

Effect of Feeding by Aromatic Honey Anise (*Pimpinella anisum*) & Fennel (*Foeniculum vulgare*) and Marjoram (*Origanum majorana*) on Nosema Disease

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ABSTRACT

Nosema disease is regarded one of the causes of Colony Collapse Disorder (CCD). Nowadays, aromatic honey has significant effect in honey-bee diseases and it is not unusual, feeding honey bees by aromatic honey for Nosema disease control. Results revealed that feeding honey bee on Anise honey by concentration 150 g/colony have the lowest infection percentage 28.78% then Anise 100 g/colony 32.94% and Anise 50 g/colony 37.89% compared with control 65.11%. In the second place Fennel honey general mean 43.11%. Finally, Marjoram honey general mean 62.76%.

On the other hand, the effect of these aromatic honey samples back to that antioxidant activity of the three types of honeys represented in flavonoids value. The chemical analysis of honey samples was carried out to clarify the beneficial compounds that have an effect on Nosema disease. Results showed that the highest flavonoids value was found in Anise honey (14.02) followed by Fennel honey (9.11) and finally Marjoram honey (8.24).

KEYWORDS: Honeybee – nosema - aromatic

1. INTRODUCTION

Nosema disease is a parasitic disease infects adult bees of *Apis mellifera* L. (Milbrath *et al.*, 2015) and belonging to fungal honeybee diseases (Moshaverinia *et al.*, 2012). This disease causes great losses in honey bee colonies around the world (Jara *et al.*, 2015 and Roussel *et al.*, 2015). Also, Bromenshenk *et al.*, 2010 revealed that Nosema disease was considered the most important reasons of CCD, Moreover, Malone *et al.*, 2001 cleared that spores of Nosema lasted viability after feeding bees on multifloral honey. The most plants that have potential feeding importance to honey bee are belonging to medicinal, aromatic and ornamental plants with 35.2% of total plants Abou-shaara 2015. Bees collect nectar that secreted by glands at the base of the flowers. The nectar has sucrose sugar with some laevulose, dextrose, moisture content and aromatic substances which have big role in microorganism control. Furthermore, honey combs can be stored and given to colonies as required (Doug 2000). Aromatic compounds have a big role against microorganisms causing diseases to humans, animals and plants in addition to its considered that safely used as an alternative to pesticides (Altundağ & Aslım, 2005). Also, Mert *et al.*, 2007 showed that Nosema disease control depending on using aromatic

compounds as well as other honeybee diseases and enemies such as Varroa mite, tracheal mite American foulbrood, European foulbrood and wax moths.

2. MATERIALS AND METHODS

2.1. Honey preparation:

Anise (*Pimpinella anisum*), Fennel (*Foeniculum vulgare*) and Marjoram (*Origanum majorana*) honey syrup:

Three concretions 50g, 100g and 150g from each of Anise, Fennel and Marjoram honey for each colony. Each concentration was applied in 250 ml water weekly. Control colonies fed by sugar syrup (2 sugar: 1 water, w/v).

2.2. Experimental bees:

The present study was carried out from November 2019 to April 2020. Twenty-seven of hybrid carniolan honeybee colonies (*Apis mellifera*) were placed on Minia region. Samples of 100 adult honeybee workers were collected randomly from the front of entrances of the hives (Shimanuki & Knox, 2000; Vongpakorn & Neramitmansook, 2003 and Matasin *et al.*, 2012). Samples were taken monthly

and adult bees were crushed individually with distilled water in a mortar (Topolska & Hartwig, 2005 & Lotfi *et al.*, 2009). After preparation on a glass slide, each sample was examined by a light microscope at x400 magnification for the presence of Nosema spores (Razmaraii *et al.*, 2013). The percentage of infected bees was determined according to the following equation (Topolska, & Hartwig, 2005).

$$\text{Infection \%} = 100 \times \frac{\text{No. of infected bees}}{\text{Total no. of bees}}$$

Data were statistically analyzed by using least significant range (Duncan, 1955). Chemical analysis was carried out according to Kaspar, et al. 2006.

3. RESULT AND DISCUSSION

Data in Table (1) and Figure (1 and 2) showed that the mean efficiency of the tested aromatic honeys in

reducing Nosema infection could be arranged in the following descending order; Anise 150g > Anise 100g > Anise 50g > Fennel 150g > Fennel 100g > Fennel 50g > Marjoram 100g > Marjoram 150g > Marjoram 50g > control resulted in 28.78%, 32.94%, 37.89%, 38.11%, 42.39%, 48.83%, 62.28%, 62.39%, 63.61% and 65.11%, respectively. Concluded from this data feeding by Anise with concentration 150g honey showed the lowest infection percent (28.78%) by Nosema compared with the other treatments.

By other words, results in Fig. (2 and 3) showed that using Anise honey helped in minimizing Nosema general mean infection 33.20% then Fennel honey 43.11% finally Marjoram honey 62.76%.

Also, Statistical analysis showed significant different between feeding by from Anise, Fennel and Marjoram honey because most means followed by different letters. These data agreement with Gashout & Guzmán-Novoa 2009 and Lin et al., 2020.

Table 1. Monthly Nosema infection percentage of honeybee colonies which fed Marjoram honey (50g & 100g and 150 g/ colony) from November 2019 to April 2020

	Anise			Fennel			Marjoram			Control
	50g	100g	150g	50g	100g	150g	50g	100g	150g	
November	37.67 Opq	37.00 pqr	38.00 nopq	37.00 pqr	37.33 pqr	36.67 qrs	37.67 opq	38.67 nopq	38.33 nopq	37.33 pqr
December	31.33 u	26.33 wx	20.67 y	44.33 ij	35.00 rs	31.67 U	58.33 f	54.00 h	55.67 gh	59.00 f
January	40.33 lmn	36.67 qrs	31.00 uv	54.67 gh	43.67 jk	43.67 Jk	81.33 b	81.67 ab	80.67 b	82.33 ab
February	32.33 tu	28.67 vw	25.67 x	63.00 e	41.33 klm	37.33 pqr	81.33 b	81.33 b	81.33 b	84.00 a
March	46.33 i	36.67 qrs	34.33 st	54.00 h	54.33 h	44.33 Ij	68.00 d	63.67 e	65.00 e	71.00 c
April	39.33 mnop	32.33 tu	23.00 y	40.00 mno	42.67 jkl	35.00 Rs	55.00 gh	54.33 h	53.33 h	57.00 fg
Mean	37.89	32.94	28.78	48.83	42.39	38.11	63.61	62.28	62.39	65.11
General mean	33.20			43.11			62.76			

For each row, means followed by the same letters are not significantly different at 5% level of probability (Duncan multiple range test)

*L.S.R. Least significant range (Duncan range at 5%).

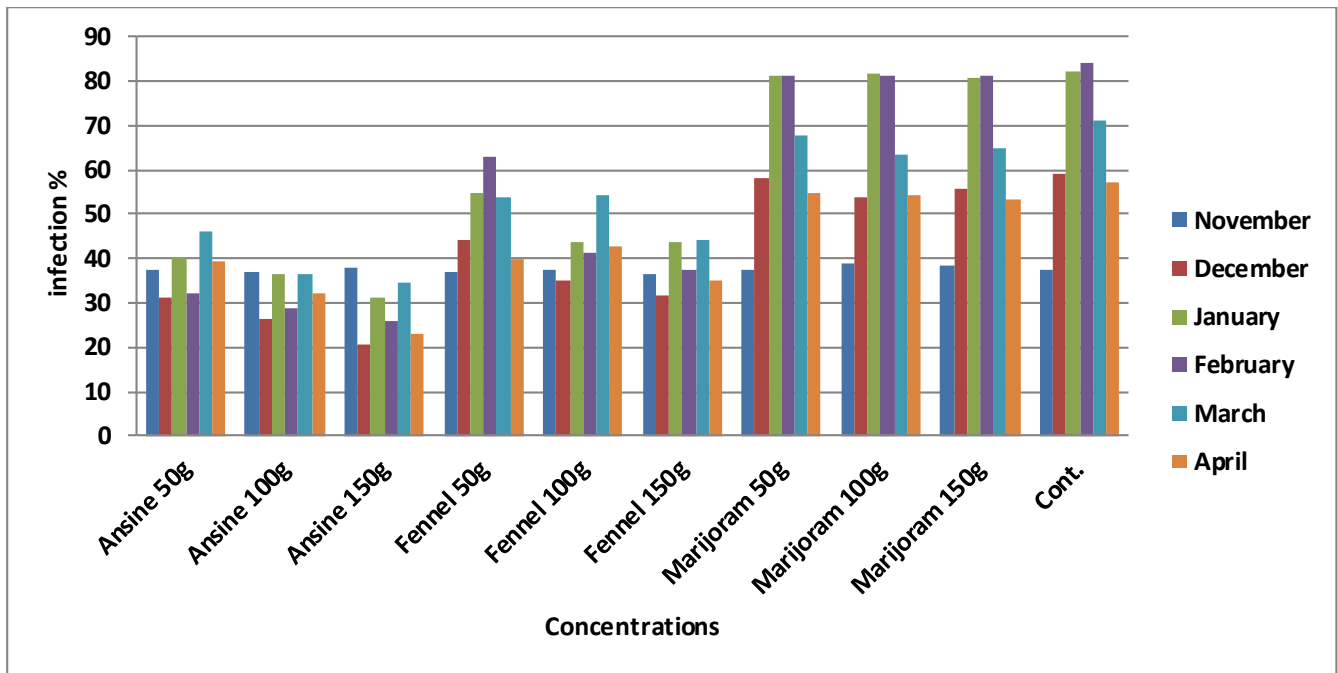


Figure 1. Mean monthly Nosema infection percentage of honeybee colonies which fed different concentrations of aromatic honey (50g & 100g and 150 g/ colony) all over study period from November 2019 to April 2020.

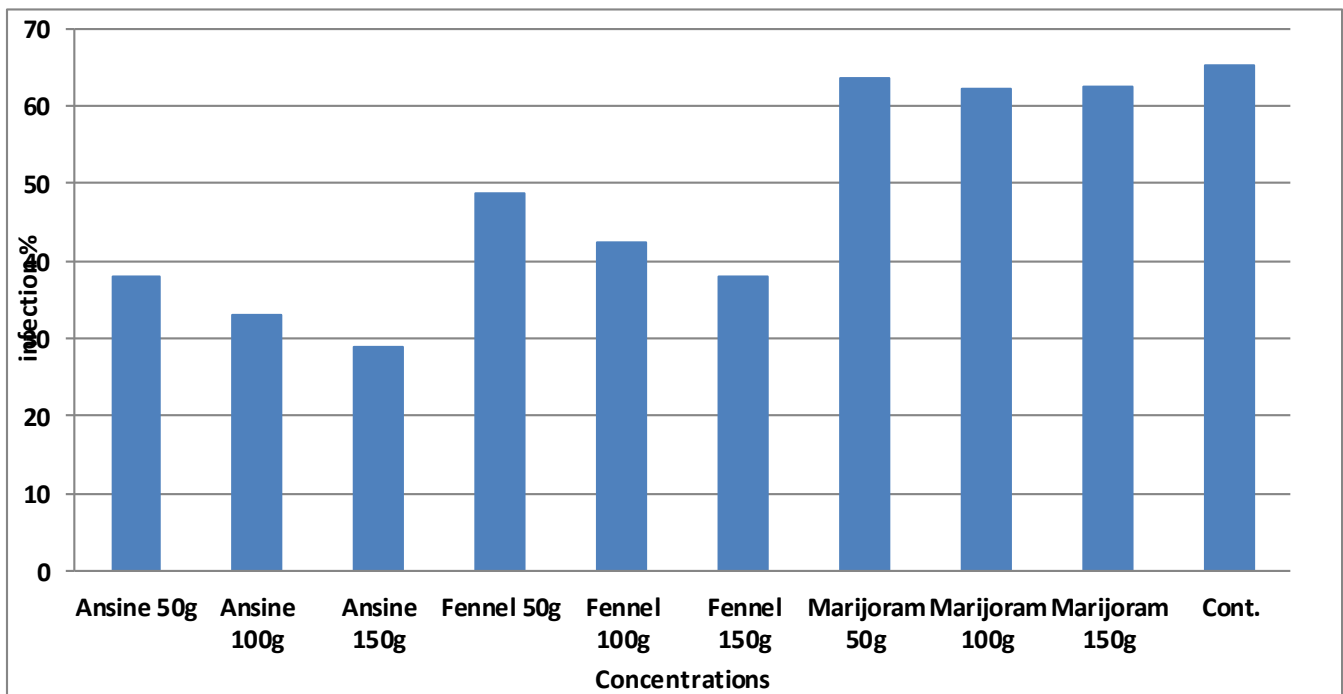


Figure 2. Mean Nosema infection percentage of honeybee colonies which fed by different aromatic honey from November 2019 to April 2020.

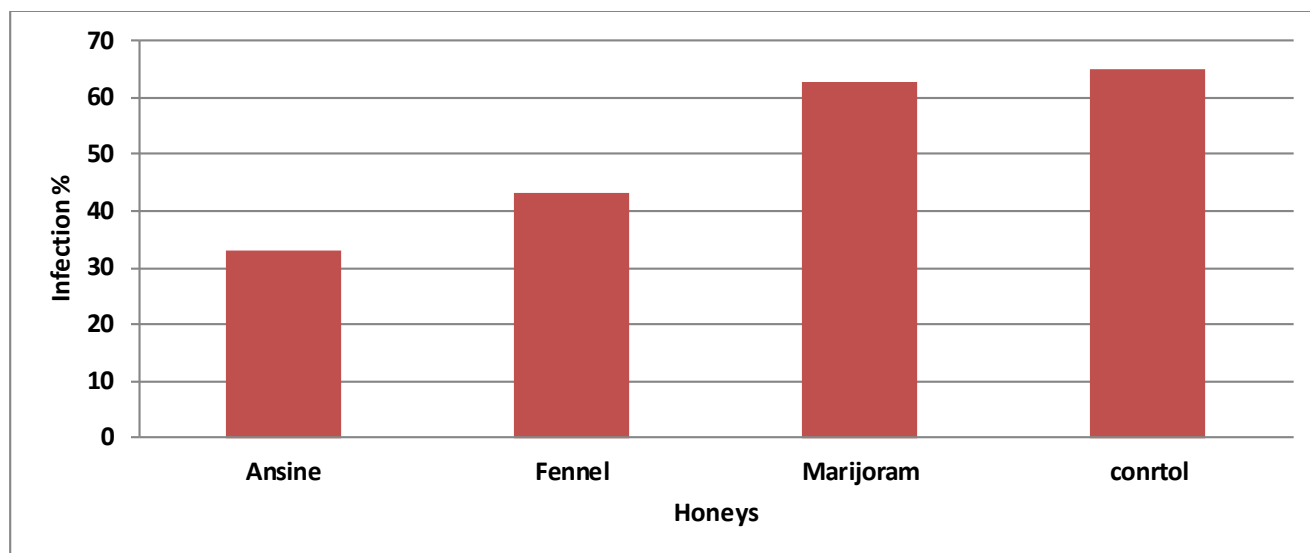


Figure 3. General mean of Nosema infection percentage of honeybee colonies which fed by different aromatic honey from November 2019 to April 2020.

Chemical analysis of teted honeys presented in table (2) and Figure (4) showed that Anise honey record the lowest concentration of TSS, glucose, sucrose, HMF and PH (79.56, 34.01, 1.36, 12.26 and 3.3, respectively) additionally, chemical analysis proved that the samples conform to the Codex Alimntarius (1998), Saudi standard (1990)' Gulf standard (1992) and the Egyptian standard (1990).

Also, data in table (2) and Figure (3) pointed that antioxidant activity of the three types of honeys represented in flavonoids was found higher in Anise honey (14.02) followed by, Fennel honey (9.11) and finally Marjoram honey (8.24). these results are in accordance with that reported by Kaspar, *et al.* 2006.

Table 2. Chemical analysis of Anise, Fennel and Marjoram honeys

Parameters	Samples		
	Anise honey	Fennel honey	Marjoram honey
TSS (%)	79.56	81.85	80.19
Moisture	10.44	8.15	9.91
Glucose (%)	34.01	35.23	34.63
Sucrose (%)	1.36	2.86	2.22
Fructose (%)	38.36	34.53	35.51
HMF (mg/kg)	12.26	18.43	21.00
PH	3.3	3.68	4.58
Total Flavonoids	14.02	9.11	8.24

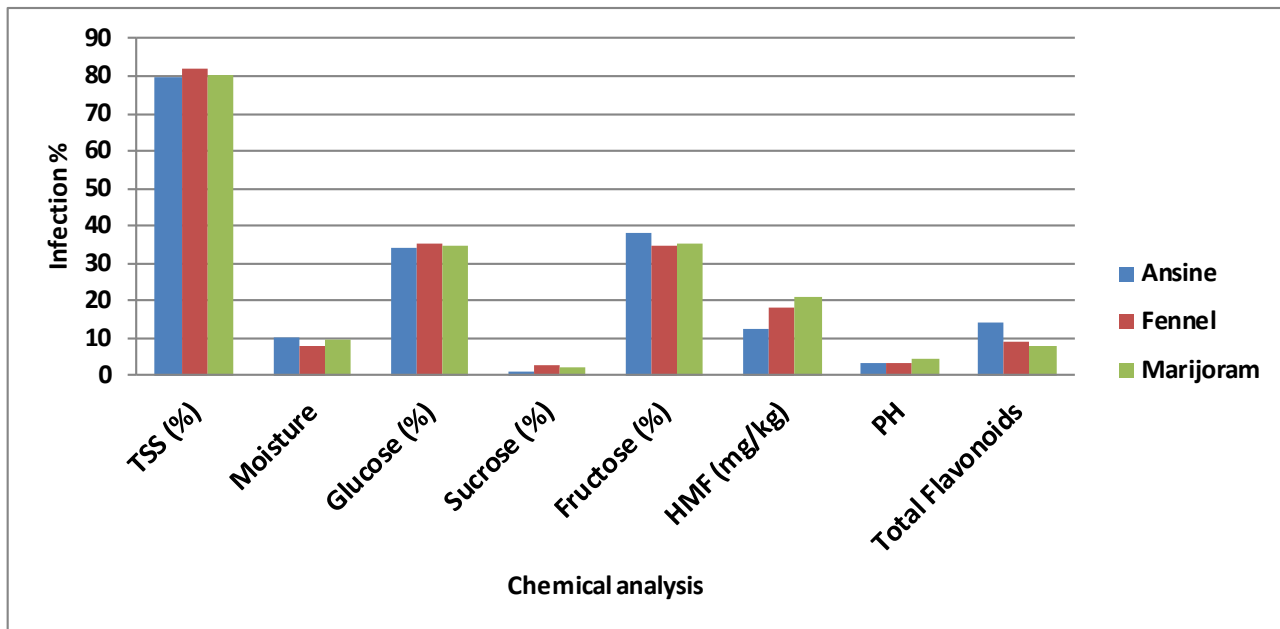


Figure 4. Chemical analysis of tested honeys Anise, Fennel and Marjoram

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الملخص العربي

تأثير التغذية بالاعسال العطرية (اليانسون، الشمر والبردقوش) علي مرض النوزيما

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يعتبر مرض النوزيما أحد أسباب انهيار طوائف نحل العسل. في الوقت الحاضر، ووجد أن لعسل النباتات العطرية تأثير كبير في مكافحة أمراض نحل العسل وليس من المعتاد تغذية نحل العسل بالعسل العطري في لمكافحة مرض النوزيما. أوضحت النتائج أن تغذية نحل العسل على عسل اليانسون بتركيز 150 جرام حقق أقل نسبة إصابة 28.78% ثم عسل يانسون بتركيز 100 جرام 32.94% وعسل يانسون 50 جرام 37.89%. مقارنة مع الكنترول الذي حقق نسبة إصابة 65.11%. وفي المرتبة الثانية عسل الشمر بمتوسط إصابة 43.11%. وأخيراً عسل البردقوش بمتوسط إصابة 62.76%.

من ناحية أخرى يعود تأثير العسل العطري إلى نشاط مضادات الأكسدة لأنواع العسل الثلاثة المتمثلة في مركبات الفلافونويد. تم إجراء التحليل الكيميائي لعينات العسل لتوضيح المركبات المفيدة التي لها تأثير على مرض النوزيما. أظهرت النتائج أن أعلى قيمة لمركبات الفلافونويد وجدت في عسل اليانسون (14.02) يليه عسل الشمر (9.11) وأخيراً عسل البردقوش (8.24).

الكلمات المفتاحية: نحل العسل - نوزيما - عطري