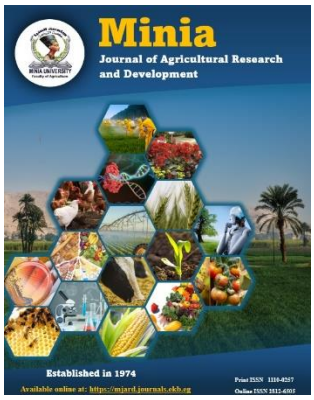
Minia J. of Agric. Res. & Develop., Minia Univ., Vol. 44 (4): 721 -730, 2024

Minia Journal of Agricultural Research and Development

Journal homepage & Available online at:
https://mjard.journals.ekb.eg



The effect of anise (*Pimpinella anisum*) flowers on production honey bee (*Apis mellifera* L.) brood area and colony strength

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Received: 29 Dec. 2024 Accepted: 11 Jan. 2025

ABSTRACT

Nowadays, aromatic plants such as Anise have significant effect in honey bee colony building because it's usually flowering at the beginning of spring. This study applied in two seasons 2022 and 2023 and it's aimed to study the effect of located honey bee colonies in anise flower on brood production and colony strength. Data showed that located honey bee colonies in Anise flower area record the highest mean sealed brood area were 596.6 and 121.6 inch^2 which recorded at 25th March, 15th. Also, at general colonies located at Anise flower were set in first place in mean sealed brood area during the spring (327.3 and 72.53 inch^2). On the other hand, results showed that the highest general mean of combs covered by bees (colony strength) was 6.27 combs which recorded with colonies located at Anise flower area in season 2022. While, the lowest of general mean covered combs (4.58) were recorded in colonies were located in other area. Moreover, middle of April month record the highest mean covered combs which 9, 6 and 8.3. In addition to colonies were the most weak in middle of February month in colonies located in flora without Anise flower (3.6 covered combs).

Keywords: Honeybee – Anise – colony - brood

INTRODUCTION

Honeybees, the most common and important pollinators of plants, are essential to agricultural output and pollination services **(Botías et al.,2012 and Mahmood et al.,2023).** Aromatic compounds are thought to be a safe substitute for pesticides and have a significant effect on microorganisms that cause diseases in humans, animals, and plants **(Altundag and Aslım, 2005 & Kadhim 2022).** Furthermore, honey, royal jelly, bee wax, propolis, pollen, and venom—all of which are utilized by humans in the culinary, cosmetics, and medicinal industries—are among the honeybee's economically significant products. They are effective in

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treating several kinds of cancer and COVID-19, which has had a major impact on world health **(Popovska et al ., 2021 ; Akongte et al ., 2023 ; and Loukas, P. and Maria, T., 2023).** At the base of the flowers are glands that release nectar. Bees gather nectar. The nectar contains moisture, sucrose sugar, some laevulose and dextrose, and aromatic compounds that are important for controlling microorganisms. Additionally, honey combs can be kept and distributed to colonies as needed **(Doug 2000** and **Darwish, M. G.(2021).).** Two trials in this study examine the connection between the honey bee, *Apis mellifera* L., colony condition and individual foraging behavior. The first experiment looks at the connection between individual workers' pollen gathering and colony brood levels. The behavioral reaction of individual nectar foragers to varying colony population levels is investigated in the second experiment, also investigates experimentally how the behavior of individual pollen and nectar foragers in the honey bee, *Apis mellifera* L., is related to the colony status. The hypothesis that individual pollen foragers from colonies with larger brood amounts should put forth more effort to get pollen resources than individual pollen foragers from colonies with lower brood quantities is tested in the first experiment **Eckert et al. (1994).**

MATERIAL AND METHODS

Nine Carnioilan honey bee colonies located in the apiary of Toukh village – Minia governorate, Egypt which anise flowers located. Also, control colonies were located in Tahnasha village – Minia governorate, Egypt which empty from anise flowers. This study applied at two seasons 2022 and 2023. Colonies with same strength (8 wax combs covered by bees), similar environmental conditions, and the same stored food (pollen and honey). The Langstroth hives were used to house the experimental foraging bee colonies.

Measuring brood area: Throughout the season, colonies were examined every twelve days. Using a wired grad frame with 1.0 square inch sections, the brood area was measured using **De Jong (1976)** method.

Colony strength (combs covered with bees):.Number of combs covered with bees was recorded e every twelve days. **(Ramesh and Tanya (2007) & Keith et al. (2013).**

Statistical Analysis: Differences between means were tested for significance (P _ 0.01 significant, two-tailed) by using Student's *t* test **Karl (1895)**

RESULTS AND DISCUSSION

Results in table (1) and Figure (1&2) showed that the highest mean sealed brood area in Anise flower area were 596.6 and 121.6 $inch^2$ which recorded at 25th March, 15th April in seasons 2022 and 2023, respectively. While, the lowest of mean sealed brood area (54.6 and 42.3 $inch^2$) were recorded at 5, 13th February in seasons 2022 and 2023, respectively. On the other hand, control colonies (located without Anise flower) were recorded the highest mean sealed brood area at 5, 25th February (52.3 and 38.3 $inch^2$) in seasons 2022 and 2023, respectively.

Notably, colonies located at Anise flower were set in first place in mean sealed brood area (327.3 and 72.53 $inch^2$ in seasons 2022 and 2023), while honey bee colonies were located in other area didn't include Anise flower recoded the lowest general mean of sealed brood area were 79.85 and 52.53 $inch^2$ in seasons 2022 and 2023, respectively.

These is data are agreement with **Crailsheim and Stotberg (1990)** and **Taha et al., 2009** they found direct effect between plants flower and brood production.

Data in table (2) and Figure (3&4) showed that the highest general mean covered combs by bees were (6.27) combs were recorded with colonies located at Anise flower in season 2022. While, the lowest of general mean covered combs (4.58) were recorded in colonies were located in other area in season 2023. Moreover, middle of April month record the highest mean covered combs which 9, 6 and 8.3, 6 in both location in two seasons 2022 and 2023, respectively. As shown in table (2) and Figure (3&4) colonies were the most weak in middle of February month in colonies located in flora without Anise flower (3.6 covered combs) in season 2023. Data are agreement, **Geslin et al. (2017), Dainat et al. (2020) and Goodrich Goodhue (2020)** they pointed that placing bee colonies in multiple flowers encouraged strength colony be building brood and nectar collecting.

Table (1): Mean sealed brood area (inch^2) for colonies located in Anise flowers and other without Anise set control during season 2022/2023 at Minia region.

2022			2023		
Date	**Brood area (Anise flowers)**	**Control (brood area without Anise flowers)**	**Date**	**Brood area (Anise flowers)**	**Control (brood area without Anise flowers)**
5 February	**54.6**	**52.3**	**13 February**	**42.3**	**40.6**
17 February	**153.3**	**53.3**	**25 February**	**55**	**38.3**
1 March	**263.3**	**66.6**	**9 March**	**59.3**	**41.3**
13 March	**410**	**81.6**	**21 March**	**64**	**55**
25 March	**596.6**	**103**	**3 April**	**93**	**68**
12 April	**486**	**122.3**	**15 April**	**121.6**	**72**
Mean	**327.3**	**79.85**	**Mean**	**72.53**	**52.53**
T test Calculated	**3.336**		T test Calculated	**2.957**	
Probability (P)	**0.0206**		Probability (P)	**0.0316**	

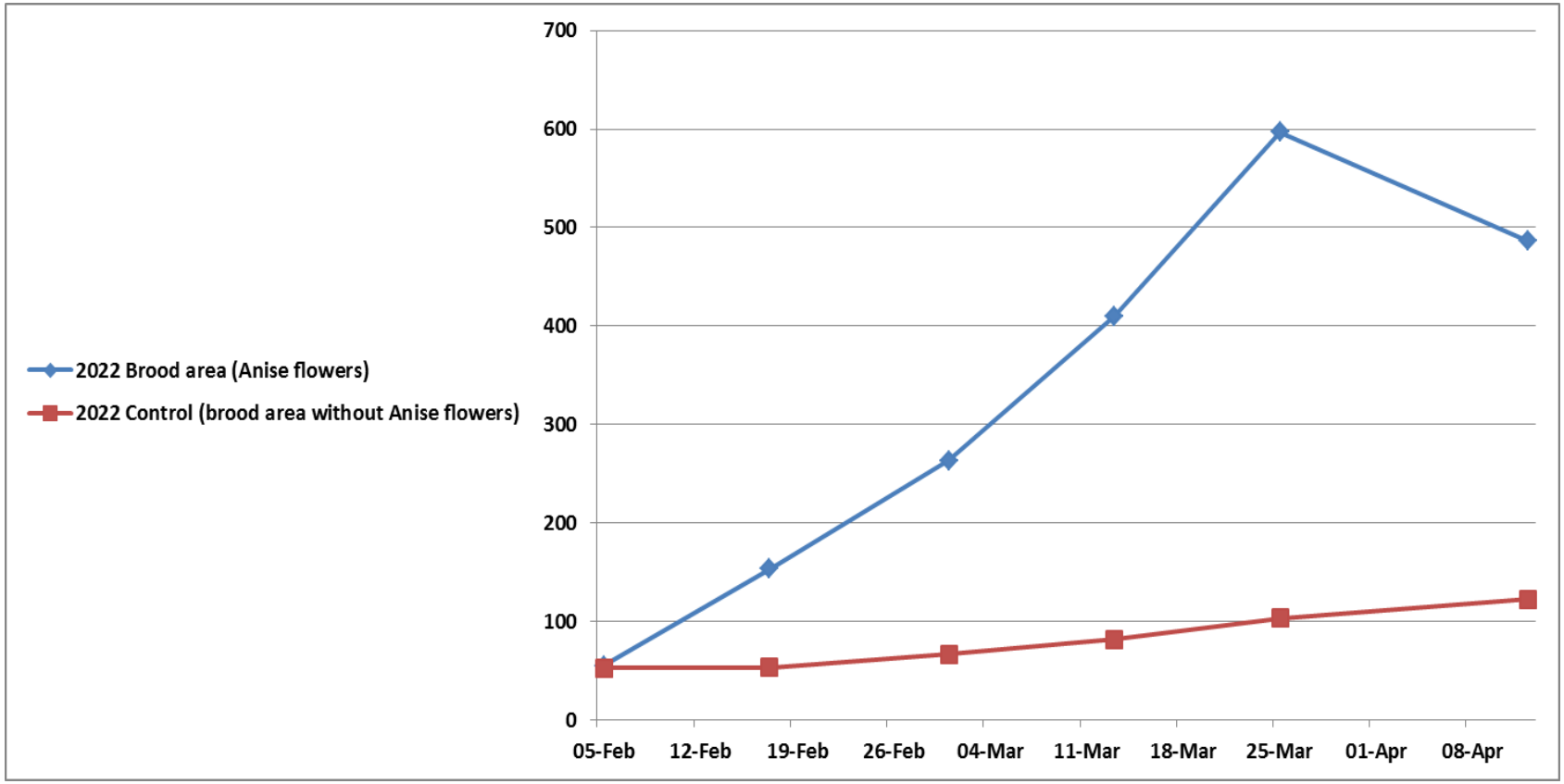

Figure (1): Mean sealed brood area (inch^2) for colonies located in Anise flowers and other without Anise set control during season 2022 at Minia region.

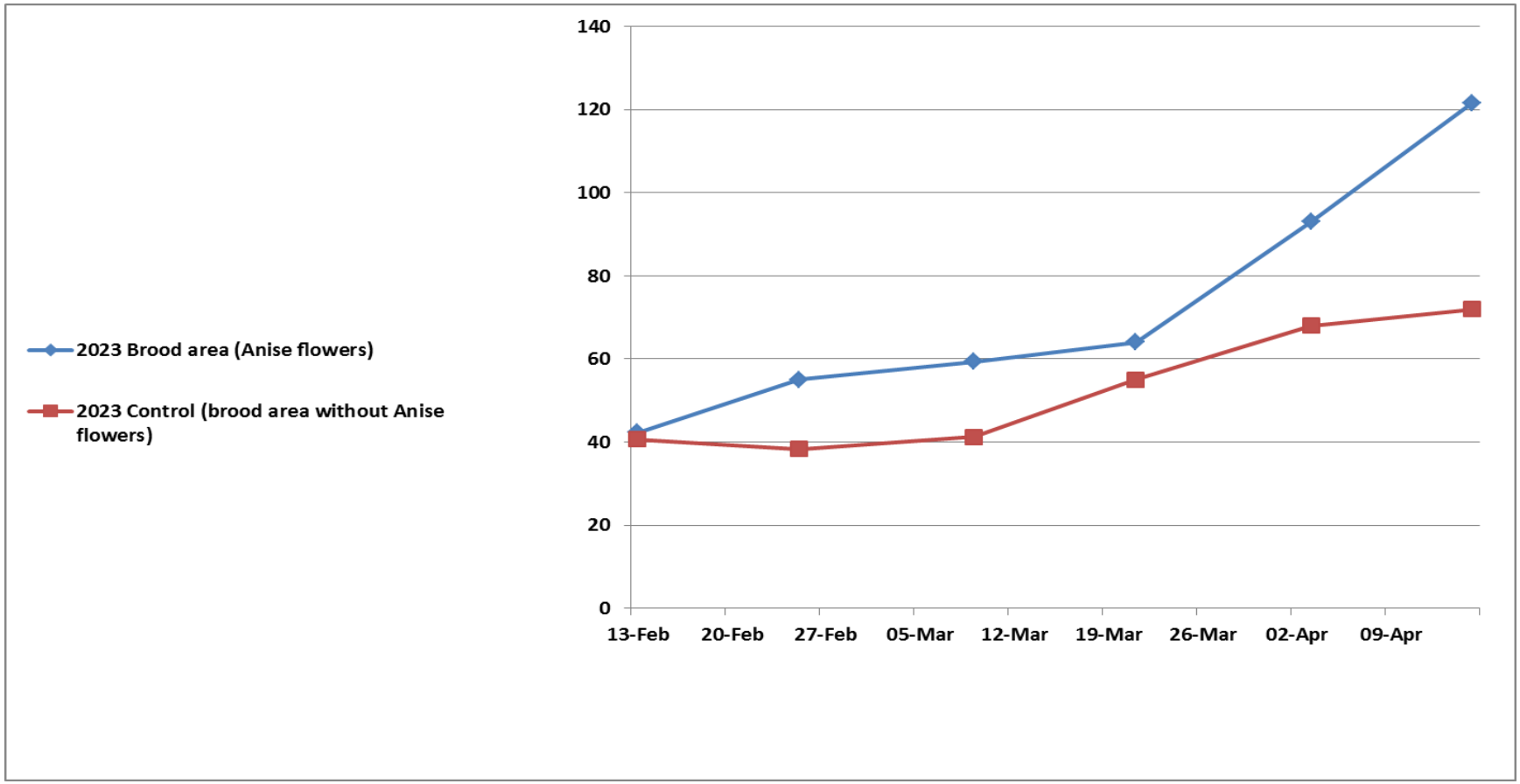

Figure (2): Mean sealed brood area (inch^2) for colonies located in Anise flowers and other without Anise set control during season 2023 at Minia region.

Table (2): Mean colony strength (N. covered combs) for colonies located in Anise flowers and other without Anise set control during season 2022/2023 at Minia region.

2022			2023		
Date	**N. covered combs (Anise flowers)**	**Control (N. covered combs without Anise flowers)**	**Date**	**N. covered combs (Anise flowers)**	**Control (N. covered combs without Anise flowers)**
5 February	**4**	**4**	**13 February**	**4**	**3.6**
17 February	**4.3**	**4**	**25 February**	**4**	**4**
1 March	**6**	**5**	**9 March**	**5**	**4.3**
13 March	**7**	**4.6**	**21 March**	**5.3**	**4.6**
25 March	**7.3**	**5.6**	**3 April**	**6**	**5**
12 April	**9**	**6**	**15 April**	**8.3**	**6**
Mean	**6.27**	**4.87**	**Mean**	**5.43**	**4.58**
T test Calculated	**2.902**		T test Calculated	**2.646**	
Probability (P)	**0.0337**		Probability (P)	**0.0456**	

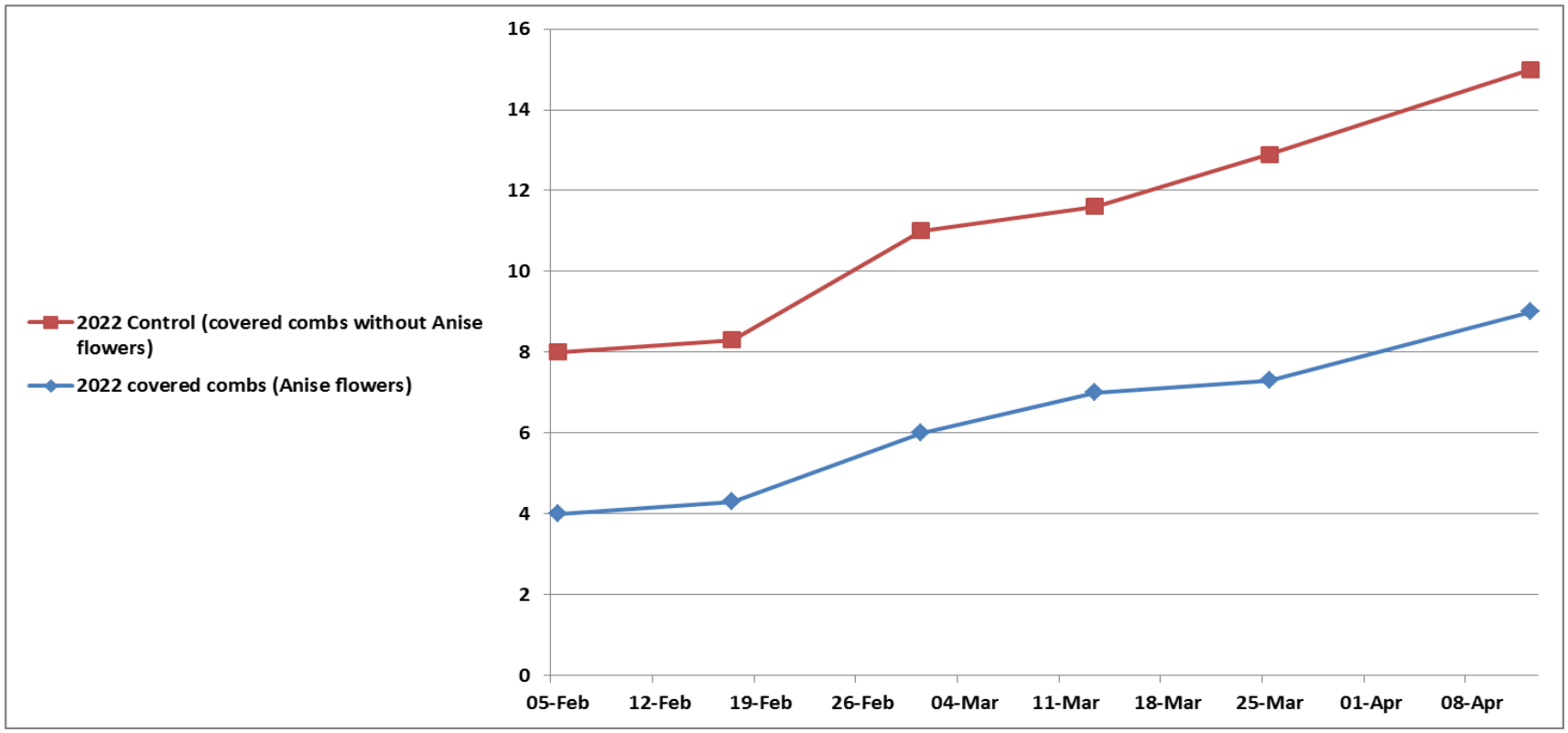

Figure (3): Mean colony strength (N. covered combs) for colonies located in Anise flowers and other without Anise set control during season 2022 at Minia region.

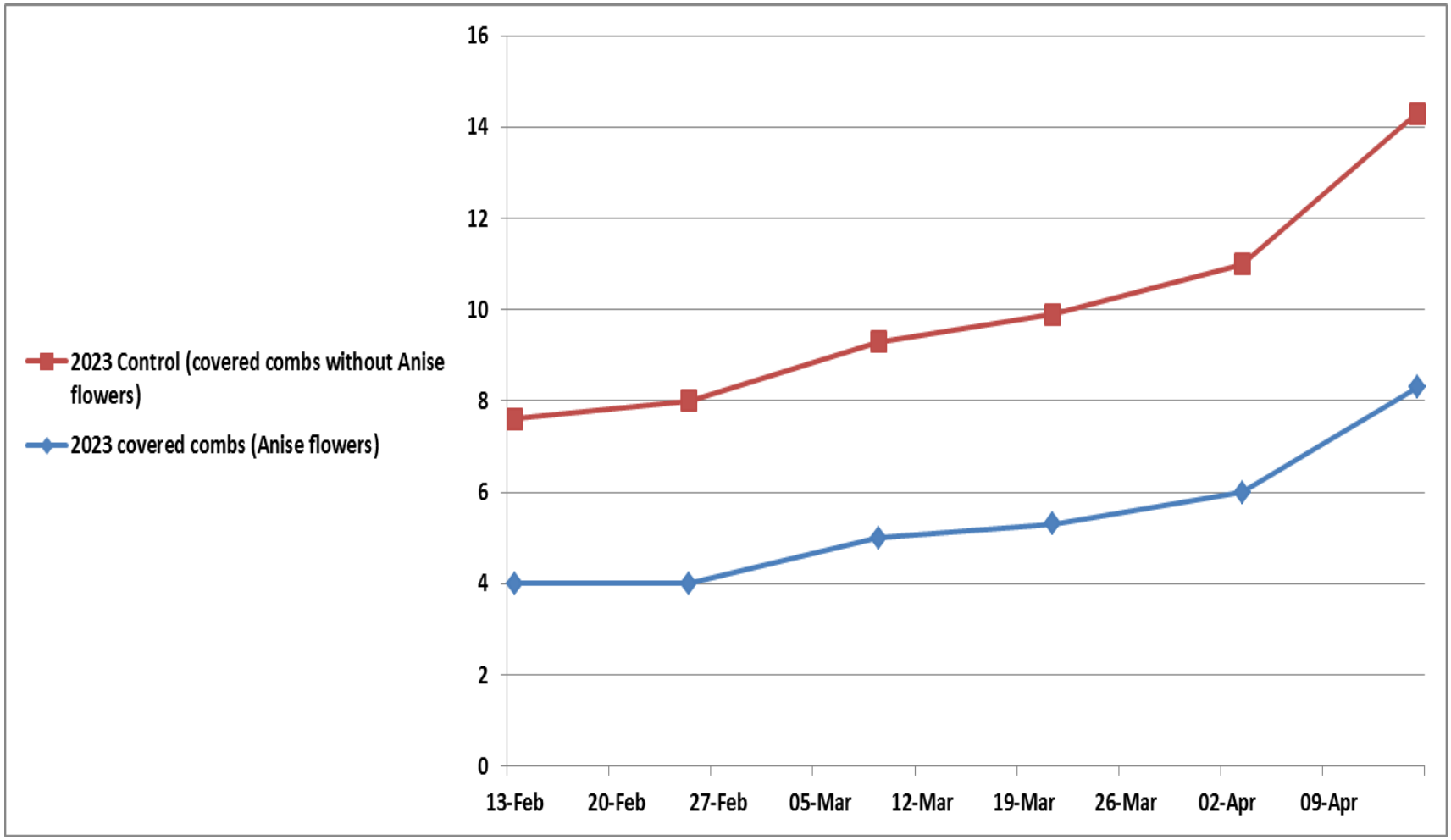

Figure (4): Mean colony strength (N. covered combs) for colonies located in Anise flowers and other without Anise set control during season 2023 at Minia region.

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الملخص العربي

تأثير ازهار اليانسون على إنتاجية نحل العسل من مساحة حضنة وقوة الطائفة

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في الوقت الحاضر النباتات العطرية مثل اليانسون تأثير كبير في بناء طوائف نحل العسل لأنه عادة ما يزهر في بداية الربيع. تم تطبيق هذه الدراسة في موسمين ٢٠٢٢ و ٢٠٢٣ ، وهدفت هذه الدراسة الى معرفة تأثير وضع طوائف نحل العسل في منطقة ازهار اليانسون على إنتاج الحضنة وقوة الطائفة. أظهرت النتائج أن طوائف نحل العسل الموجودة في منطقة زهرة اليانسون سجلت أعلى متوسط لمساحة الحضنة المغلقة حست بلغت ٥٩٦.٦ و ١٢١.٦ بوصة مربعة والتي تم تسجيلها في ٢٥ و ١٥ مارس. كما أنه الطوائف الموجودة عند منطقة زهرة اليانسون احتلت المرتبة الأولى في متوسط مساحة الحضنة المغلقة خلال فصل الربيع (٣٢٧.٣ و ٧٢.٥٣ بوصة٢). من ناحية أخرى أظهرت النتائج أن أعلى متوسط للاقراص المغطاة بالنحل (قوة الطائفة) كانت متوسط ٦.٢٧ قرص حيث تم تسجيلها مع الطوائف المتواجدة عند منطقة زهرة اليانسون في موسم ٢٠٢٢. بينما سجل أقل متوسط للاقراص المغطاة بالنحل (٤.٥٨) في الطوائف التي كانت تتواجد في مناطق أخرى بخلاف اليانسون. كما سجل منتصف شهر إبريل أعلى متوسط اقراص مغطاة بالنحل وهو ٩ و ٦ و ٨.٣ بالإضافة إلى أن الطوائف الأكثر ضعفا ظهرت في منتصف شهر فبراير في الطوائف المتواجدة في النباتات بدون زهرة اليانسون ٣.٦ قرص مغطى بالنحل.

الكلمات المفتاحية: نحل العسل – اليانسون – طائفة – الحضنة