin (3, 5, 7-trihidroxiflavona), effective against gram-positive bacteria, as well as fungi and viruses (Suzgec *et al*., 2005; Zahin *et al*., 2010). The oil restores the tissues, reactivates circulation, and regulates cholesterol; is anticoagulant, anticatarrhal, mucolytic, antispasmodic, and expectorant.

The African Zulu and Xhosa currently preserved the tradition, in the ritual ceremonial, burned leaves of *Helichrysum* spp., 'imphepho' as incense and used the dry as body ointment. They know also the properties anti-fungal, anti-bacterial, disinfecting, and repellent of insects. Is utilized for respiratory diseases and burned connects to the ancestors in rites of passage and burial rituals; if inhaled it is calming and soothing, purifies the body and used to take contact with God (Hutchings, 2007).

8. Discussions

Considering the possibility that the pollen is not ancient and that it comes from later contributions

The first botanical knowledge are attributed to Aristotle and Theophrastus; his original studies have been lost during the first centuries A.D., but arrived to our times collected by Pliny and Dioscorides. These authors have assembled the knowledge of many other earlier Roman, Greek and Asian; the information have been so valuable that his information has come up to the Middle Ages, being relieved only from the 15th century, by authors like Matthiolus (1577) and Tabernaemontanus (1687). These physicists and naturalists collected the work of the most ancient writers such as Hippocrates, Galen, Dioscorides, Pliny, but expanding the knowledge of the nature.

While ago 2000 years in the embalming practices were used oils, ointments and perfumed balsams, in the Middle Ages there are a decline of these substances of vegetable origin. During this time, it returns the art of embalming the corpses after the funeral ritual with innovative techniques, such as the injection of chemical substances or the immersing of the body in alcohols. Botanical knowledge, are thus relegated in old treaties while it contributes to new knowledge in medicine and the ancient ethno-cultural uses are in hand only of the folk wisdom. For example *Helichrysum stoechas* is mentioned against the gout mixing leaves and flowers in wine.

If we suppose that the relic is not a funeral cloth and a few forgers it been recreated in medieval times, we should consider that in this period the pollens were still some unknown dust; from 17th and 18th century is when started its discovery. Thus, in the epoch had wanted to reproduce a possible burial cloth would have had access to scarce texts written in Latin of the 1st century A.D. to obtain the information of how smearing the linen and the body with ointments based on *Cistus*, Cistaceae, Apiaceae (*Ferula*), *Pistacia* and *Helichrysum* plants, imagining that in the future their component would recognize. Had they the culture to repeat a ritual burial to honor the king, including the expensive old ointments such as the laudanum, *Cistus* oil, galbanum (*Ferula*), mastic and oil of *Pistacia*, turpentine, terebinth, and *Helichrysum* oil, knowing that tomorrow pollen or other debris would be find?

A few profitable forgers probable would have documented only with the Gospels and must be used

only the spice of myrrh and aloe referred. What type of aloe and myrrh are these and how they have been prepared? How do explain then that pollen types more abundant discovered belongs to plants used in the funeral rituals of 2000 years ago but it are registered in the Gospels?

Considering the possibility that the pollen was the witness of the burial ritual of the fabric that wrapped a corpse 2000 years ago

Although the Bible has left incomplete information of the plants with ethnocultural value of Asia Minor, history confirms that 2000 years ago lived several cultures that shared knowledge at the same time in which the Christian religion is originated. For this reason it is necessary to resort to other historical texts that have fortunately have come up to us, as those of Pliny the Elder and Dioscorides who speak widely about the species used in the rites of passage of the epoch and the previous ones.

Considering that the Shroud is authentic, that have wrapped a corpse of a Jewish man, and that it stayed hidden, protected and guarded humbly until the year 1355 A.D., it has been necessary that remain in a place protected, away from insects, humidity or any other agent that alters its linen fabric. If in the moment of the preparation of the funeral ritual it has been smeared with oils and ointments, it is possible that these, with the time, has been oxidized by air and probably can not be identified as such.

Oils and ointments are not soluble in water, but in alcohol, fat, wax or other vegetable oils, and probably determined that fabric yellowing, at the same time that has preserved it for being powerful insect repellent. Thanks to these substances, it has managed to conserve although several centuries, as well as other very old fabrics, as those of the Copts: the smeared products would have allowed to protect the fabric, at the same time to allow emerge its ingredients masked in the pollen grains found.

The discovery of the pollen, according to Max Frei and of the later reviews of the samples carried out by Danin *et al*., 1999 (Flora of the Shroud of Turin), testify that the Shroud of Turin has passed through Asia Minor. Does the pollen identified serve to give an explanation of more facts, as well as the geographical origin? This response must be sought between all types that have been identified; the geographical origin of most relevant pollen is difficult to identify because the majority of them, are Mediterranean.

My questions go beyond to compete with this fact. Once pollen identification are correct, it is essential to question what details and relationships can provide to answer to How? Where? When? We should, after the explanations, be able to answer to how these elements can help us about the ethnocultural uses that have been realized in the relic, and then, it would be possible to reconstruct the history of the relic.

The discoveries here discussed, which rely on the control with optical and electronic microscopy photos, indicates that the Shroud possibly has smeared with oil of *Helichrysum*, resins of laudanum (*Cistus*), oil of Cistaceae, mastic (*Pistacia* spp.), turpentine, terebinth and with aromatic galbanum (*Ferula* spp.), or that has entry in contact with them in a moment of the rites burial. This conclusion is according with the quantities of the pollen presences most abundant. The oil of *Helichrysum*, exclusively produced from fresh inflorescences, extracted in oldest manual form contains more quantity of pollen regard to other ointments that are derived from other parts of plants. Thus, the use of this flower oil clarifies why this pollen is found in high number in the entire surface of the relic and that, until now, had been identified as *Gundelia tounefortii*. The morphology of this pollen not correspond with the one that is present in the fabric, confirmed to the fact that in all the Mediterranean area, *Gundelia*, never has entered in a burial rites, but only in food uses. The presences of the other important pollen as *Pistacia*, *Cistus*, Cistaceae, Apiaceae (*Ferula* spp.), also they refer to balsams, resins and ointments that may have been used in the funeral ritual, but these substances, proceeding

from other parts of the plants that are not flowers, would explain the reason because their pollen not appear in values abundant.

These results help to clarify the ethno-cultural meaning of pollen more represented in the relic. According to the scientists of 2000 year ago, we can affirm that the fabric and possibly the body wrapped have been treated with honor of king: with a crown composed of flowers of *Helichrysum*, which would indicate the condition of important personality or king who has been considered Jesus. Pollen reveals the anointing, unction, of some parts of the body and of the burial cloth with this oil, which symbol of immortality and as a preservative of the fabric tissue and the body. Other ointments which have entered into the burial ritual with ingredients based on laudanum, mastic, terebinth, and aromatic galbanum, are very popular in the Mediterranean.

9. **Conclusions**

The studies of pollen are complex, but once identified exactly the species which originates it, are able to bring interesting and clear information. Pollen study on the Shroud of Turin up to the date, have come to determine that it contains pollen originates from Asia Minor. The correct pollen identifications now provide valuable information the really fact, because the plants, with their balsams, ointments and oils or spices, have entered in the funeral rituals and burial.

The study of Danin *et al*., (1999) tests that the most common species of the 204 identified pollen in order of abundance are *Gundelia*, *Cistus*, Cistaceae, and Apiaceae. The *Gundelia* species would be erroneously identified, being *Helichrysum* spp. The unpublished identification of the most abundant pollen in the relic as *Helichrysum*, clarifies the fact that had not considered before: the possible preparation of the body and the funeral ritual with oils and ointments.

The investigations realized till now have focused on defining the journey of the Shroud, disregarding evidence that pollen they were demonstrating about the preparation of the funeral ritual, which at the moment includes botanical species of: *Cistus* spp. y Cistaceae, *Ferula* spp., *Helichrysum* spp., and *Pistacia* spp. that are all Mediterranean species.

In the samples collected by Frei there are 109 pollen that still are without determining (Danin *et al*., 1999). If it was possible to analyze them, and another sampler recollected, might be elucidated to more definitive results about the funeral ritual.

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