

POLLENS OF MELLIFEROUS PLANTS OF ECOLOGIC ZONES IV AND V OF TOGO

ABSTRACT

Pollinic analysis carried out on samples of honey harvested from natural beehives located in some parts of zones ecologic IV and V of the Guinean Zone of Togo: Danyi-Elavanyo, Danyi-Akayo, Igblélékoutsè-Béna and Azianfokopé has permitted to obtain 3625 grains of pollen which are grouped in 82 different types of pollen of melliferous plants; only 43 of them have been identified up to level species. *Elaeis guineensis*'s pollens are the most abundant and the only one found in all the samples of honey analysed. As a whole, the "Arboreal Pollens" are more represented than the "Non Arboreal Pollens" namely 87% against 23%.

Besides, the photo of some of these pollens determined has been presented. The terminology used has been the one of Bonnefille and *al.* (1980), Ybert (1979) and others palynological collections. The photographs have been carried out with microscope photonic, followed of their numerisation by a photomicroscope equipped with a camera, a computer and the softwares Quancoul and Motic Images Plus 2.0.

Keywords: *Togo; Guinean Zone; Honey; Pollinic Analysis; Pollen; Melliferous Plants*

1. INTRODUCTION

Pollens are male reproduction cells of flowery plants. They are issued from stamens of flowers. They are obtained from the transformation of mother cells contained in cylindrical sacks pollinics of anthers.

Their study contributes among things to the identification and classification of plants including melliferous plants. Melliferous plants are vegetable species from which bees extract their substances, particular the nectar, the pollen and the resin to feed and for its diverse productions, one of which is honey [3].

These studies conducted on the morphology of pollens allowed bringing out pollinic characteristics of each family, genus and species.

The morphology of the pollen grain of the plants met in Africa has been the object of study for specialists, as Maley (1970), Ybert (1979), Bonnefille Riollot (1980), Ambougou Atisso (1991) and Sowunmi Adebisi (1995). Unfortunately, these studies don't cover the continent as a whole and concern less flowery plants especially those which produce pollen; even if nowadays the project « African Pollen Database » (Viencens and *al.*, 2007) attempt to gather great number of photography of African pollen.

In Togo, alone the works conducted by Lobreau-Callen and *a/*. (1986) have allowed to listing certain melliferous three from study of morphology of the pollen grain identified in the samples of the honey studies.

This study aims specifically, on the one hand, at determining the pollinic composition of the honeys harvested in the areas of study, by the same time trying to draw up the list of melliferous plants presented in the areas, on the other hand, at describing certain pollen of these plants.

2. MATERIAL AND METHODS

2.1 Material

Honey has been the base material used for this study. It has been harvested in four localities from the natural beehives put on threes in two ecologic zones:

- tree localities at zone IV, two of them on plateau of Dayes (Danyi-Elavanyo et Danyi-Akayo) and one on plateau of Akposso at Bena (Igbélékoutsé);
- one locality at zone V (Azianfokopé-Takpla).

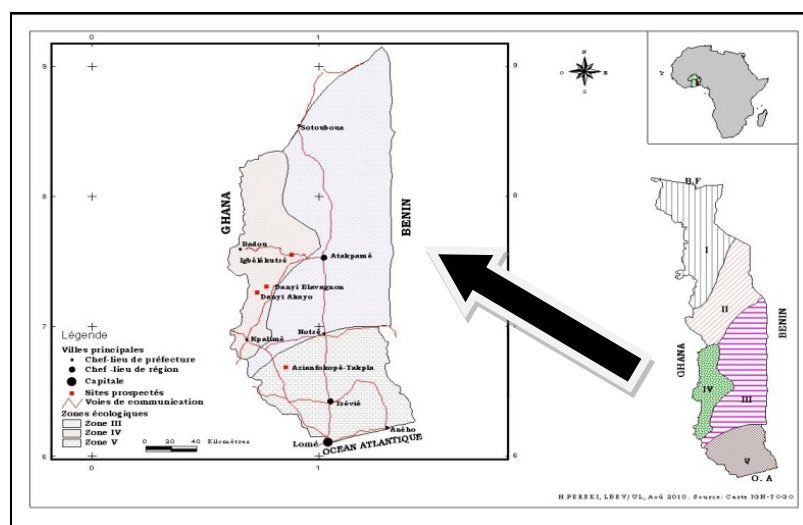


Fig. 1. Environment studied

Hive opening





Fig. 2. Trunk of *Albizia adianthifolia* (Caesalpiniaceae) at Danyi-Akayo or Yésuvikopé

2.2 Methods

2.2.1. Pollinic analysis of honey

30 ml of honey have been taken and treated according to the method of Erdtman (1960) so as to eliminate the ingredients: sugars, proteins, wax and pectocellulosic membrane, etc. For each sample of honey, roughly 20 μ l of solution obtained after centrifugation are, first time, put up between blades and strips, and then, observed under microscopic for identify and count their palynologic population.

The determination of the pollens has been done up to specie level (*Elaeis guineensis*), or genus level (*Ficus*), or again family level (Poaceae). In most of these cases the pollinic types are determined and represented by the genus (*Bidens*-type) or the species (*Bridelia ferruginea*-type). For the determination at the family level, it adds the suffix "undiff", which means undifferentiated to designate this pollinic type. (Euphorbiaceae undiff).

Also the terms "Arboreal Pollens" (AP) and "Non Arboreal Pollens" (NAP), have been used to designate respectively pollen from ligneous species (trees, small shrubs, ligneous creeper) and these from grassy species.

Generally it has been admitted that the total number of pollen grains to count must reach at least 300 (tree hundred) and the number of pollinic tax must be equal or superior to 20 per sample. The sum pollinic calculation doesn't take into account the underterminatable pollen grains. It helps to calculate the percentage of different pollinic taxons and to obtain the pollinic spectre of each sample. A pollinic spectre is made of the identified pollinic taxons together with their numbers and representative rate.

2.2.2. Terminology and photography of pollen grains

The terminology of pollen grain used in this study is this used by Bonnefille and *al.* (1980), Ybert (1979) and other palynologic collections. The pictures of the pollen grains have been taken with a photonic microscope at lens 100x followed by their digitalization by a camera incorporated photomicroscope, a computer and the softwares Quancould and Motic Images Plus 2.0.

3. RESULTS AND DISCUSSION

3.1 Results

All in all, 3625 pollen grains have been numbered in the samples of honey analysed and grouped into 82 pollinic taxons among which 43 identified up to level species, 28 identified up to level gender and 04 identified up to level family. The undeterminable pollens haven't been taken into account.

3.1.1 Pollinic spectres

The table hereafter presents the honey's pollinic spectres of different localities considered.

Table 1. Pollinic spectres of honey harvested in the localities studies

POLLINICS TAXONS	LOCALITY 1	LOCALITY 2	LOCALITY 3	LOCALITY 4
DICOTYLEDONES				
AMARANTHACEAE				
<i>Amaranthus</i> -type	+	-	-	-
<i>Celosia argentea</i> -type	+	-	-	-
<i>Cyathula</i> -type <i>prostrata</i>	++	-	-	-
<i>Amaranthaceae undiff.</i>	-	-	+	++
ANACARDIACEAE				
<i>Mangifera indica</i>	+	-	++	-
<i>Lannea</i> -type	+	-	+	-
<i>Lannea</i> -type <i>kerstingii</i>	-	-	-	++
ANNONACEAE				
<i>Annonaceae undiff.</i>	-	-	-	+
APOCYNACEAE				
<i>Tabernaemontana crassa</i> -type	-	-	-	+
ASTERACEAE				

<i>Ageratum-type conyzoides</i>	++	+	-	-
<i>Aspilia africana</i>	-	+	-	-
<i>Bidens-type</i>	++++	-	-	+
<i>Pluchea ovalis-type</i>	+	-	-	-
<i>Vernonia-type</i>	+	-	-	+
BOMBACACEAE				
<i>Ceiba pentandra</i>	+	+	-	-
BORAGINACEAE				
<i>Cordia</i>	-	-	++	-
CAESALPINIACEAE				
<i>Berlinia-type</i>	-	-	-	++
<i>Cassia -type</i>	-	-	-	+
<i>Daniellia oliveri-type</i>	-	-	-	+
<i>Delonix regia-type</i>	+	-	-	-
<i>Dialium guineense-type</i>	-	-	+	-
CELASTRACEAE				
<i>Maytenus</i>	-	-	-	+
CHRYSOBALANACEAE				
<i>Parinari-type</i>	-	-	+	-
CLUSIACEAE				
<i>Harungana madagascariensis-type</i>	-	-	-	++
COMBRETACEAE				
<i>Combretum-type racemosum</i>	-	-	+	-
<i>Terminalia-type glaucescens</i>	-	++	+	-

<i>Combretaceae undiff.</i>	+	-	-	-
CONVOLVULACEAE				
<i>Ipomoea-type</i>	+	-	-	-
DILLENACEAE				
<i>Tetracera alnifolia-type</i>	-	++	-	+
EUPHORBIACEAE				
<i>Alchornea cordifolia</i>	-	++	-	-
<i>Bridelia ferruginea-type</i>	-	++	-	-
<i>Hymenocardia acida-type</i>	-	-	-	++
<i>Macaranga-type</i>	-	+	+	+
<i>Mallotus-type</i>	+	-	-	+
<i>Securinega virosa</i>	+	+	-	++
<i>Tetrorchidium didymostemon-type</i>	-	++	+	+++
<i>Euphorbiaceae undiff.</i>	-	-	-	++
FABACEAE				
<i>Canavalia-type</i>	+	-	-	-
<i>Centrosema pubescens-type</i>	+	-	-	-
<i>Indigofera-type microcarpa</i>	-	+	-	-
<i>Millettia-type</i>	-	-	-	++
<i>Pterocarpus-type</i>	-	+	-	-
<i>Fabaceae undiff.</i>	-	++	++	+++
MALVACEAE				
<i>Abutilon-type</i>	+	-	-	-
<i>Sida</i>	+	-	-	-
MIMOSACEAE				

<i>Acacia-type mellifera</i>	-	-	-	+
<i>Albizia-type adianthifolia</i>	-	++	-	-
<i>Dichrostachys cinerea</i>	-	-	-	+
<i>Entada-type abyssinica</i>	-	++	++	+++
<i>Pentaclethra macrophylla</i>	-	++	-	-
<i>Schrankia leptocarpa</i>	-	++	-	+
type <i>Xylia schliebenii</i>	-	+	-	-
type <i>Xylia torreana</i>	-	++	-	-
MORACEAE				
<i>Antiaris-type africana</i>	-	+++	-	-
<i>Ficus</i>	-	-	++++	++
MYRTACEAE				
<i>Psidium guajava-type</i>	+	+	+	-
<i>Syzygium-type</i>	-	-	+	+
OCHNACEAE				
<i>Lophira alata-type</i>	-	-	-	+
OLACACEAE				
<i>Olax</i>	-	+	-	-
PORTULACACEAE				
<i>Talinum-type</i>	+	-	-	-
RHAMNACEAE				
<i>Rhamnaceae undiff.</i>	-	-	-	++
RUBIACEAE				
<i>Canthium-type subcordatum</i>	+	-	-	-

<i>Crossopteryx febrifuga</i>	-	+	-	-
<i>Mitragyna inermis-type</i>	-	-	-	+
<i>Nauclea-type</i>	-	+	+	+
<i>Rubiaceae undiff.</i>	-	+	+	++
RUTACEAE				
<i>Citrus</i>	+	++	-	+
<i>Zanthoxylum-type xanthoxylloides</i>	-	+	+	+
<i>Rutaceae undiff.</i>	-	-	+	-
SAPINDACEAE				
<i>Cardiospermum halicacabum</i>	+	-	-	-
<i>Lecaniodiscus cupanioides</i>	-	-	+	-
<i>Paullinia pinnata</i>	-	-	+	+
<i>Sapindaceae undiff.</i>	-	-	+	-
STERCULIACEAE				
<i>Cola-type</i>	-	-	+	-
TILIACEAE				
<i>Grewia-type</i>	+	-	-	+
ULMACEAE				
<i>Celtis</i>	-	+++	-	-
<i>Holoptelea grandis</i>	-	++	-	-
VITACEAE				
<i>Cissus</i>	-	-	-	++
MONOCOTYLEDONES				
AGAVACEAE				

<i>Agavaceae undiff.</i>	-	-	-	+
ARECACEAE				
<i>Elaeis guineensis</i>	+++++	+++	++++	+
POACEAE				
<i>Poaceae undiff.</i>	+	+	+	-
TYPHACEAE				
<i>Typha</i>	+	-	-	-
indeterminate	-	+	+	++
TOTAL OF POLLEN NUMBERED	2182	311	810	322

Locality 1 : Azianfokopé-Takpla ; locality 2 : Danyi-Elavanyo ; locality 3 : Danyi-Akayo ;
locality 4 : Igbélékoutsè (Béna) ; undiff : undifferentiated ; - : absent ; + : % between 0 and
1 ; ++ : % between 1 and 10 ; +++ : % between 10 and 30 ; ++++ : % between 30 and 50 ;
+++++ : % > 50.

3.1.2 Distribution of the pollinic taxons according to pollen categories

Following the precision made in material and methods, two categories of pollens have been
identified: "Arboreal Pollens" (AP) and "Non Arboreal Pollens". The graphic below presents
for each locality the distribution of pollinic taxons according to the two categories of pollen
identified.

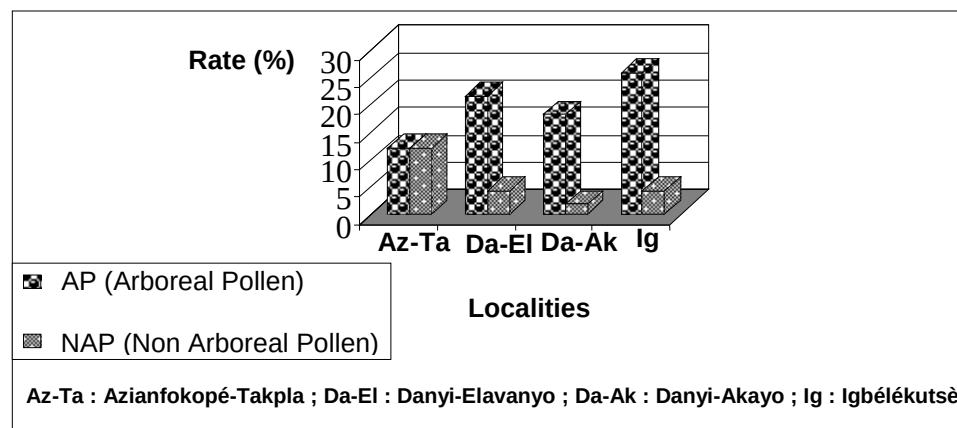


Fig. 3. Frequency of pollinic taxons of localities according to pollen categories

163 In Azianfokopé-Takpla the rate of Non Arboreal Pollens (NAP) is nearing the rate of Arboreal
 164 Pollens (AP). But in the other tree localities, the rate of the NAP remains largely lower than
 165 the rate of AP (16,67 % against 83,33 % at Danyi-Elavanyo; 8,7 % against 91,3 % at Danyi-
 166 Akayo et 14,29 % against 85,71 % at Igbélékoutsè-Béna).

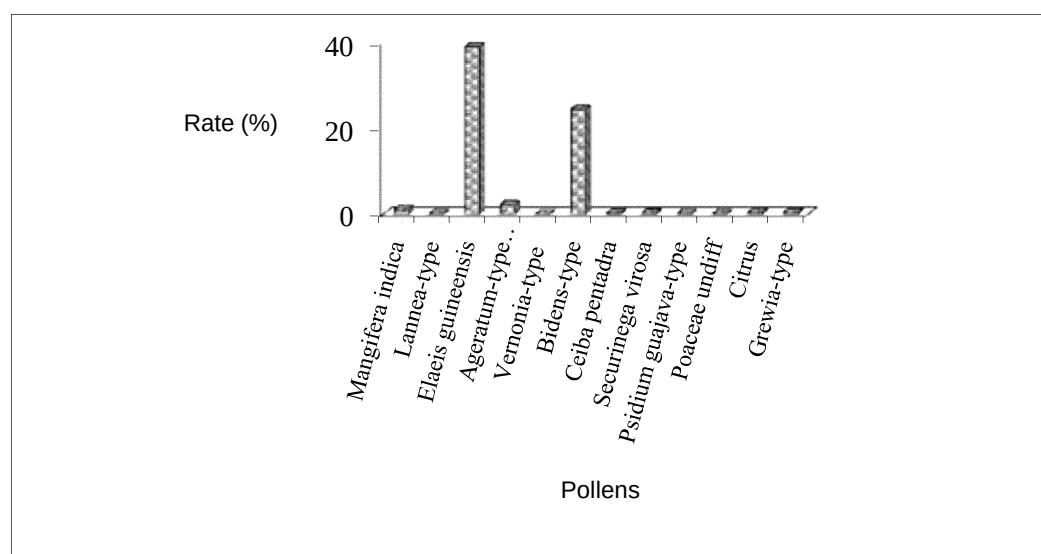
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168 3.2 Discussion

169

170 The 3625 pollen grains numbered in the samples of honey analysed are grouped into 82
 171 pollinic taxons belonging to 35 melliferous families. Only 43 pollinic taxons have been
 172 identified up to level species. The pollinic spectrum obtained from analysis reveal the
 173 presence of some of these pollens in both honey of the two ecologic zones IV and V. The
 174 figure 3 present the representation of these pollens according to total of numbered pollens.

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176

177 Fig. 4. Pollens present in the two ecologic zones

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181 Furthermore, it is important to note that only pollen of *Elaeis guineensis* have been
 182 found in all of the samples of honey harvested. This is due to fact that plants which
 183 produce them are abundantly available in the localities and also constitute the
 184 provisions source for bees (Yedomonhan 2004; Dongock and *al.* 2004;
 185 Yedomonhan and *al.* 2009).

186

187 The melliferous flora constituted by taxons identified is dominated by ligneous
 188 plants (trees, small shrubs, ligneous creeper). This shows that the pollens taken
 189 from woody species are largely superior to those which are taken from grassy plants
 190 by bees. The high rate of these taxons in spectre implies its availability in the nearby
 191 vegetation. This result confirms the reality on the site studied. On the whole, the
 192 zone studied is dominated by the forest. The ligneous plants, being the most
 193 available and visible, attract worker bees in search of flowers nutritious elements
 194 (pollen nectar, resin, water, miellat) which are mainly transformed into honey and

propolis. This predominance of ligneous taxons rhymes with the results of others authors as Sawadogo (1993), Aloma (2000), Nombre (2003), Dongock and *al.* (2008). But it's opposed to the works of Fohounfo (2002), Yedomonhan (2004). Nevertheless it is necessary to notice that the resuts obtained in Azianfokopé-Takpla reveal that there is as much Arboreal Pollen as Non Arboreal Pollen. The high rate of pollen withdrawn from herb flowers comparatively to these of other localities is due to fact that this locality is a savannah and limited by agricultural domains. So, the bees would be influenced by these ecological conditions.

The pollinic spectre analysis obtained from this study shows that the samples of honey harvested have been done from several nectars of plant. Yedomonhan (2004) clarify that the status of poly-flower honey or one-flowery honey depends on the relative proportion of different types of pollen which make it. A honey is calling one-flower if the number of only type of pollen is superior at 45 % of all pollens identified [16]. From this standpoint, we can affirm that the honeys of Azianfokopé-Takpla and Danyi-Akayo are one-flower honeys. It is respectively honey of *Elaeis guineensis* (51,15% of all pollens) and that of *Ficus* (45,56% of all pollens). The flatly abundance of species pollens mentioned above would be linked not only to the quantity but also the quality of the pollen [9].

3.3 Photos of a few pollens (x 1000)

Plate 1 – Dicotyledonae

Amaranthaceae : *Amaranthus*-type (fig.3) ; **Anacardiaceae** : *Mangifera indica* (figs. 1a, 1b, 1c) ; *Lannea*-type (figs. 2a, 2b, 2c) ; **Asteraceae** : *Bidens*-type (figs. 4a, 4b)

Plate 2 – Dicotyledonae

Asteraceae: *Ageratum*-type *conyzoides* (figs. 5a, 5b, 5c); *Aspilia africana* (figs. 6a, 6b, 6c); *Vernonia*-type (figs. 7a, 7b); **Bombacaceae** : *Ceiba pentandra* (figs. 8a, 8b)

Plate 3 – Dicotyledonae

Combretaceae : *Terminalia*-type *glaucescens* (figs. 9a, 9b); **Euphorbiaceae** : *Hymenocardia acida*-type (figs. 10) ; **Malvaceae** : *Sida* (figs. 11a, 11b); **Moraceae** : *Ficus* (figs. 12a, 12b); **Mimosaceae** : *Acacia*-type *mellifera* (figs. 13)

Plate 4 – Dicotyledonae

Mimosaceae : *Shrankia leptocarpa* (figs. 14); **Portulacaceae** : *Talinum*-type (fig. 15); **Sapindaceae** : *Cardiospermum halicacabum* (figs. 16a, 16b) ; **Tiliaceae** : *Grewia*-type (figs. 17a, 17b)

Plate 5 – Dicotyledonae

Mimosaceae : *Dichrostachys cinerea* (figs. 18a, 18b)

Plate 6 – Monocotyledonae

Arecaceae : *Elaeis guineensis* (fig. 19a, 19b, 19c, 19d) ; **Poaceae** : Poaceae undiff (fig. 20a ; 20b, 20c)

Plate 1 – Dicotyledonae

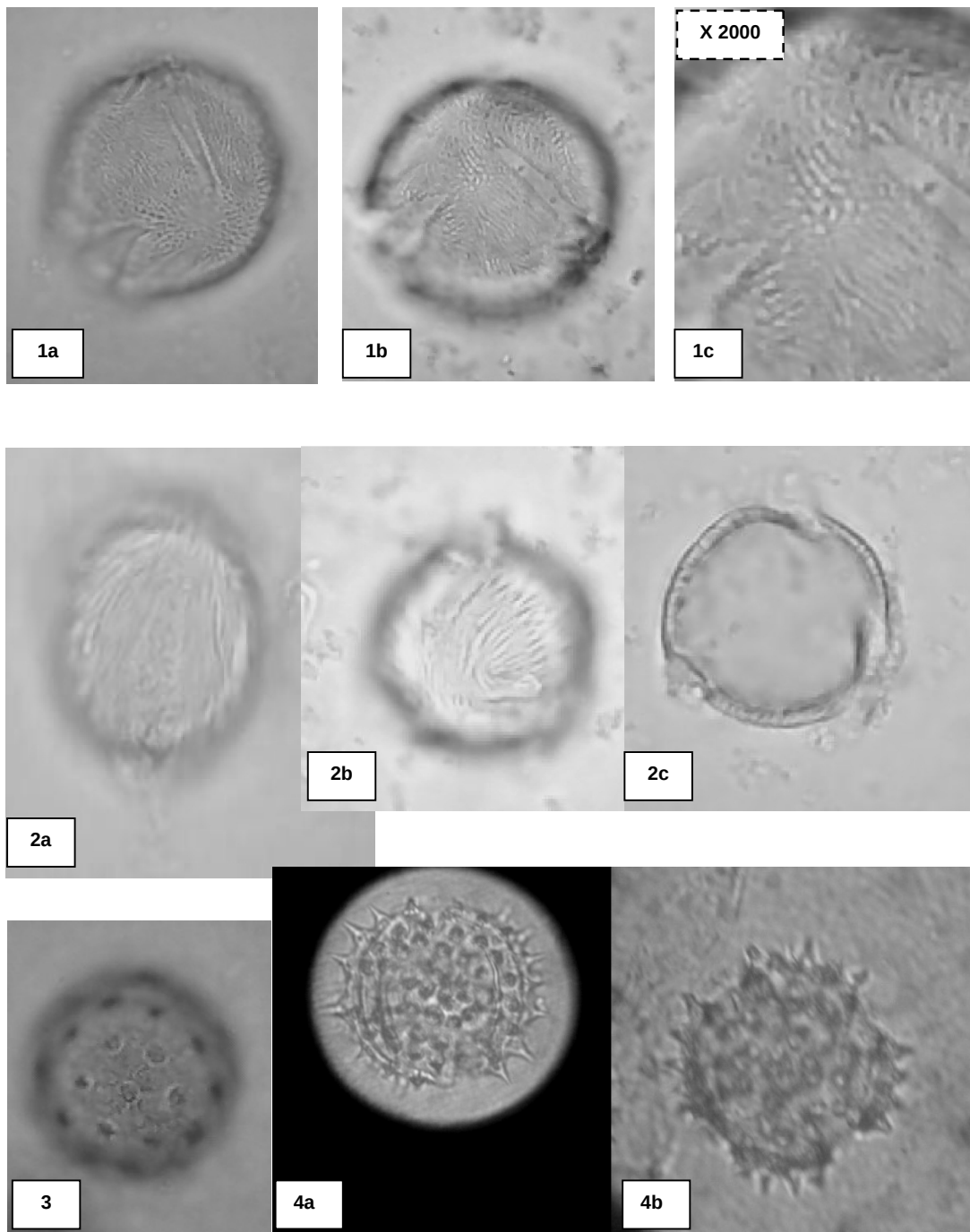


Plate 2 – Dicotyledonae

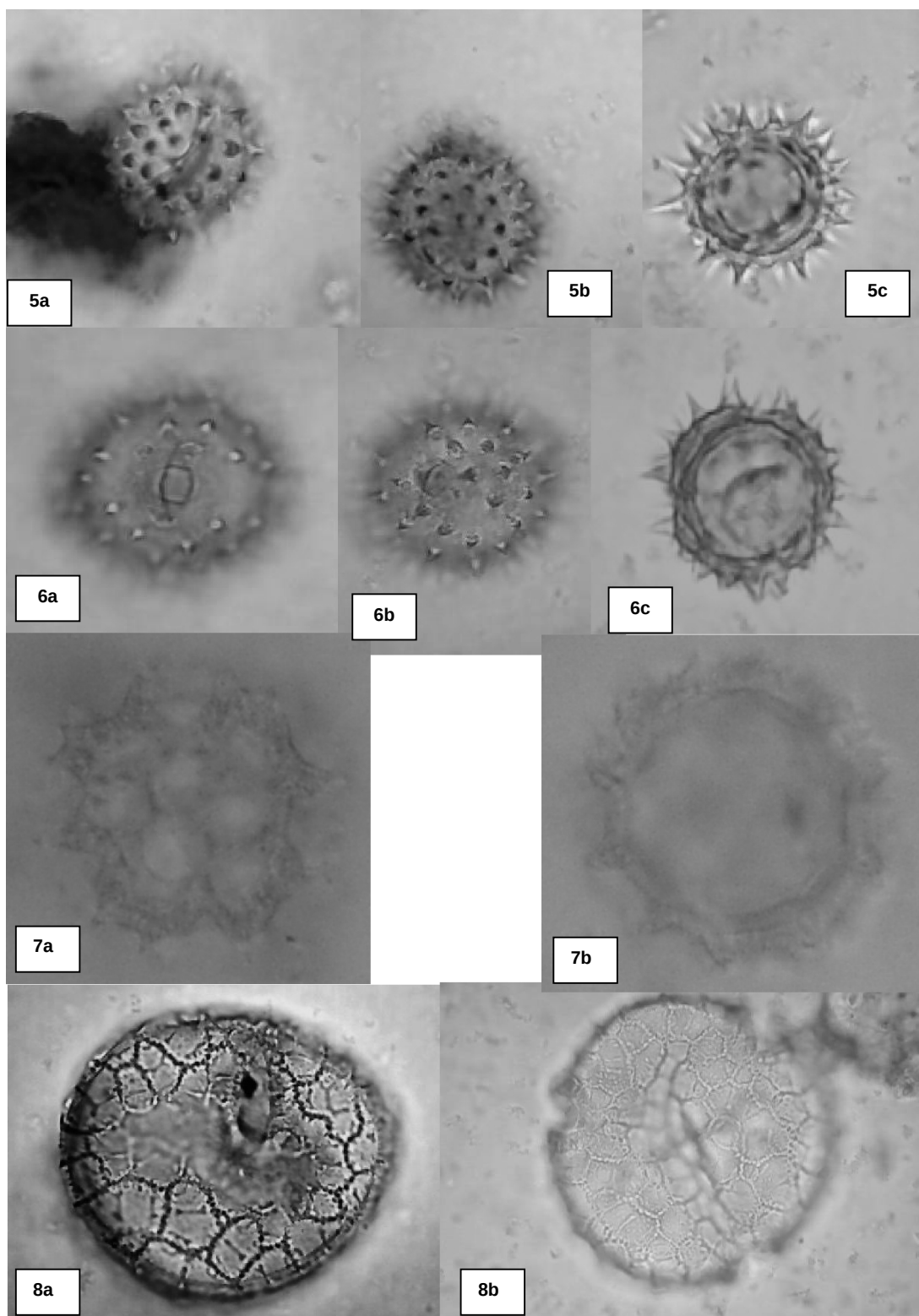


Plate 3 – Dicotyledonae

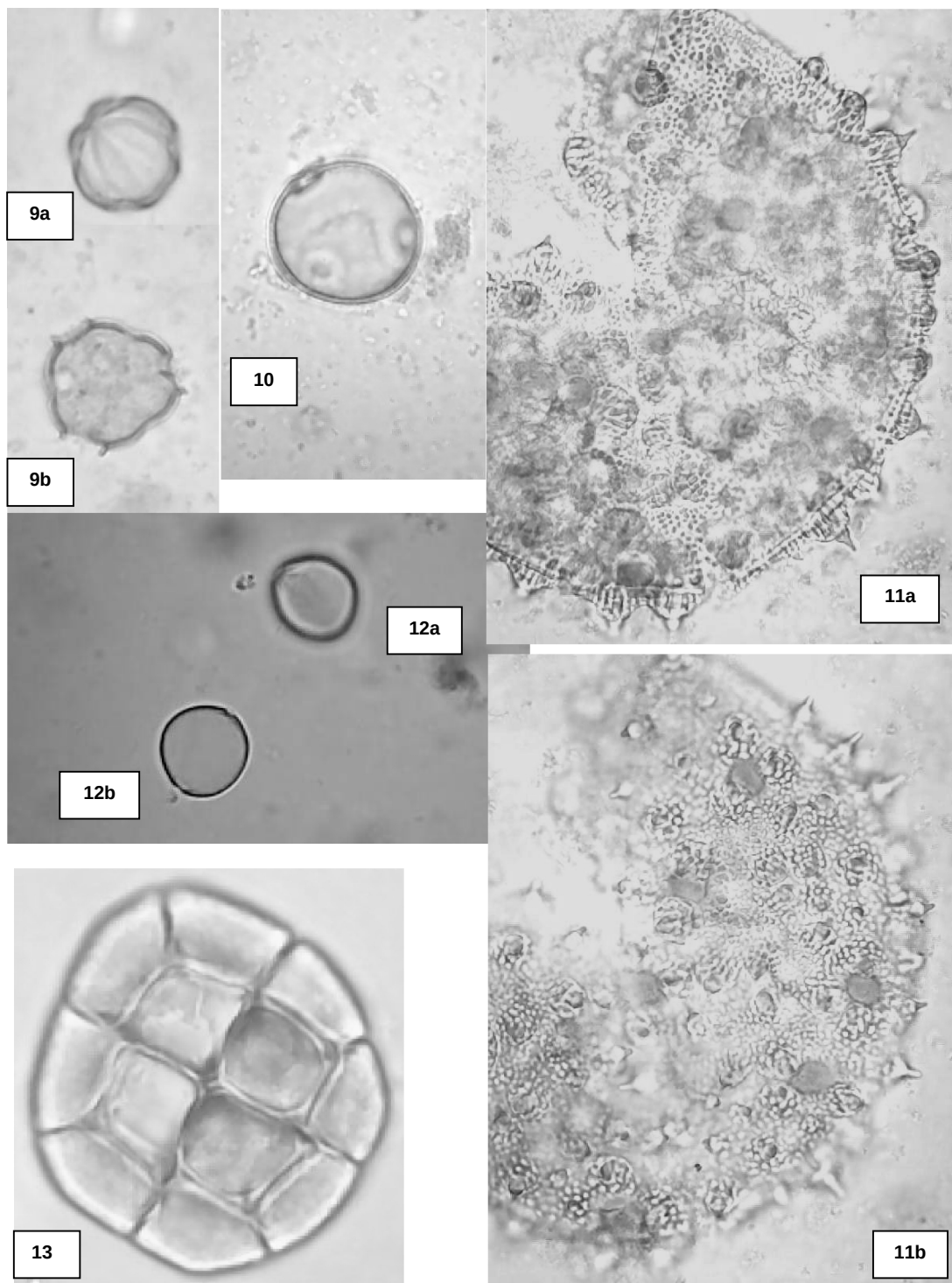


Plate 4 – Dicotyledonae

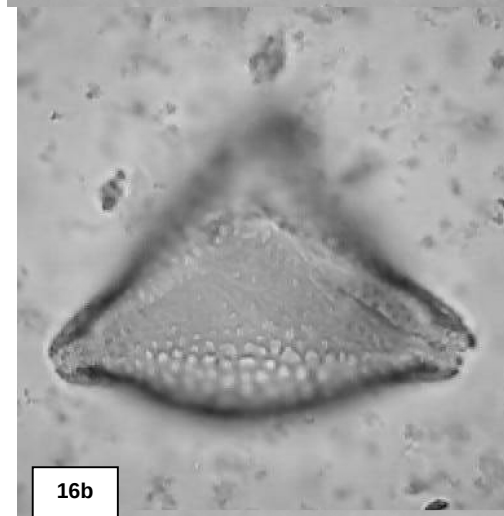
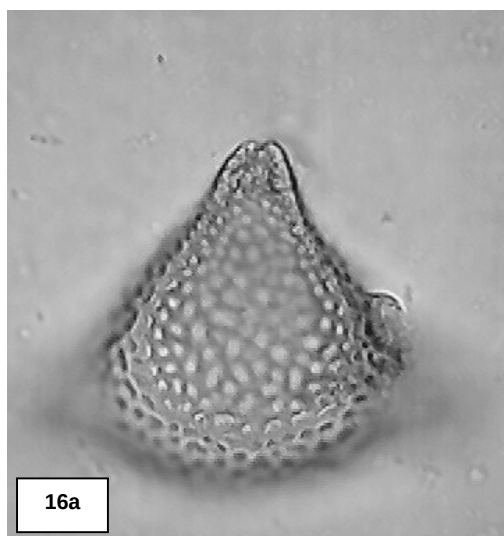


Plate 5 – Dicotyledonae

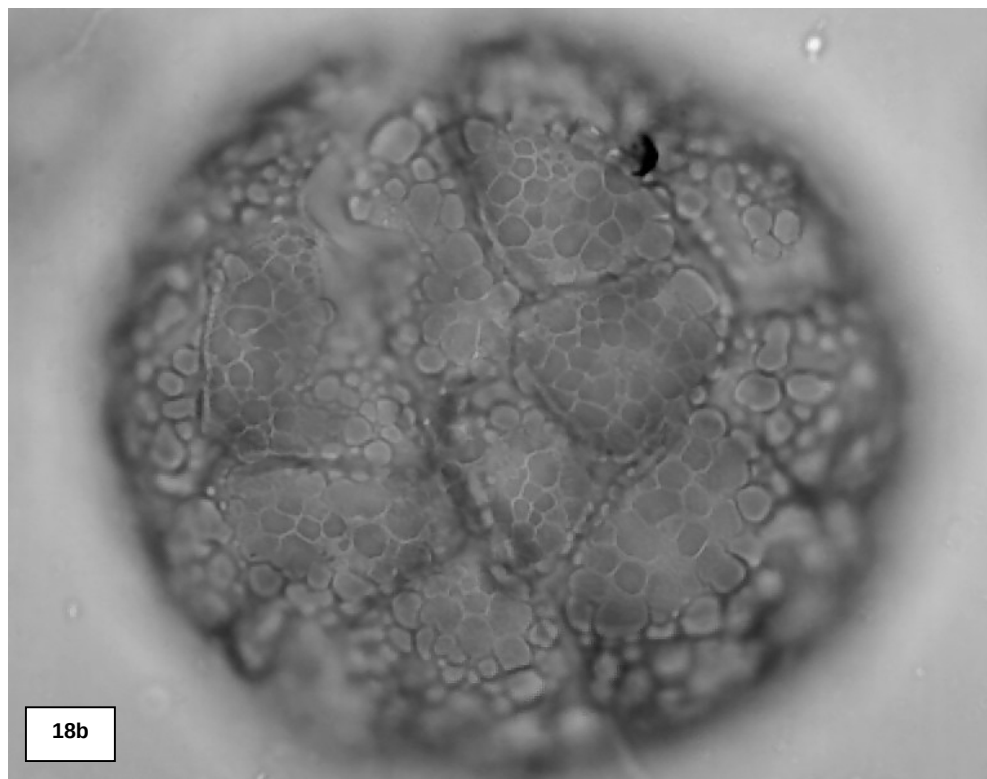
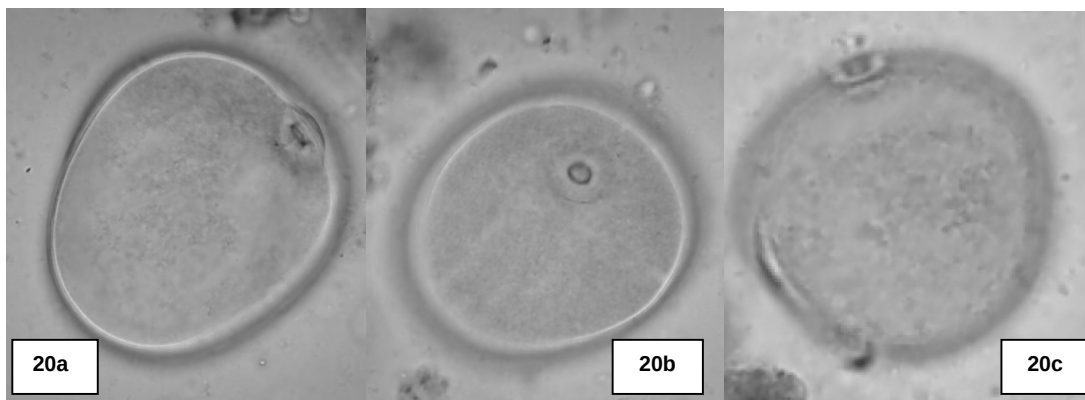


Plate 6 – Monocotyledonae



4. CONCLUSION

The pollinic analysis of honey's samples harvested has help us to count 3625 pollen grains which are grouped into 82 pollinic taxons belonging to 35 melliferous families. The analysis has proved that:

- the pollen of *Elaeis guineensis* (Arecaceae) are more collected than the others
- in the localities of harvest of the ecological zone IV studied, the Arboreal Pollens outnumbers the Non Arboreal Pollens (nearly 87 % against 23 %) compared to the locality of ecological zone V where the rate of both categories of pollens are identical.
- the honeys of Azianfokopé-Takpla and Danyi-Akayo are qualified as one-floral honeys.

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