

STUDIES ON POLLINATION OF *Nigella sativa* L. IN ASSIUT REGION

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ABSTRACT

*A general survey study of insect pollinators visiting *Nigella sativa* L. blossoms in Assiut region, showed that the collected insects belong to eight orders. Hymenopterous insects formed 56.38 %, *Apis mellifera* L. was the most common Hymenopterous, as it constituted 26.90 %. Insects of orders Coleoptera, Diptera and Lepidoptera came in the second class, forming 16.21, 16.13 and 15.98 % of the total insect count, respectively. While orders Neuroptera, Odonata, Orthoptera and Hemiptera were poorly represented.*

*Regarding seasonal activity of honeybee foragers on *Nigella sativa* L. fields, it was found that the ratio of pollen and nectar foragers was 60.60, 39.34 %, respectively. Daily peak activity of pollen and nectar foragers was detected at 3 p.m.*

The mean weight of 1000 seeds resulted from honeybee pollinated and open pollinated plots revealed a significant increase in comparison with insect-excluded. The mean weight of seeds calculated per feddan was 782.7, 760.8, 650.4 kg for honeybee pollinated plots, open pollinated and insect-excluded, respectively. Percentage of essential oil was nearly similar in three treatments.

Key words: Pollination, *Nigella sativa* L , Assiut region

INTRODUCTION

Black-cumin (*Nigella sativa* L.) is a medicine plant grown for its aromatic seeds and oil use in flavoring food and in medicine. It is cultivated extensively in Upper Egypt, specially in Assiut region. Free (1970) reported that pollination of some medicine plants as black cumin (*Nigella sativa* L.) need more study.

In Egypt, pollinators of medicinal plants were studied by many investigators such (El-Berry *et al.*, 1974, El-Hefny *et al.*, 1979; Hussein and Abdel-Aal, 1982; Hussein, 1983; Atallah *et al.*, 1989b and Haddad and Kharala, 2004).

The present investigation was designed to determine insect pollinators of *Nigella sativa* L. as well as their seasonal and daily activities. Moreover, the foraging activity of honeybee foragers on *Nigella sativa* L. plants was also studied, the effect of pollination on weight of 1000 seeds, estimated seed yield per feddan and oil content of seeds.

MATERIALS AND METHODS

The experiments were carried out at the apiary of the faculty of Agriculture, Assiut, Al-Azhar University during 2005-2006.

Black common (*Nigella sativa* L.) seeds were sown on 10 October 2005. all agricultural practices were made as usual.

At the onset of flowering three treatments were applied as follow: a) untreated plots (2 × 2 m) selected for open pollination as control, b) plots covered with wooden frames covered with plastic screen (14 mesh/insh) to exclude insect visitors, c) plots covered with plastic screen cages as in (b), and provided with honeybee baby nuclei. (For each treatment 3 replicates were selected at random), insects visiting flowering plants were collected during blooming period that started on February 22, and lasted on April 12, 2006. The survey was carried out a day weekly at two-hour intervals, starting at 7 am and lasted to 5 pm in 2 × 2 m area.

The activity of honeybee foragers in gathering *Nigella sativa* L. nectar and/or pollen was carried out a day weekly at 2-hour intervals; i.e, from 7 am to 5 pm by counting the number of honeybee workers collecting nectar and /or pollen per 2 × 2 m. Weight of 1000 seeds (g), estimated seed yield per feddan was recorded. Air dried seeds of the tested plants were used for extraction of oil by distillation method according to A.O.A. C. (1990).

The factorial design was used in the analysis of present results and differences between treatments were compared by L.S.D. and Duncan's multiple range test.

RESULTS AND DISCUSSION

Part 1: Insect pollinators of *Nigella sativa* L. and their foraging behaviour:

***1. General survey of Nigella sativa* L. insect pollinators:**

Insect visitors of *Nigella sativa* L. blossoms were collected a day weekly at two hour intervals, starting at 7 am and lasted to 5 pm allover the blooming period of 2005-2006 season at Assiut region.

General survey of insect pollinators of *Nigella sativa* L. (Tables 1 and 2) indicated that the total number of collected insects was 1339. These visitors were found belonging to 27 insect species of seven insect orders, i.e. Coleoptera (5 species), Odonata (1 species), Orthoptera (1 species), Diptera (5 species), Hemiptera (1 specie), Lepidoptera (7 species) and Hymenoptera (7 species).

The total collected numbers of Coleopterous insects were 217 insects, representing 16.21 % of the total insect count. Daily activity of Colepterous recorded between 7 am to 5 pm, daily peak activity of Colepterous insects was noticed 3 pm (Table 2). *Pachnoda fasciata* was the most abundant Colepterous insects (11.35 %) of the total insect catch.

Neuropterous insects were represented by *Cueta variegata* and *Ischnura senegalensis*, that were very poorly represented, forming 0.07 % of the total insect each. *Euprepacnemis plorans* was the unique representative of order Orthoptera forming 2.46 % of the total insect count.

Tab 1

Tab2

The total collected numbers of dipterous insects were 216 insects, representing 16.13 % of the total insect count. Seasonal peak activity of dipterous insect was recorded during the last week of February. *Syrphus corollae* was the most abundant dipterous insect, forming 10.38 % of the total insect catch. Daily activity of the dipterous insects was noticed allover the day time between 7 am to 5 pm, daily peak activity was detected at 1 pm.

Hemipterous insects were represented by *Aspongopus vidautus* that was poorly represented 0.30 %.

Insects belonging to order Lepidoptera counted 112 insects and constituted 8.38 % of the total insect catch. The peak of seasonal occurrence of lepidopterous insects was detected during the second week of April. *Polymmatous baeticus* was the most dominant, forming 4.63 % of the total insect catch. Daily peak activity of Lepidopterous insects was detected at 11 am.

As shown in Tables 1 and 2, insects belonging to order Hymenoptera represented the major visitors of *Nigella sativa* L. blossoms, as it recorded 755 insects and constituted 56.38 % of the total insect count. Honeybees were the most dominant species among Hymenoptera insects, as they formed 26.96 % of the total insect count. Seasonal activity of Hymenopterous insects was the highest on March 15. Their daily peak activity was detected at 3 pm (Tables 1, 2). Weak correlation was detected between the number of insects visitors and both prevailing air temperature ($r = 0.352$) and RH % ($r = 0.425$).

The effect of insect pollination on some medicinal plants were studied in Assiut and Minia region by many investigators such as (Hussein, 1983; Hussein *et al.* 1989; Omar 1987 and Atallah and Eshban, 1989 a & b).

Part 2: Foraging behaviour of honeybee workers on *Nigella sativa* blossoms:

a. Seasonal activity of nectar and pollen foragers:

As shown in Table 3, the mean number of nectar collectors (17.75 bees/ 2×2 m). Whereas, the number of pollen gatherers (27.38 per 2×2 m). In this concern Hussein (1983) and Omar (1989) indicated that the prevailing temperature and moisture are of great importance in determining the changes in the population activity of both flies and bees. The effect of weather conditions on the activity of insects has been reported by many investigators (Moczar, 1959; Stelleman and Meeuse, 1976 and Yousif-Khalil *et al.*, 1989).

b. Daily activity of nectar and pollen foragers:

Data presented in Table 4 indicated that daily activity of nectar and pollen foragers was started at 9 am. The daily peak activity of nectar and pollen gatherers was detected at 3 pm. These results are in partial accordance with those of Omar (1989) who found the peak activity of flies and honeybees on some medicinal plant in Assiut region was observed between 10 am to 3 pm.

Tab 3-5

Part 3: Effect of open pollination, insect exclusion and honeybee pollination on seed quantity and quality:

1. Weight of 1000 seeds (g):

The result in Table 5, revealed significant increase in the weight of 1000 seeds in open pollinated and in honeybee pollinated plants compared with that in plants prevented from insect visits. These results disagreed with those of Nizar and Kamal (2004) who stated that no difference was found in the weight of 1000 seed; who found the average weight of 1000 seed was the same for both pollination conditions (3.35 g/1000 seeds).

2. Estimated seed yield per feddan:

Obtained results that the estimated seed yield/feddan as a result of open pollination, insect exclusion and honeybee pollination recorded 760.8, 650.4 and 782.6 kg for the three treatments, respectively (Table 5). Statistical analysis cleared that the lowest calculated seed yield/feddan was recorded for insect exclusion, while the highest one was recorded for honeybee pollination. Open pollination showed an intermediate seed yield. Generally, the differences between treatments were significant

The reported increase in seed yield and its correlation with insect pollination, was also reported by many investigators such as Nizar and Kamal (2004) who reported a significant increase (28 %) in the bee pollinated *Nigella sativa* L. as that of the self-pollinated.

3. Essential oil content:

Obtained results indicated that the mean percentage of essential oil *Nigella sativa* L. seeds in open pollinated, insect-protected and honeybee provided plots were nearly similar, the differences between the three treatments were insignificant.

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دراسات على تلقيح الحبة السوداء في منطقة اسيوط – مصر

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تم إجراء حصر للحشرات الملقحة للحبة السوداء في اسيوط فأظهرت الدراسة أن الحشرات التي تم جمعها تتبع ثمان رتب رتبة غشائية الأجنحة هي الأكثر تواجدا حيث بلغت نسبتها ٥٦.٣٨٪ وكان نحل العسل هو الأكثر تعدادا حيث سجل ٢٦.٩٪. وجاءت الحشرات التابعة لكل من رتبة غمدية الأجنحة، ذات الجناحين و حرشفية الأجنحة في المرتبة الثانية مكونة ١٦.٢١، ١٦.١٣، و ١٥.٩٨٪ من جملة الحشرات المجمعة على التوالي بينما كانت رتب شبكية الأجنحة، الرعاشات، مستقيمة الاجنحه و نصفية الأجنحة هي الأقل تواجدا.

بدراسة نشاط الجمع الموسمي لشغالات نحل العسل على أزهار الحبة السوداء اتضح أن نسبة كل من جامعات اللقاح والرحيق ٦٠.٦٠، ٣٩.٣٤٪ على التوالي. ووجد أن قمة النشاط اليومي للشغالات الجامعة للقاح والرحيق عند الساعة الثالثة بعد الظهر.

بالنسبة لوزن ١٠٠٠ بذرة وجد انه في حالة التلقيح المفتوح والمزود بالنحل أكثر معنوية عن المعزولة عن التلقيح – ووزن محصول الفدان من البذور كانت ٧٨٢.٧، ٧٦٠.٨، ٦٥٠.٤ كجم/الفدان لكل من المزود بالنحل والتلقيح المفتوح والمعزول على التوالي – وان نسبة الزيت المستخلص من البذور كانت تقريبا متساوية في الثلاث حالات.