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Viability of honeybee colonies exposed to sunflowers grown from seeds treated with the neonicotinoids thiamethoxam and clothianidin.

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1 **Viability of honeybee colonies exposed to sunflowers**  
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16 **Abstract**

17 In this study, honeybee colonies were monitored in a field study conducted on  
18 sunflowers grown from seeds treated with the systemic neonicotinoids thiamethoxam or  
19 clothianidin. This field trial was carried out in different representative growing areas in  
20 Spain over a beekeeping season. The health and development of the colonies was  
21 assessed by measuring factors that have a significant influence on their strength and  
22 overwintering ability. The parameters assessed were: colony strength (adult bees), brood  
23 development, amount of pollen and honey stores and presence and status of the queen.  
24 The concentration of residues (clothianidin and thiamethoxam) in samples of beebread  
25 and in adult bees was at the level of  $\text{ng}\cdot\text{g}^{-1}$ ; in the ranges of  $0.10 - 2.89 \text{ ng}\cdot\text{g}^{-1}$  and  $0.05 -$   
26  $0.12 \text{ ng}\cdot\text{g}^{-1}$ ;  $0.10 - 0.37 \text{ ng}\cdot\text{g}^{-1}$  and  $0.01 - 0.05 \text{ ng}\cdot\text{g}^{-1}$ , respectively. Multivariate models  
27 were applied to evaluate the interaction among factors. No significant differences were  
28 found between the honeybee colonies of the different treatment groups,  
29 either exposed or not to the neonicotinoids. The seasonal development of the colonies  
30 was affected by the environmental conditions which, together with the initial strength of  
31 the bee colonies and the characteristics of the plots, had a significant effect on the  
32 different variables studied.

33

34 **Keywords:** neonicotinoid residues, honeybee colony, higher tier study, sunflower crop

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