

Main reasons for honey bee colony mortality in Portugal.

A snapshot of beekeepers' beliefs

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Introduction

Since winter 2006, extensive honey bee colony losses with distinctive features were first reported in the USA ('Colony Collapse Disorder', CCD). Global research over the past few years attempting to pin point CCD's most likely causes, recurrently pointed out that no single factor is universally responsible for this disorder. Nevertheless, stressors e.g. the Varroa mite, some 'new generation' pesticides, an ever expanding 'pathosphere' affecting European *Apis mellifera* strains (just to name a few) and their multiple interactions with other long ongoing stress sources clearly compromise the multi-level immune defense of honey bees, disrupting their social system and leading colonies to collapse. In Spain, various reports have suggested that *Nosema ceranae* is the main culprit regarding the abnormally high colony mortality levels reported. In Portugal, no reliable information existed (other than a few discrete anecdotal reports) on honey bee colony mortality levels across the beekeeping regions of the country, nor their 'perceived' causes. As a result, we carried out this work focusing on narrowing this knowledge gap by getting an overview of our beekeepers opinions. This study appears in the context of a project submitted by FNAP Measure 6A National Beekeeping Program (under EU Regulations No. 917/2004, No. 797/2004 and No. 1234/2007), in partnership with research institutions of the authors, under coordination of Prof. Sância Pires.



Methodology

To investigate claims of abnormally high honey bee colony mortality in Portugal during 2011, a survey was carried out via telephone interviews. It included 662 (~ 4%) registered Portuguese beekeepers and followed the basic 'Coloss' questionnaire. Interviewees were selected accounting for total numbers of colonies and the geographical distribution of their apiaries across the country. The 'sampling grid' was set to 5 beekeepers per county, fully covering continental Portugal and jointly considering the autumn and winter periods.

Results

When beekeepers were individually asked to provide their views on the main causes for the colony mortalities observed (Table 1), albeit the regional variations, Varroa destructor was flagged (by 24% of them) as the key problem they are faced with in terms of colony survival. 'Poor quality' queens (mentioned by 13%), colony starvation (indicated by 12%), colonies overwintering in 'weak conditions' (pointed out by 12%) and 'nosemosis' (suspected by 6%) are other considerable sources of problems encountered. Twenty four percent of the participating beekeepers also additionally singly brought up an extra difficulty from a residual group of additional 'relevant challenges' posed by wasps, ants, chalkbrood, American foulbrood, bee-eaters, pesticide intoxications or thymol application induced accidents.

The overall annual colony mortality that beekeepers historically regard as 'natural' for their own apiaries is 9.7 ± 0.2 (mean \pm standard error of the mean), not significantly deviating from the 10.8 ± 0.2 they consider 'normal' for the wider region where their apiaries are located. Over the combined autumn and winter seasons (Table 2), the initial number of interviewees' productive colonies (100507) decreased 4.0% (i.e. 3979). Furthermore, if the comparison is made with the total number of productive colonies existing in early spring of the previous year (94848), an increase of 2.0% was observed in April 2011. Although incorporating a considerable commitment to colony splitting and swarm captures, this increase is still surprising given the outcome of a nation wide survey focused on *N. ceranae* (showing that 51% of the 277 sampled apiaries across the country were infected by this microsporidian).

It also demonstrates that the media hype generated around 'unexplained high colony mortality' occurring in Portugal was clearly unwarranted.

Districts	Unknow	Starvation	Poor queen	Varroa	Nosema	Poor colony condition in fall	Other causes
Aveiro	47%	22%	11%	17%	0%	3%	17%
Beja	24%	24%	21%	32%	3%	32%	29%
Braga	52%	7%	22%	15%	0%	4%	7%
Bragança	63%	2%	10%	30%	8%	8%	43%
Castelo Branco	62%	19%	12%	12%	23%	8%	19%
Coimbra	61%	14%	6%	11%	3%	3%	17%
Évora	20%	13%	23%	30%	8%	18%	28%
Faro	20%	18%	27%	41%	2%	27%	31%
Guarda	67%	11%	7%	19%	11%	15%	33%
Leiria	52%	6%	13%	26%	0%	3%	3%
Lisboa	41%	8%	16%	24%	0%	0%	32%
Portalegre	33%	14%	12%	27%	2%	18%	29%
Porto	42%	12%	15%	18%	6%	0%	18%
Santarém	52%	10%	10%	17%	5%	2%	29%
Setúbal	19%	17%	13%	36%	4%	28%	28%
Viana Castelo	67%	0%	11%	19%	4%	0%	4%
Vila Real	36%	0%	11%	18%	7%	11%	54%
Viseu	63%	8%	0%	25%	4%	4%	33%
Mean	44%	12%	13%	24%	6%	12%	24%

Table 1 – Believed causes for colony mortality observed between April and October 2010 (beekeepers were allowed to indicate more than one cause).

Table 2 –District-aggregated summary of information collected on numbers of productive colonies, noticed seasonal mortality, honey production and transhumance intensity).

Districts	Nº of inquiries	Productive colonies on 2010-04-01	Spring / Summer colony deaths	Productive colonies on 2010-10-01	Autumn / Winter colony deaths	Productive colonies on 2011-04-01	Annual honey harvest (Kg/col)	Beekeeping operations including transhumance
Aveiro	36	2084	21	2197	64	2105	20,3	14%
Beja	38	13132	28	13800	1693	13272	16,0	26%
Braga	27	1212	16	1363	64	1421	13,4	4%
Bragança	63	10034	48	11279	779	10417	17,0	17%
Castelo Branco	26	2369	15	2596	162	2447	12,8	8%
Coimbra	36	2085	18	2261	201	2303	14,6	22%
Évora	40	8804	33	9147	1188	8189	16,2	15%
Faro	49	24415	32	24288	1823	24656	12,6	41%
Guarda	27	2128	14	2333	175	2200	20,2	4%
Leiria	31	1589	13	1683	147	1742	12,1	23%
Lisboa	37	1965	19	2184	249	2205	11,6	14%
Portalegre	51	5292	37	5946	878	5154	14,0	20%
Porto	33	4104	16	4698	119	4697	18,7	30%
Santarém	42	3523	15	3557	68	3763	13,4	12%
Setúbal	47	6106	38	6672	922	5746	13,3	4%
Viana do Castelo	27	1984	9	2137	37	2148	19,3	26%
Vila Real	28	3084	18	3425	205	3039	19,1	43%
Viseu	24	938	19	941	139	1024	17,1	4%
Total	662	94848	409	100507	8913	96528	281,7	-
Mean	37	5269	23	5584	495	5363	16	18%