EFFICIENCY OF INSECT POLLINATORS ESPECIALLY HONEYBEES, *Apis mellifera* L. ON PRODUCTIVITY OF OILSEED RAPE AND SESAME CROPS

By

MOHAMED SALAH ABDALLAH EL-MASARAWY
B.Sc. Agric. Sci. (Plant Protection), Fac. Agric., Cairo Univ., 2004

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ABSTRACT

This work was carried out in the apiary of Experimental Station, Faculty of Agriculture, Cairo University, Egypt. during two successive seasons (06 / 07 & 07 / 08), to evaluate the effect of open pollination on some productive parameters of canola (rapeseed) (*Brassica campestris* L. & *Brassica napus* L.) and two lines of sesame "*Sesamum indicum* L. " (Taka 1 & Taka 2). Also the foraging behavior of honeybee workers throughout day periods (5 times / day) on flowers of the mentioned species and lines was studied.

The obtained results showed that the mean no. of foraging bees / m² / min. on canola flowers were increased gradually and reached to its maximum (9.76 & 9.40 bees / m² / min.) at 12:00 PM during the first and second seasons, respectively. The activity of bees started to decline and reached to its minimum activity at 4:00 PM (2.11 & 1.92 bees / m² / min.) in the same seasons. Nearly the same trend was observed in the case of sesame crop, whereas the corresponding figures were (3.24 & 2.98 bees / m² / min.) at 12:00 PM. and (1.28 & 1.24 bees / m² / min.) at 4:00 PM.

The maximum percentage of nectar collectors from canola flowers occurred at 12:00 PM (76% & 80%) while the minimum percentage occurred at 8:00 AM (6% & 7%) of total honeybee foragers. The opposite trend was noticed for the pollen gathers.

On the other hand, the maximum percentage of nectar collectors from sesame flowers occurred at 2:00 PM (80.50% & 81.50%), and the minimum percentage occurred at 8:00 AM (14.50% & 16.00%), during the first & second seasons, respectively. The opposite trend was noticed for the pollen gathers.

The open pollination in canola resulted in increasing the number of pods / and weight of seeds / individual plant , seeds weight / m², mean estimated yield / feddan, and Seed Index than those produced from caged treatment. Also, the presence of pollinators on canola increased the germination of resulting seeds from 74.00% to 96.00% and from 88.00% to 98.00% for both species of canola. The open pollination in sesame crop nearly gave the same effect on the mentioned parameters of canola and increased the germination percentage from 75.00% & 77.00% to 95.00% & 96.00% for the two lines of sesame.

Although the canola and sesame crops considered as self pollination crops, the open pollination induced an alternation of chemical composition of produced seeds and increased the percentage of total lipids, crude protein and carbohydrates than those produced from caged treatments.

Key words: Rapeseed - Sesame - Honeybee - Pollination - Insect pollinators

DEDICATION

Thanks for great God for guiding me through my thesis which supported me for more learning and scientific research in the future. I dedicate this work to my family whom support me as general in my life, and give me emotional support needed for the study, so I send my sincere thanks to my dear father ***Dr. Salah Abd Allah****, my dear mother* ***Dr. Zakia El-Sherbeny****, and my dear brother* ***Dr. Ahmed Salah****. I'm very grateful to my family which gives love, guidance, help, aid, and encouragement to me in this work.*

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اسم الطالب: محمد صلاح المعصراوى **الدرجة:** ماجستير

عنوان الرسالة: فعالية الحشرات الملقحة خاصة نحل العسل على إنتاجية محصولي الكانولا والسمسم

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فرع: الحشرات الإقتصادية **تاريخ منح الدرجة: ٢٠ / ٤ /٢٠١٠**

المستخلص العربي

أجريت هذه الدراسه فى منحل محطة التجارب الزراعيه – كلية الزراعه – جامعة القاهره – مصر ، وذلك خلال موسمين متتاليين، وذلك بهدف دراسة تأثير التلقيح الخلطى على انتاجية نوعين من الكانولا (لفت الزيت) هما *Brassica campestris* L. *& Brassica napus* L. وايضا صنفين من السمسم *Sesamum indicum* L. هما طاقه ١ و طاقه ٢. كذلك تم دراسة نشاط وسلوك شغالات نحل العسل على أزهار المحاصيل سابقة الذكر خلال ساعات النهار المختلفه.

وقد أظهرت نتائج الدراسه ما يلى:

اولا: بالنسبه لنشاط وسلوك سروح النحل: يتضح ان نشاط نحل العسل على أزهار الكانولا يزداد تدريجيا كلما اتجهنا لمنتصف النهار ليصل أقصى تعداد للنحل / متر مربع / دقيقه عند الساعه الثانية عشره ظهرا (٩.٧٦، ٩.٤٠) للموسمين، ثم يتناقص العدد تدريجيا بعد ذلك ليصل الى ادنى حد له عند الساعه الرابعه بعد الظهر(٢.١١، ١.٩٢)، وجد ان نسبة النحل الجامع للرحيق تصل الى ٤٣% ، ووصلت نسبة النحل الجامع لحبوب اللقاح الى ٥٧% فى موسمى الدراسه.

ولوحظ نفس الاتجاه بالنسبه لنشاط سروح النحل على أزهار السمسم فقد وصل أقصى تعداد للنحل / المتر المربع / دقيقه عند الثانية عشره ظهراً(٣.٢٤، ٢.٩٨)، بينما كان أقل تعداد عند الرابعه بعد الظهر(١.٢٨، ١.٢٤). وكذلك كان متوسط نسبة النحل الجامع للرحيق وحبوب اللقاح متساويه تقريبا (٥٠.٧%، ٤٩.٣%) على التوالى فى موسمى الدراسه.

ثانيا: تأثير التلقيح الخلطى على إنتاجية ونوعية البذور: على الرغم من ان الكانولا والسمسم من المحاصيل التى تكون فيها نسبة التلقيح الذاتى مرتفعه، الا ان التلقيح الخلطى أظهر نتائج جيده ذات فروق معنويه لكلا من: عدد القرون وزن بذور / النبات الواحد - محصول المتر المربع الواحد - الانتاجيه المتوقعه من الفدان الواحد - وزن الألف بذره (Seed Index) – عن تلك النتائج المتحصل عليها من معاملة التلقيح الذاتى (داخل الاقفاص) وذلك لكلا من نوعى الكانولا وصنفى السمسم محل الدراسه.

أظهرت النتائج ان للتلقيح الخلطى تأثير ايجابى ملموس على سرعة الانبات ونسبة الانبات فى كلا من الكانولا والسمسم مقارنة بالبذور الناتجه من معاملة التلقيح الذاتى (الاقفاص) .

كذلك اوضحت نتائج التحليل الكيماوى للبذور تفوق معاملة التلقيح الخلطى عن مثيلتها للتلقيح الذاتى فى كلا من(نسبة الدهون الكليه والبروتين الخام والكربوهيدرات) وذلك لكلا من نوعى الكانولا وصنفى السمسم.

الكلمات الدالة: الكانولا(لفت الزيت) - السمسم - نحل العسل - التلقيح الخلطي - الحشرات الملقحه

فعاليـة الحشـرات الملقحـة خاصـة نحـل العسـل علـى إنتاجيـة محصولـي الكانـولا والسمسـم

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في العلوم الزراعية
(حشرات إقتصادية)

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للحصول على درجة

الماجستير

في

العلوم الزراعية
(حشرات إقتصادية)

قســـــم الحشرات الإقتصادية و المبيدات
كليـــــة الزراعـــة
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٢٠١٠

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INTRODUCTION

The rapeseed (canola) is one of the most important oilseed crops in the world where the seed production has reached to 40 million tones during the year of 2000 and ranked as the second largest volume oilseed traded following soybeans. However, until now it was cultivated in small areas (about 2000 feddans and produced 4 thousands tones) in Egypt (Taha, 2007), as a Turnip rape (*Brassica campestris* L.), and Swede rape (*Brassica napus* L.) for oilseed.

These crops are self – fertile and can give good yield without insect pollination, but in presence of pollinators, especially honeybees, it produced greater seed yield than without insect pollinators (Friese and Stark, 1983; Williams, 1985). Also a remarkable improvement on the qualities of seeds was observed with the cross-pollination (Sabbahi *et al*., 2005). Many authors reported that rapeseed plots caged with bees produced greater seed yields than plots caged without bees (Fujita, 1939; Jenkinson *et al*., 1953; Barbier, 1978). They added that when bees are present, plants produce fewer flowers but set a greater proportion of them, show earlier petal fall, have more seeds per pod and that seeds are more even in size and more viable (Meyerhoff, 1958; Radchenko, 1964; Williams, 1984).

The presence of pollinators on canola flowers increases the germination of resulting seeds from 83 % to 96 % (Keven and Eisikawitch, 1990). Also (Karise *et al*., 2004) found that the insect pollinators make positive effects on reduction of flowering period, an acceleration of ripening, an increase of seed germination rate and

increasing of seed yield production by 19 - 25 %. On the other hand the Brassica species are considered as an abundant source of nectar and pollen and very attractive to bees (Free and Nuttal, 1968).

Bell (1984) recorded that chemical composition of canola's oil approximately is 35 - 45 % oil; 25 % protein; 25 % carbohydrates; and 5 % lignin.

Sesame (*Sesamum indicum* L.) is considered one of the most important oil-seeds crops cultivated in different parts of the world, such as India, Sudan, and China, sesame is an annual crop grown in the tropics and sub-tropics for its edible oil extracted from seeds, also these sesame seeds used after hulled to manufactured Tahina and Halawa (Abou-Gharbia *et al*., 2000; Namiki, 1995).

Sesame is usually considered to be a self-pollinated member of the family Pedaliaceae, but several reports indicate that under particular environmental conditions, cross pollination levels of up to 65 % may be reached (Martinez and Quilanton, 1964; Khidir, 1973; and Crane and Walker, 1984). An increased seed set on the exposed plants was also achieved, (Srivastava and Singh, 1968 and Rashad *et al*., 1979).

The flowers of sesame are a good source of nectar and pollen for different insect species, especially honeybees (McGregor, 1976). The chemical composition of sesame's oil approximately is 44 - 58 % oil, 18 - 25 % protein, 12 - 14 % carbohydrates, 5 - 6 % fibers, 5 % ash. (Kahyaoglu and Kaya, 2006; Mohamed, 1998).

This work aims to study the foraging behavior of honeybee workers on flowers of canola and sesame in the period of their blooming. Also, to study the role of insect-pollinators in an improving

the yields of *B. campestris* and *B. napus* on cultivars and sesame crop, such as, seed weight / plant, seed index (weight of 1000 seed), estimated yield per one feddan, calculating germination speed index, germination percentages and chemical analysis of seeds.