Small cell size: an evaluation of its benefit in the control of *Varroa destructor* in honeybees *Apis mellifera* under European conditions

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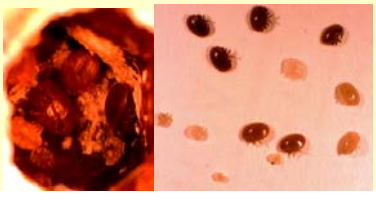
Introduction

Varroa destructor is a serious pest of the honeybee and, in general, infested colonies succumb within two years if left untreated. Chemical acaricides though effective, may only be used at the beginning and end of the foraging season and result in the build up of residues in the wax and honey and consequently the evolution of a resistant mite population. In contrast biotechnical controls may be incorporated into beekeeping management strategies and thus play an integral part in any integrated pest management system. Small cell size is a biotechnical control and the aim of this study was to examine the effect of small cell size on the reproduction of the mite and to establish if their were any advantages to using small cell comb with the European honeybee *Apis mellifera mellifera*.

Materials and methods

Six test colonies were inoculated with 500 bees (>20% mites prevalence) and introduced into new brood boxes with the freshly drawn foundation arranged alternately with small (4.9mm) and standard (5.4mm) frames. At 2 week intervals, during July – September 2007, eggs/young larvae on adjacent frames were demarcated using a template and removed after a period of 16-17 days, thus ensuring that humidity, temperature and bee movements were comparable in both samples. The total mite population in the test colonies was estimated using natural mite fall on each sampling date. Brood comb sizes were measured for both cells sizes and expressed as the mean linear distance per cell size. A total of 2229 sealed cells were opened (plate 1) and the mite families reconstructed. The brood's stage of development was used as a time reference from the time the cell was sealed. Prevalence data was analysed using binary logistic regressions, while abundance and intensity were analysed using a log link function and log link linear function respectively.

Plate 1



Results

The natural mite fall increased in all test colonies over the experimental period, but the growth varied between colonies (Figure 1) ($F_{[4,19]}$=14.74 p<0.05 and $F_{[3,19]}$=4.02 p<0.05, respectively). Smaller cells were significantly more likely to be infested with mother mites than standard cells and the probability of both cell types being infested increased over the season (Table 1). A significant colony effect was recorded. In contrast, abundance and intensity were not significantly effected by cell size, but both variables increased over time and colony effect was significant (Table 1). Furthermore, cell size had no effect on the number of female or male offspring per reproductive cycle.

Figure 1
Natural mite fall in test colonies during Jul-Sept 2007

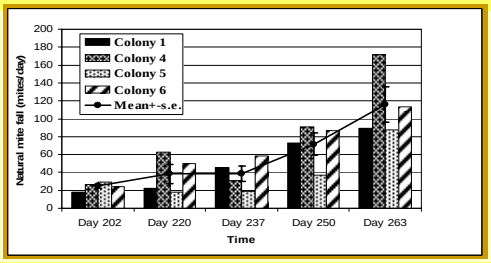


Table 1
The prevalence, intensity and abundance of mother mites in four test colonies during Jul-Sept 2007

(a) Prevalence					
	B ± SE	Wald X^2	df	P	Exp(B)
Cell size	0.216 ± 0.097	5.005	1	0.025	1.242
Colony		13.163	3	0.004	
Time	0.046 ± 0.002	360.9	1	<0.001	1.047
Colony X Time		14.291	3	0.003	
(b) Intensity					
		Wald X^2		P	
Cell		1.217		0.27	
Colony		35.456		<0.001	
Time		21.443		<0.001	
Cell X Colony		10.335		0.016	
(c) Abundance					
		Wald X^2		P	
Cell size		0.356		0.5	
Colony		13.041		0.005	
Time		315.545		<0.001	
Cell X Colony		11.048		0.011	
Cell X Time		0.353		0.553	
Colony X Time		12.134		0.007	
Cell X Colony X Time		12.432		0.014	

Conclusions

The was no evidence that a reduced brood cell size contribute to a reduction in the infestation or reproductive success of *Varroa destructor* in honeybee colonies under European conditions