Antibiotic Resistance genes in honey bees (*Apis mellifera ligustica*) from Umbria, Italy

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Background

The honey bees can serve as bioindicators of the state of pollution of the environment in which they live. Furthermore, they can act as collector and disseminator of antibiotic resistance genes; the use of antibiotics for therapeutic purposes in humans and animals over time can be associated with the presence of antimicrobial residues in the environment and, in some cases, accumulated by honey bees. The use of antibiotics has exerted selective pressure in recent years to determine the onset and spread of antibiotic resistance genes, some of which are responsible for the therapeutic failure of infectious diseases in humans and animals.

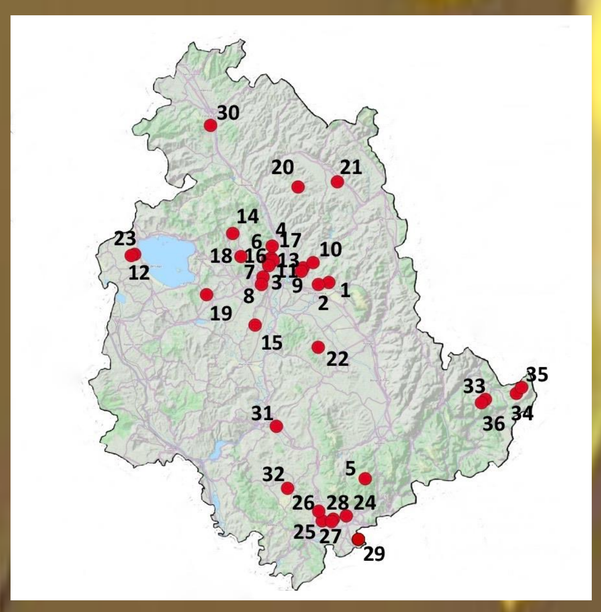

Figure 1. Map of the apiculture sites.

Figure 2. Gel electrophoresis of the PCR products.

Objective

This study aimed to assess the occurrence of antibiotic resistance genes in honey bees.

To this end, the prevalence of 4 selected genes [tet(M), aac(6')-aph(2”), blaZ and sul1] coding for resistance to tetracycline, aminoglycosides, beta-lactams and sulfonamide was determined.

Materials and Methods

36 samples of 10 bees each were collected in 35 Umbrian apiculture sites (Italy). After DNA extraction, the PCR was performed for the following target genes: tet(M), aac(6')-aph(2”), blaZ and sul1.

SAMPLE	APH	BLAZ	TETM	SUL-1	SUL-2
1	-	+	-	-	+
2	-	-	-	+	+
3	-	-	-	-	-
4	+	+	+	+	+
5	-	-	+	+	+
6	-	+	-	+	+
7	-	+	-	+	+
8	-	-	-	+	-
9	-	-	-	-	-
10	-	+	+	+	-
11	-	-	-	-	-
12	-	-	-	-	+
13	+	-	-	-	-
14	-	-	-	-	-
15	-	-	-	-	+
16	-	-	-	-	-
17	-	-	-	-	-
18	-	-	-	-	-
19	-	-	-	-	-
20	-	-	-	-	-
21	-	-	-	-	+
22	-	-	-	+	-
23	-	-	-	-	-
24	-	-	-	-	+
25	-	-	-	-	+
26	-	-	-	-	+
27	-	-	-	-	+
28	-	-	-	-	+
29	-	-	-	-	+
30	-	-	-	+	-
31	-	+	-	-	+
32	-	-	-	-	+
33	-	+	+	+	+
34	-	+	-	-	-
35	-	-	-	-	-
36	-	-	-	-	-

Figure 3. Table with the results of the analysis.

Results

Of the samples being tested, three were positive for tet(M) gene (8,33%), two were positive for aac(6’)-aph(2’’) gene (5,56%), six for blaZ gene (16,67%), ten for sul1 (27,78%) and eight samples showed multiple drug resistances.

Conclusions

This study contributes to the monitoring of the presence of antibiotic resistance genes in insects which are not directly treated with antibiotics but which can be exposed though the environment. The honey bee represents in fact, an environmental bioindicator and a sentinel of the presence of antibiotic resistance genes in the ecosystem, suggesting a prudent use of antimicrobial compounds.