

27/70	Stingless bee honey from the world 002:	Venezuela 02
<p> <i>Melipona compressipes</i> n=2 <i>Melipona crinita</i> n=1 <i>Melipona eburnea</i> n=1 <i>Melipona favosa</i> n=6 <i>Melipona lateralis</i> n=3 <i>Melipona paraensis</i> n=4 <i>Melipona</i> sp. group <i>fulva</i> n=1 <i>Nannotrigona</i> sp. aff. <i>chapadana</i> n=1 <i>Scaptotrigona</i> sp. 2 n=1 <i>Scaptotrigona</i> sp. aff. <i>polystica</i> n=1 <i>Frieseomelitta paupera</i> n=1 <i>Frieseomelitta</i> sp. grupo <i>varia</i> n=2 <i>Tetragonisca angustula</i> n=3 </p>		

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KEYWORDS

honey, physicochemical composition, melissopalynology, stingless bees, Venezuela

ORIGINAL WORK

VIT P. 1997. Quality Factors and Approach to the putative anticataract properties of stingless bee (Apidae; Meliponinae) Honey from Venezuela. PhD Thesis. School of Pure and Applied Biology, University of Wales, Cardiff, UK; 221 pp.

PREVIOUS PUBLICATIONS

- VIT P, RICCIARDELLI D'ALBORE G. 1994. Melissopalynology fro stingless bees (Hymenoptera : Apidae : Meliponinae) in Venezuela. *J.Apicult.Res.* 33(3):145-154.
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- VIT P, FERNÁNDEZ-MAESO MC, ORTIZ-VALBUENA A. 1998. Potential use of the three frequently occurring sugars in honey to predict stingless bee entomological origin. *J.Appl.Entomol.* 122,5-8.
- VIT P, PERSANO ODDO L, MARANO ML, SALAS DE MEJÍAS E. 1998. Venezuelan stingless bee honeys characterised by multivariate analysis of compositional factors. *Apidologie* 29:377-389.

Table 1. Stingless bee identification

Nr.	SB species	Author year	Entomologist	Honey samples
1	<i>Frieseomelitta paupera</i>	Provancher, 1988	Camargo JMF USP, Ribeirão Preto, Brasil	12
2	<i>Frieseomelitta</i> sp. grupo <i>varia</i>	Lepeletier, 1836	Camargo JMF USP, Ribeirão Preto, Brasil	13, 14
3	<i>Melipona compressipes</i>	Fabricius, 1804	Camargo JMF USP, Ribeirão Preto, Brasil	6, 20
4	<i>Melipona crinita</i>	Moure & Kerr, 1950	Camargo JMF USP, Ribeirão Preto, Brasil	16
5	<i>Melipona eburnea</i>	Friese, 1900	Camargo JMF USP, Ribeirão Preto, Brasil	15
6	<i>Melipona favosa</i>	Fabricius, 1798	Camargo JMF USP, Ribeirão Preto, Brasil	2, 4, 5, 7, 8, 21
7	<i>Melipona lateralis</i>	Erichson, 1848	Camargo JMF USP, Ribeirão Preto, Brasil	10, 17, 18

8	<i>Melipona paraensis</i>	Duke, 1916	Camargo JMF USP, Ribeirão Preto, Brasil	23, 25, 26, 27
9	<i>Melipona</i> sp. group <i>fulva</i>	Lepeletier, 1836	Camargo JMF USP, Ribeirão Preto, Brasil	9
10	<i>Nannotrigona</i> sp. aff. <i>chapadana</i>	Schwarz, 1938	Camargo JMF USP, Ribeirão Preto, Brasil	3
11	<i>Scaptotrigona</i> sp. 2	-	Camargo JMF USP, Ribeirão Preto, Brasil	19
12	<i>Scaptotrigona</i> sp. aff. <i>polystica</i>	Moure, 1950	Camargo JMF USP, Ribeirão Preto, Brasil	24
13	<i>Tetragonisca angustula</i>	Latreille, 1811	Camargo JMF USP, Ribeirão Preto, Brasil	1, 11, 22

Table 2. Geographical origin of honey samples

Nr.	Date ddmmyy	Location	GPS	Country
1	-	Barinas (Barinas)	-	Venezuela
2	-	Barinas (Barinas)	-	Venezuela
3	-	Barinas (Barinas)	-	Venezuela
4	-	El Guayabo (Apure)	-	Venezuela
5	-	Elorza (Apure)	-	Venezuela
6	-	Guasualito (Apure)	-	Venezuela
7	-	Guasualito (Apure)	-	Venezuela
8	-	Punto Fijo (Falcón)	-	Venezuela
9	-	Guaramajé (Amazonas)	-	Venezuela
10	-	Guaramajé (Amazonas)	-	Venezuela
11	-	Acarigua (Portuguesa)	-	Venezuela
12	-	Barrancas (Barinas)	-	Venezuela
13	-	El Paují (Bolívar)	-	Venezuela
14	-	Santa Elena de Uairén (Bolívar)	-	Venezuela
15	-	San Fernando de Atabapo (Amazonas)	-	Venezuela

16	-	San Fernando de Atabapo (Amazonas)	-	Venezuela
17	-	San Juan de Manapiare (Amazonas)	-	Venezuela
18	-	San Juan de Manapiare (Amazonas)	-	Venezuela
19	-	San Juan de Manapiare (Amazonas)	-	Venezuela
20	-	San Juan de Manapiare (Amazonas)	-	Venezuela
21	-	Mérida (Mérida)	-	Venezuela
22	-	Mérida (Mérida)	-	Venezuela
23	-	Maroa (Amazonas)	-	Venezuela
24	-	Maroa (Amazonas)	-	Venezuela
25	-	Maroa (Amazonas)	-	Venezuela
26	-	Maroa (Amazonas)	-	Venezuela
27	-	Maroa (Amazonas)	-	Venezuela

Table 3. Type of stingless bee management and technology

Nr.	Hive, model	Extraction	Processing	Storage temperature
1	Box	Pressed	Natural	Frozen
2	Wall	Syringe suction	Natural	Frozen
3	Box	Pressed	Natural	Frozen
4	Box	Syringe suction	Natural	Frozen
5	Box	Syringe suction	Natural	Frozen
6	Log	Syringe suction	Natural	Frozen
7	Log	Syringe suction	Natural	Frozen
8	Box	Syringe suction	Natural	Frozen
9	Tree	Syringe suction	Natural	Frozen
10	Tree	Syringe suction	Natural	Frozen
11	Wall	Pressed	Natural	Frozen
12	Box	Pressed	Natural	Frozen
13	Box	Pressed	Natural	Frozen
14	Box	Pressed	Natural	Frozen
15	Tree	Syringe suction	Natural	Frozen
16	Tree	Syringe suction	Natural	Frozen

17	Tree	Syringe suction	Natural	Frozen
18	Tree	Syringe suction	Natural	Frozen
19	Tree	Pressed	Natural	Frozen
20	Tree	Syringe suction	Natural	Frozen
21	Box	Syringe suction	Natural	Frozen
22	Box	Pressed	Natural	Frozen
23	Tree	Syringe suction	Natural	Frozen
24	Tree	Pressed	Natural	Frozen
25	Tree	Syringe suction	Natural	Frozen
26	Tree	Syringe suction	Natural	Frozen
27	Tree	Syringe suction	Natural	Frozen

Table 4. Physicochemical composition
(see method and units in the reference section)

Nr.	SB species	Free acidity	Ash	Electrical conductivity	Diastase activity	HMF	Invertase activity	Nitrogen	Reducing sugars	Apparent Sucrose	Water
1	13	56,40	0,34	7,05	16,50	20,40	27,70	137,60	61,35	3,60	22,80
2	6	37,20	0,04	1,44	2,64	5,04	150,70	90,60	68,04	3,14	25,40
3	10	62,80	0,29	8,35	8,70	19,34	84,20	118,43	62,56	0,29	17,90
4	6	32,80	0,16	2,32	2,64	21,66	112,80	102,00	69,60	1,40	23,30
5	6	37,20	0,10	0,74	3,50	24,60	70,70	60,16	73,10	3,62	24,20
6	3	48,40	0,04	1,95	2,64	31,62	169,10	114,60	65,94	0,72	25,20
7	6	37,20	0,17	2,41	3,10	6,00	131,10	69,68	70,40	1,21	23,90
8	6	51,60	0,21	3,57	2,64	24,69	31,80	52,75	70,75	1,21	22,90
9	9	38,00	0,02	1,20	2,64	5,54	9,50	29,94	61,60	5,58	28,30
10	7	37,20	0,17	2,23	2,64	4,47	26,70	16,16	69,70	1,40	25,30
11	13	43,60	0,47	7,79	35,60	4,63	66,00	150,33	70,40	0,61	22,80
12	1	61,20	0,52	7,79	6,60	4,50	20,00	47,73	64,60	0,90	27,50
13	2	72,40	0,40	7,60	11,20	4,63	206,60	145,92	52,36	5,58	23,80
14	2	63,20	0,52	7,55	13,70	4,20	214,30	162,60	51,16	6,07	18,40

15	5	32,40	0,40	3,99	3,40	5,06	25,10	47,73	58,60	0,63	27,40
16	4	9,20	0,39	6,46	3,00	5,54	22,30	52,53	61,60	0,72	30,80
17	7	44,40	0,04	1,38	2,64	2,60	75,30	28,53	60,08	0,60	29,70
18	7	40,40	0,11	1,35	3,00	4,47	74,70	25,56	64,60	1,24	31,50
19	11	84,00	0,32	2,31	2,64	5,54	15,90	28,53	53,66	1,40	29,50
20	3	30,40	0,19	2,38	3,00	24,50	23,20	95,45	68,75	1,07	27,70
21	8	24,80	0,21	1,85	2,64	20,40	43,40	50,03	69,70	1,40	25,30
22	13	44,80	0,34	7,13	16,90	4,47	56,70	140,35	65,94	1,95	23,90
23	8	69,60	0,27	2,70	2,64	6,10	29,60	20,78	53,66	0,90	30,10
24	12	20,00	0,29	3,43	2,64	5,84	36,10	25,56	52,36	1,24	25,20
25	8	24,40	0,15	1,04	2,64	4,69	11,40	13,37	64,60	1,95	26,10
26	8	14,40	0,11	0,85	3,30	2,22	20,00	10,59	63,03	0,60	23,70
27	8	13,20	0,04	0,87	3,00	0,43	18,10	12,60	61,92	1,23	25,70
Method		1	2	3	4	5	6	7	8	9	10

Nr.	SB species	fructose	glucose	sucrose	maltose	turanose	trehalose	erlose	melezitose	fructose/ glucose (F/G)	fructose/ maltose (F/M)	glucose /maltose (G/M)	hexoses/ maltose (H/M)
1	13	26,41	22,90	0,00	26,13	1,37	0,00	0,00	0,00	1,15	1,01	0,88	1,89
2	6	45,54	36,71	0,00	4,22	4,22	0,00	0,00	0,11	1,24	10,79	8,70	19,49
3	10	34,71	23,26	0,39	24,87	4,65	0,00	0,00	0,00	1,49	1,40	0,94	2,33
4	6	41,59	38,53	0,05	1,84	0,00	0,00	0,00	0,00	1,08	22,60	20,94	43,54
5	6	42,67	41,03	0,26	1,69	0,00	0,00	0,00	0,00	1,04	25,25	24,28	49,53
6	3	34,40	29,88	0,19	3,61	0,00	5,24	0,00	0,22	1,15	9,53	8,28	17,81
7	6	36,23	33,58	0,12	1,41	0,00	0,00	0,00	0,00	1,08	25,70	23,82	49,51
8	6	35,53	34,72	0,37	1,86	0,31	0,00	0,00	0,00	1,02	19,10	18,67	37,77
9	9	33,45	29,65	0,32	4,01	0,35	0,00	0,00	0,00	1,13	8,34	7,39	15,74
10	7	33,15	32,19	0,18	2,83	0,00	3,92	0,00	0,00	1,03	11,71	11,37	23,09
11	13	25,64	22,90	0,00	23,96	1,08	0,00	0,00	0,00	1,12	1,07	0,96	2,03
12	1	15,51	14,58	0,00	25,68	1,22	1,87	0,00	0,00	1,06	0,60	0,57	1,17
13	2	16,14	13,86	0,22	38,70	0,65	0,00	4,22	0,00	1,16	0,42	0,36	0,78
14	2	13,81	6,69	0,00	56,39	1,54	0,00	0,00	4,76	2,06	0,24	0,12	0,36

15	5	33,58	36,76	0,06	1,41	0,00	0,00	0,00	0,00	0,91	23,82	26,07	49,89
16	4	32,34	28,36	0,21	0,88	0,00	0,00	0,00	0,00	1,14	36,75	32,23	68,98
17	7	30,25	30,15	0,00	1,61	0,00	0,00	0,00	0,00	1,00	18,79	18,73	37,52
18	7	28,41	27,98	0,00	2,02	0,00	0,00	0,00	0,00	1,02	14,06	13,85	27,92
19	11	28,97	27,99	0,00	4,99	0,80	0,00	0,00	0,00	1,04	5,81	5,61	11,41
20	3	32,10	30,06	0,00	1,61	0,00	0,00	0,00	0,00	1,07	19,94	18,67	38,61
21	8	35,45	30,21	0,05	1,00	0,00	0,00	0,00	0,00	1,17	35,45	30,21	65,66
22	13	26,26	20,78	0,00	28,50	1,50	0,00	3,50	0,00	1,26	0,92	0,73	1,65
23	8	28,93	27,15	0,00	1,51	0,00	0,00	0,00	0,00	1,07	19,16	17,98	37,14
24	12	38,69	27,34	0,00	6,16	1,84	2,33	0,90	0,00	1,42	6,28	4,44	10,72
25	8	42,44	37,73	0,00	1,07	0,09	0,00	1,65	0,00	1,12	39,66	35,26	74,93
26	8	37,08	33,05	0,08	1,23	0,00	0,00	1,84	0,00	1,12	30,15	26,87	57,02
27	8	41,22	36,39	0,05	1,00	0,00	0,00	1,89	0,00	1,13	41,22	36,39	77,61
Method		11											

Table 5. Sensory evaluation

Not available.

Table 6. Bioactivity

Not available.

Table 7. Melissopalynology

(see method 12 in the reference section)

Sample Nr.**1*****Tetragonisca angustula***

Maurizio class III

Pollen counts 367

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
Combretum sp. 1	136	37.1	A	xxxx	xxxx	xxxx	xxx	
Citrus aurantium	41	11.2	S	xxxx	x			
Astronium graveolens	37	10.1	S	xxxx				
Coriandrum sativum	28	7.6	S	xxx				

<i>Grewia</i> sp. 1	27	7.4	S	xxx
<i>Verbesina turbascensis</i>	21	5.7	S	xx
<i>Combretum</i> sp. 2	17	4.6	S	xx
<i>Myrcia</i> sp. 1	8	2.2	R	x
<i>Hyeraea</i> sp.1	7	1.9	R	x
<i>Pinus</i> sp. 1	5	1.4	R	x
<i>Bidens</i> sp.1	5	1.4	R	x
<i>Rubus</i> sp.1	5	1.4	R	x
<i>Pithecellobium saman</i>	4	1.1	R	x
<i>Tridax procumbens</i>	4	1.1	R	x
<i>Croton</i> sp. 1	3	0.8	R	x
<i>Antigonon leptopus</i>	3	0.8	R	x
Moraceae sp.1	2	0.5	R	x
<i>Grevillea robusta</i>	2	0.5	R	x
<i>Sorgum vulgare</i>	2	0.5	R	x
Cyperaceae sp.1	2	0.5	R	x
<i>Centartherum punctatum</i>	2	0.5	R	x
<i>Tithonia diversifolia</i>	2	0.5	R	x
<i>Ruellia</i> sp. 1	1	0.3	R	x
Solanaceae sp.1	1	0.3	R	x
<i>Hyptis suaveolens</i>	1	0.3	R	x
<i>Clerodendrum</i> sp. 1	1	0.3	R	x

Sample Nr.

2

Melipona favosa

Maurizio class II

Pollen counts 256

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Mimosa pudica</i>	118	46.1	D	xxxx	xxxx	xxxx	xxxx	xx
<i>Grewia</i> sp. 1	63	24.6	A	xxxx	xxxx	xx		
<i>Mimosa arenosa</i>	36	14.1	S	xxxx	xx			
Mimosoideae sp. 1	16	6.3	S	xxx				
<i>Eucalyptus</i> sp. 1	9	3.5	S	xx				
<i>Grevillea robusta</i>	3	1.2	R	x				
<i>Bursera karsteriana</i>	3	1.2	R	x				
Solanaceae sp. 1	3	1.2	R	x				
<i>Tridax procumbens</i>	3	1.2	R	x				
<i>Senecio tamoides</i>	1	0.3	R	x				
<i>Coriandrum sativum</i>	1	0.3	R	x				

Sample Nr.

3

Nannotrigona sp. near *chapadana*

Maurizio class III

Pollen counts 230

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Julbernardia</i> sp.1	112	48.7	D	xxxx	xxxx	xxxx	xxxx	xxxx
<i>Combretum</i> sp.2	49	21.3	A	xxxx	xxxx	x		

<i>Angelonia</i> sp.1	38	16.5	A	xxxx xxx
<i>Tridax procumbens</i>	6	2.6	R	x
<i>Citrus aurantium</i>	4	1.8	R	x
Rubiaceae sp. 1	4	1.8	R	x
<i>Eucalyptus</i> sp. 2	3	1.3	R	x
<i>Croton</i> sp. 1	3	1.3	R	x
<i>Bidens</i> sp. 1	2	0.9	R	x
<i>Zea mays</i>	2	0.9	R	x
Mimosoideae sp. 2	2	0.9	R	x
<i>Yuca gloriosa</i>	1	0.4	R	x
Podocarpaceae sp. 1	1	0.4	R	x
<i>Cocos nucifera</i>	1	0.4	R	x
<i>Ruellia metallica</i>	1	0.4	R	x
Moraceae sp. 1	1	0.4	R	x

Sample Nr.

4

Melipona favosa

Maurizio class III

Pollen counts 212

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
Rubiaceae sp. 1	60	28.3	A	xxxx	xxxx	xxx		
<i>Grewia</i> sp. 1	56	26.4	A	xxxx	xxxx	xxx		
<i>Antigonon leptopus</i>	22	10.4	S	xxxx				
Mimosoideae sp. 3	18	8.5	S	xxx				
Solanaceae sp. 2	16	7.6	S	xxx				
<i>Psidium guajava</i>	15	7.0	S	xxx				
<i>Combretum</i> sp. 1	15	7.0	S	xxx				
<i>Schrankia</i> sp. 1	3	1.4	R	x				
<i>Pithecellobium saman</i>	3	1.4	R	x				
<i>Tridax procumbens</i>	1	0.5	R	x				
<i>Inga edulis</i>	1	0.5	R	x				
<i>Hyptis suaveolens</i>	1	0.5	R	x				
<i>Ocimum basilicum</i>	1	0.5	R	x				

Sample Nr.

5

Melipona favosa

Maurizio class III

Pollen counts 205

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Myrcia</i> sp. 2	94	45.9	D	xxxx	xxxx	xxxx	xxxx	xx
Solanaceae sp. 3	26	12.7	S	xxxx	x			
<i>Grewia</i> sp. 1	21	10.2	S	xxxx				
<i>Citrus aurantium</i>	17	8.3	S	xxx				
<i>Bursera karsteniana</i>	12	5.9	S	xx				
<i>Combretum</i> sp.2	8	3.9	S	xx				
<i>Angelonia</i> sp. 1	6	2.9	R	xx				

<i>Acacia angustissima</i>	3	1.4	R	x
Rubiaceae sp. 1	3	1.4	R	x
<i>Malachia alceifolia</i>	3	1.4	R	x
<i>Cecropia</i> sp. 1	1	0.5	R	x
<i>Mimosa scabrella</i>	1	0.5	R	x
<i>Bidens</i> sp. 1	1	0.5	R	x
<i>Inga edulis</i>	1	0.5	R	x
<i>Hyptis suaveolens</i>	1	0.5	R	x
<i>Moringa oleifera</i>	1	0.5	R	x
<i>Tridax procumbens</i>	1	0.5	R	x
<i>Ruellia</i> sp. 1	1	0.5	R	x
Sapindaceae sp. 1	1	0.5	R	x
Moraceae sp. 1	1	0.5	R	x
<i>Triumfetta</i> sp. 1	1	0.5	R	x
<i>Zea mays</i>	1	0.5	R	x

Sample Nr. **6** ***Melipona compressipes***

Maurizio class III

Pollen counts 404

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
Φ <i>Mimosa pudica</i>	182	45.1	D	xxxx	xxxx	xxxx	xxxx	xx
<i>Julbernardia</i> sp. 1	54	13.4	S	xxxx	xx			
<i>Cassia</i> sp. 1	48	11.9	S	xxxx	x			
Myrtaceae sp. 1	39	9.7	S	xxxx				
Solanaceae sp. 4	27	6.7	S	xxx				
<i>Dalbergia</i> sp. 1	18	4.5	S	xx				
<i>Combretum</i> sp. 1	10	2.5	R	x				
<i>Grevillea robusta</i>	8	2.0	R	x				
<i>Zea mays</i>	6	1.5	R	x				
<i>Angelonia</i> sp. 1	4	1.0	R	x				
<i>Latyris</i> sp. 1	2	0.5	R	x				
<i>Acacia angustissima</i>	1	0.2	R	x				
Malpighiaceae sp. 1	1	0.2	R	x				
<i>Mimosa scabrella</i>	1	0.2	R	x				
<i>Eucalyptus</i> sp. 3	1	0.2	R	x				
<i>Verbesina turbascensis</i>	1	0.2	R	x				
Melastomataceae sp. 1	1	0.2	R	x				

Sample Nr. **7** ***Melipona favosa***

Maurizio class III

Pollen counts 309

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Terminalia catappa</i>	294	95.2	D	xxxx	xxxx	xxxx	xxxx	xxxx
<i>Zanthoxylum fagara</i>	6	1.9	R	x				
Sapindaceae sp. 2	2	0.7	R	x				

<i>Myrcia</i> sp.3	2	0.7	R	x
<i>Grewia</i> sp. 1	1	0.3	R	x
<i>Tithonia diversifolia</i>	1	0.3	R	x
Bombacaceae sp. 1	1	0.3	R	x
Mimosoideae sp. 3	1	0.3	R	x
<i>Verbesina turbascensis</i>	1	0.3	R	x

Sample Nr.

8

Melipona favosa

Maurizio class III

Pollen counts 259

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Antigonon leptopus</i>	114	44.0	A	xxxx	xxxx	xxxx	xxxx	xx
<i>Angelonia</i> sp.1	109	42.0	A	xxxxx	xxxxx	xxxxx	xxxxx	x
Mimosoideae sp.4	16	6.1	S	xxxx				
<i>Alternanthera</i> sp. 1	10	3.9	S	xx				
<i>Myrcia</i> sp.4	3	1.2	R	x				
Solanaceae sp. 4	2	0.8	R	x				
Rubiaceae sp. 1	2	0.8	R	x				
unidentified 242	2	0.8	R	x				
unidentified 252	1	0.4	R	x				

Sample Nr.

9

Melipona sp. group *fulva*

Maurizio class I

Pollen counts 276

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
unidentified 243	105	38.0	A	xxxx	xxxx	xxxx	xxx	
Moraceae sp.2	94	34.0	A	xxxxx	xxxxx	xxxxx	xxx	
unidentified 251	36	13.0	S	xxxxx	x			
<i>Combretum</i> sp. 2	27	9.7	S	xxxxx				
Solanaceae sp. 5	5	1.8	R	x				
Moraceae sp. 3	3	1.1	R	x				
Rubiaceae sp. 1	1	0.4	R	x				
<i>Psidium guianensis</i>	1	0.4	R	x				
<i>Mimosa pudica</i>	1	0.4	R	x				
<i>Acacia farnesiana</i>	1	0.4	R	x				
<i>Leucaena</i> sp. 1	1	0.4	R	x				
Sapindaceae sp. 2	1	0.4	R	x				

Sample Nr.

10

Melipona lateralis kangarumensis

Maurizio class I

Pollen counts 236

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Cecropia</i> sp. 2	99	42.0	A	xxxx	xxxx	xxxx	xxxx	x
<i>Angelonia</i> sp. 1	77	32.6	A	xxxx	xxxx	xxxx	x	
<i>Astronium graveolens</i>	39	16.5	S	xxxx	xxx			
<i>Grewia</i> sp.1	9	3.8	S	xx				
<i>Combretum</i> sp.2	5	2.1	R	x				
<i>Solanaceae</i> sp. 5	2	0.9	R	x				
<i>Borreria capitata</i>	2	0.9	R	x				
<i>Lythraceae</i> sp.1	1	0.4	R	x				
<i>Anacardium occidentale</i>	1	0.4	R	x				
<i>Mimosa pudica</i>	1	0.4	R	x				

Sample Nr.

11

Tetragonisca angustula

Maurizio class III

Pollen counts 333

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Moraceae</i> sp. 1	253	76.0	D	xxxx	xxxx	xxxx	xxxx	xxxx
<i>Ceiba pentandra</i>	19	5.7	S	xx				
<i>Bombacaceae</i> sp. 2	13	3.9	S	xx				
<i>Cyperaceae</i> sp. 1	10	3.0	S	x				
<i>Sapindaceae</i> sp.. 1	9	2.7	R	x				
<i>Croton</i> sp. 2	8	2.4	R	x				
<i>Spilanthes americana</i>	6	1.8	R	x				
<i>Pluchea odorata</i>	6	1.8	R	x				
<i>Paulinia cauliflora</i>	3	0.9	R	x				
<i>Syzygium jambos</i>	2	0.6	R	x				
unidentified 248	2	0.6	R	x				
<i>Cucurbita pepo</i>	1	0.3	R	x				
<i>Hyptis suaveolens</i>	1	0.3	R	x				

Sample Nr.

12

Frieseomelitta paupera

Maurizio class III

Pollen counts 279

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Spondias mombin</i>	185	66.3	D	xxxx	xxxx	xxxx	xxxx	xx
<i>Tabebuia rosea</i>	29	10.4	S	xxxx				
<i>Melicocca bijuga</i>	24	8.6	S	xxx				
<i>Combretum</i> sp.2	9	3.2	S	x				
<i>Grevillea robusta</i>	9	3.2	S	x				

Moraceae sp.1	6	2.1	R	x
<i>Tithonia diversifolia</i>	4	1.4	R	x
<i>Protium</i> sp. 1	3	1.1	R	x
<i>Machaerium</i> sp. 1	3	1.1	R	x
Solanaceae sp. 4	3	1.1	R	x
<i>Psidium guajava</i>	2	0.7	R	x
<i>Grewia</i> sp. 1	1	0.4	R	x
<i>Croton</i> sp. 1	1	0.4	R	x

Sample Nr.

13

Frieseomelitta sp. grupo varia

Maurizio class III

Pollen counts 244

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Protium</i> sp. 2	87	35.7	A	xxxx	xxxx	xxxx	xx	
<i>Combretum</i> sp. 2	78	32.0	A	xxxx	xxxx	xxxx	x	
<i>Bixa orellana</i>	37	15.2	S	xxxx	xx			
<i>Lonchocarpus pentaphylus</i>	16	6.6	S	xxx				
<i>Borreria capitata</i>	7	2.9	R	x				
<i>Myrcia</i> sp. 2	4	1.6	R	x				
<i>Zea mays</i>	3	1.2	R	x				
<i>Piper</i> sp. 1	2	0.8	R	x				
Palmae sp. 1	2	0.8	R	x				
<i>Combretum</i> sp. 1	2	0.8	R	x				
<i>Struthantus</i> sp. 1	1	0.4	R	x				
Sapindaceae sp. 1	1	0.4	R	x				
<i>Ocimum basilicum</i>	1	0.4	R	x				
<i>Lagerstroemia indica</i>	1	0.4	R	x				
<i>Acacia angustissima</i>	1	0.4	R	x				
<i>Stigmaphyllon</i> sp. 1	1	0.4	R	x				

Sample Nr.

14

Frieseomelitta sp. grupo varia

Maurizio class III

Pollen counts 234

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Zanthoxylum fagara</i>	110	47.0	D	xxxx	xxxx	xxxx	xxxx	xxx
<i>Piscidia piscipula</i>	27	11.5	S	xxxx	x			
<i>Pseudoginopsis chenopoidea</i>	16	6.8	S	xx				
<i>Protium</i> sp. 1	16	6.8	S	xx				
<i>Combretum</i> sp.1	11	4.7	S	xx				
<i>Bidens</i> sp. 1	5	2.0	R	x				
<i>Cucurbita pepo</i>	5	2.0	R	x				
<i>Ruellia metallica</i>	4	1.7	R	x				
Palmae sp.1	4	1.7	R	x				
<i>Zea mays</i>	4	1.7	R	x				
<i>Myrcia</i> sp. 2	3	1.3	R	x				

<i>Ceiba pentandra</i>	3	1.3	R	x
<i>Verbesina turbascensis</i>	3	1.3	R	x
<i>Cecropia</i> sp. 3	3	1.3	R	x
<i>Ruellia</i> sp. 1	2	0.9	R	x
<i>Symphonia</i> sp. 1	2	0.9	R	x
<i>Piper</i> sp.1r	2	0.9	R	x
<i>Pinus</i> sp. 1	2	0.9	R	x
<i>Croton</i> sp. 2	2	0.9	R	x
Cyperaceae sp. 1	2	0.9	R	x
<i>Combretum</i> sp. 2	2	0.9	R	x
<i>Bombacopsis chinata</i>	2	0.9	R	x
Solanaceae sp. 5	2	0.9	R	x
<i>Jatropha curcas</i>	1	0.4	R	x
<i>Struthantus</i> sp.1	1	0.4	R	x

Sample Nr. **15** **Melipna eburnea**

Maurizio class III Pollen counts 220

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Weinmannia</i> sp. 1	129	58.6	D	xxxx	xxxx	xxxx	xxxx	xxxx
<i>Myrcia</i> sp. 3	26	11.8	S	xxxx	x			
Mimosoideae sp. 5	23	10.5	S	xxxx				
unidentified 246	21	9.5	S	xxxx				
<i>Piper</i> sp. 1	16	7.3	S	x				
unidentified 244	2	0.9	R	x				
<i>Latyrus</i> sp. 1	2	0.9	R	x				
Mimosoideae sp. 6	1	0.5	R	x				

Sample Nr. **16** **Melipona crinita**

Maurizio class II Pollen counts 220

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Myrcia</i> sp.3	87	34.0	A	xxxx	xxxx	xxxx	xx	
Mimosoideae sp. 5	52	20.3	A	xxxx	xxxx			
unidentified 252	34	13.3	S	xxxx	x			
<i>Euphorbia pulcherrima</i>	29	11.3	S	xxxx				
<i>Angelonia</i> sp. 1	27	10.5	S	xxxx				
<i>Piscidia piscipula</i>	22	8.6	S	xxxx				
Cyperaceae sp. 1	3	1.2	R	x				
Solanaceae sp. 6	2	0.8	R	x				

Sample Nr. **17**

Melipona lateralis kangarumensis

Maurizio class III

Pollen counts 343

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Mimosa pudica</i>	150	43.7	D	xxxx	xxxx	xxxx	xxxx	xx
<i>Myrcia</i> sp. 3	66	19.2	A	xxxx	xxxx			
<i>Combretum</i> sp. 1	39	11.4	S	xxxx				
Mimosoideae sp. 4	28	8.1	S	xxx				
<i>Tabebuia rosea</i>	15	4.4	S	xx				
<i>Euphorbia pulcherrima</i>	10	2.9	R	x				
<i>Protium</i> sp. 2	8	2.3	R	x				
<i>Leucaena</i> sp. 2	8	2.3	R	x				
Ulmaceae sp. 1	5	1.5	R	x				
<i>Zanthoxylum</i> sp. 2	4	1.2	R	x				
<i>Cecropia</i> sp. 2	3	0.9	R	x				
<i>Anacardium occidentale</i>	3	0.9	R	x				
Palmae sp. 1	2	0.6	R	x				
<i>Piptadenia</i> sp. 1	1	0.3	R	x				
Solanaceae sp. 7	1	0.3	R	x				

Sample Nr. **18**

Melipona lateralis kangarumensis

Maurizio class III

Pollen counts 307

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Machaerium</i> sp.1	142	46.3	D	xxxx	xxxx	xxxx	xxxx	xx
<i>Euphorbia pulcherrima</i>	35	11.4	S	xxxx				
<i>Zanthoxylum fagara</i>	31	10.1	S	xxxx				
Mimosoideae sp. 4	27	8.8	S	xxx				
<i>Lonchocarpus</i> sp. 1	18	5.8	S	xx				
<i>Zanthoxylum</i> sp. 1	13	4.2	S	xx				
Mimosoideae sp. 5	8	2.6	R	x				
<i>Combretum</i> sp. 2	8	2.6	R	x				
<i>Tabebuia rosea</i>	7	2.3	R	x				
Palmae sp. 1	6	2.0	R	x				
<i>Myrcia</i> sp. 2	5	1.6	R	x				
<i>Mimosa pudica</i>	4	1.3	R	x				
unidentified 247	3	1.0	R	x				

Sample Nr. 19

Scaptotrigona ochrotricha

Maurizio class III

Pollen counts 205

Pollen types	total	%	F C	histogram of relative abundance (%)					
				0	25	50	75	100	
<i>Astronium graveolens</i>	153	74.6	D	xxxx	xxxx	xxxx	xxxx	xxxx	xx
unidentified 251	21	10.3	S	xxxx					
Ulmaceae sp. 1	13	6.3	S	xxx					
Myrtaceae sp. 1	8	3.9	S	x					
<i>Vernonia brasiliiana</i>	6	2.9	R	x					
<i>Combretum</i> sp. 2	4	2.0	R	x					

Sample Nr. 20

Melipona compressipes

Maurizio class III

Pollen counts 238

Pollen types	total	%	F C	histogram of relative abundance (%)					
				0	25	50	75	100	
unidentified 243	58	24.4	A	xxxx	xxxx	xx			
<i>Antigonon leptopus</i>	57	23.9	A	xxxx	xxxx	x			
<i>Machaerium</i> sp. 1	29	12.2	S	xxxx	x				
Ulmaceae sp. 1	27	11.4	S	xxxx					
<i>Combretum</i> sp. 1	26	10.9	S	xxxx					
<i>Zanthoxylum</i> sp. 2	20	8.4	S	xxx					
<i>Tabebuia rosea</i>	10	4.2	S	xx					
<i>Combretum glandiflorum</i>	7	3.0	S	x					
<i>Protium</i> sp. 1	2	0.8	R	x					
Solanaceae sp. 3	1	0.4	R	x					
<i>Piper</i> sp. 1	1	0.4	R	x					

Sample Nr. 21

Melipona favosa

Maurizio class III

Pollen counts 231

Pollen types	total	%	F C	histogram of relative abundance (%)					
				0	25	50	75	100	
<i>Triumfetta</i> sp. 1	61	26.4	A	xxxx	xxxx	xx			
<i>Myrcia</i> sp. 2	58	25.1	A	xxxx	xxxx	xx			
<i>Antigonon leptopus</i>	53	22.9	A	xxxx	xxxx	x			
<i>Machaerium</i> sp. 1	23	10.0	S	xxxx					
<i>Grewia</i> sp. 1	20	8.7	S	xxx					
Solanaceae sp.3	4	1.7	R	x					

<i>Inga edulis</i>	3	1.3	R	x
<i>Schrankia</i> sp. 1	3	1.3	R	x
<i>Combretum</i> sp. 1	3	1.3	R	x
<i>Philoxerus</i> sp. 1	2	0.9	R	x
<i>Citrus aurantium</i>	1	0.4	R	x

Sample Nr. 22

Tetragonisca angustula

Maurizio class III

Pollen counts 307

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Cordia alliodora</i>	107	34.9	A	xxxx	xxxx	xxxx	xx	
<i>Piper</i> sp. 1	65	21.2	A	xxxx	xxxx			
<i>Machaerium</i> sp. 1	53	17.3	A	xxxx	xxx			
<i>Euphorbia pulcherrima</i>	35	11.4	S	xxxx	x			
<i>Julbernardia</i> sp. 1	20	6.5	S	xxx				
<i>Melochia parviflora</i>	17	5.5	S	xx				
<i>Combretum</i> sp. 1	3	1.0	R	x				
<i>Ocimum basilicum</i>	2	0.7	R	x				
<i>Cyathula</i> sp. 1	1	0.3	R	x				
<i>Thunbergia erecta</i>	1	0.3	R	x				
<i>Hyptis mutabilis</i>	1	0.3	R	x				
<i>Bidens</i> sp. 1	1	0.3	R	x				
<i>Grewia</i> sp. 1	1	0.3	R	x				

Sample Nr. 23

Melipona paraensis

Maurizio class I

Pollen counts 320

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Protium</i> sp. 2	247	77.2	D	xxxx	xxxx	xxxx	xxxx	xxxx
<i>Combretum</i> sp. 2	66	20.6	A	xxxx	xxxx			
<i>Cecropia</i> sp. 2	2	0.7	R	x				
<i>Verbesina turbascensis</i>	1	0.3	R	x				
<i>Bidens</i> sp. 1	1	0.3	R	x				
<i>Myrcia</i> sp. 3	1	0.3	R	x				
<i>Machaerium</i> sp. 1	1	0.3	R	x				
Cyperaceae sp. 1	1	0.3	R	x				

Sample Nr. 24

Scaptotrigona sp. aff. polystica

Maurizio class II

Pollen counts 344

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Protium</i> sp. 2	113	32.8	A	xxxx	xxxx	xxxx	x	
<i>Weinmannia</i> sp. 1	100	29.1	A	xxxx	xxxx	xxxx		
<i>Machaerium</i> sp. 1	77	22.4	A	xxxx	xxxx	x		
<i>Myrcia</i> sp. 3	20	5.8	S	xx				
unidentified 250	16	4.7	S	xx				
<i>Combretum</i> sp. 1	7	2.0	R	x				
<i>Caesalpinia pulcherrima</i>	6	1.7	R	x				
<i>Combretum</i> sp. 2	3	0.9	R	x				
<i>Palmae</i> sp. 1	2	0.6	R	x				

Sample Nr. 25

Melipona paraensis

Maurizio class III

Pollen counts 388

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Angelonia</i> sp. 1	191	49.2	D	xxxx	xxxx	xxxx	xxxx	xxxx
<i>Piscidia piscipula</i>	148	38.1	A	xxxx	xxxx	xxxx	xxx	
Lythraceae sp. 2	31	8.0	S	xxx				
<i>Myrcia</i> sp. 3	8	2.0	R	x				
<i>Combretum glandiflorum</i>	5	1.3	R	x				
<i>Caesalpinia pulcherrima</i>	3	0.8	R	x				
<i>Merremia umbellata</i>	1	0.3	R	x				
Bombacaceae sp. 2	1	0.3	R	x				

Sample Nr. 26

Melipona paraensis

Maurizio class III

Pollen counts 297

Pollen types	total	%	F C	histogram of relative abundance (%)				
				0	25	50	75	100
<i>Machaerium</i> sp. 1	128	43.1	A	xxxx	xxxx	xxxx	xxxx	x
Theaceae sp. 1	88	29.6	A	xxxx	xxxx	xxxx		
<i>Dalbergia</i> sp. 1	56	18.9	A	xxxx	xxxx			
Lythraceae sp. 2	12	4.0	S	xx				
Moraceae sp. 3	4	1.3	R	x				
<i>Combretum</i> sp. 2	3	1.0	R	x				

Myrcia sp. 4	2	0.7	R	x
unidentified 249	2	0.7	R	x
Bombacaceae sp. 2	2	0.7	R	x

Sample Nr. **27**

Melipona paraensis

Maurizio class III

Pollen counts 286

Pollen types	total	%	F C	histogram of relative abundance (%)					
				0	25	50	75	100	
unidentified 243	150	52.4	D	xxxx	xxxx	xxxx	xxxx	xxxx	x
<i>Machaerium</i> sp. 1	60	21.0	A	xxxx	xxxx				
<i>Myrcia</i> sp. 2	52	18.2	A	xxxx	xxx				
Lythraceae sp. 2	14	5.0	S	xx					
unidentified 249	6	2.1	R	x					
<i>Anacardium occidentale</i>	3	1.0	R	x					
<i>Caesalpinia pulcherrima</i>	1	0.3	R	x					

Table 8. Analysts.

Analysis	Free Acidity	Ash	Electrical conductivity	Diastase	HMF	Invertase	Nitrogen	Reducing sugars	Apparent Sucrose	Water	Sugars HPLC	Pollen
Analysts	Vit P		Marano ML Persano Oddo L	Pulcini P	Marano ML Persano Oddo L	Pulcini P	Salas de Mejías E			Marano ML Persano Oddo L	Ortiz - Valbuena A Fernández-Maeso MC	Vit P Ricciardelli D'Albore G

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Method	Parameter	Technique	Units
1	Free acidity	Titrimetric ¹	g water/100 g honey
2	Ash	Gravimetric ¹	g ash/100 g honey
3	Electrical conductivity	Conductimetric ²	mS/cm
4	Diastase activity	Enzymatic ³	DN
5	HMF	Colorimetric ⁴	mg HMF/kg honey
6	Invertase activity	Enzymatic ⁵	IN

7	Nitrogen	Titrimetric ⁶	mg N/100 g honey
8	Reducing sugars	Titrimetric ⁴	g reducing sugars/100 g honey
9	Apparent sucrose	Titrimetric ⁴	g sucrose/100 g honey
10	Water	Refractometric ¹	g water/100 g honey
11	Sugars HPLC	HPLC ⁷	g sugars/100 g honey
12	Melissopalynology	Microscopic ⁸	relative abundance

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