Succession of various insect pollinators/visitors visiting on niger crop (\textit{Guizotia abyssinica} cass.)

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\begin{abstract}
Studies on the succession of various insect pollinators/visitors on niger crop was undertaken during the Rabi 2011-12. Total 15 species of insect pollinators/visitors were found visiting on niger flowers. Amongst the pollinators/visitors, \textit{Apis cerana indica} appeared first on niger flower followed by \textit{Apis florea}, \textit{Danaus chrysippus}, \textit{Eristalis sp.}, \textit{Pelopidas mathias}, \textit{Apis dorsata}, \textit{Musca domestica}, \textit{Nazara virudula}, \textit{Dysdercus cingulatus}, \textit{Leptocorisa acuta}, \textit{Amata passelis}, \textit{Chrysomya bezziana}, \textit{Coccinella septempunctata}, \textit{Vespa cincta} and \textit{sarcophaga} sp. They were found visiting on niger flower throughout the blooming period.

\textbf{Key Words:}
Niger crop, Succession of insect pollinators/visitors

\textbf{How to view point the article:}
\end{abstract}

\textbf{INTRODUCTION}

Niger (\textit{Guizotia abyssinica} cass.) is an important oilseed crop which is cultivated in Ethiopia and India. The common name of niger sorguja (Bengali), sarguza (Oriya), alashi (Telugu), ramtal (Hindi) and ramtil in Punjabi of various regional Indian languages. It is a branched annual herbaceous plant, grows up to a height of 1.8 meter. The niger plant complete its life cycle in 3-4 months. The yellow flower heads of 2-3 cm develop in the leaf axil, in a cluster of two to five.

This crop is widely adopted to all types of soil in Chhattisgarh and also in India, it is commonly grown on poor and acidic soils or on hilly slopes that are very low in fertility. The area of this oilseed crop in Chhattisgarh is 1.08 lakh hectare with the production of 0.27 lakh tones and productivity is 260 kg ha\textsuperscript{-1} (Anonymous, 2011).

There is good demand of niger seed in domestic as well as in foreign market due to its valuable use in different sector of agriculture and applied industries. The crop is totally dependent on external agents for its reproductive development by way of pollination through external agencies particularly taking the help of insects that to the honey bee, which frequently visit flowers gathering pollens as well as nectar for sustaining their life, which in turns results into florets get cross pollinated (Bhambure, 1958).

\textbf{MATERIAL AND METHODS}

The experiment was conducted at Raj Mohini Devi College of Agriculture and Research Station, Ambikapur of Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). It was upland, single plot keeping plot size 10x10m\textsuperscript{2}, variety was JNC-9, spacing 30x10cm and was sown on 01/09/2011. The observations were recorded when the niger crop started flowering pollinators/visitors were observed starting from 0700hrs up to 1700hrs at two hours intervals once every week, on randomly selected places from one square meter area within five minutes during early as well as peak flowering period.
RESULTS AND DISCUSSION

During the course of the study, 15 species of insect pollinators/visitors were recorded on niger flowers. Among them Indian honey bee (Apis cerana indica) was the first pollinator observed to pollinate on niger crop which visited the crop throughout the flowering period, other bee pollinators like *Apis florea* and *Apis dorsata* were also recorded. Besides, these some pollinators/visitors viz., *Danaus chrysippus*, *Eristalis* sp., *Musca domestica*, *Nazaara virudula*, *Dysdercus cingulatus*, *Coccinella septumpunctata*, *Vespa cincta*, *Leptocoris acuta*, *Amata passelis*, *Pelopidas mathias*, *Sarcophaga* sp. and *Chrysomya* sp. were also recorded throughout the blooming period on niger crop (Table 1). The succession of pollinators/visitors were reported as under:

**Indian honey bee (Apis cerana indica):**

The *Apis cerana indica* was observed as a prominent pollinator of niger crop. Its first appearance on niger flower was observed in the second week of October with a mean population of 7.5 bees/5min/m². The population of bees gradually increased during 3rd week of October 2011 (18.83 bees/5min/m²), 4th week of October 2011 (28.83 bees/5min/m²) and reached its peak population in 1st week of November (33.33 bees/5min/m²) thereafter, it continued to decrease during second week of November 2011 (30.83 bees/5min/m²), 3rd week of November 2011 (26.16 bees/5min/m²), 4th week of November 2011 (13.33 bees/5min/m²) and last week of November 2011 (6.5 bees/5min/m²). The mean population was 20.66 bees/5min/m².

These findings corroborated the results of Singh and Chaudhary (2002) who recorded the insect visitors of ber mainly *Apis dorsata* (24.88 %), *A. cerana indica* (18.39 %) and *A. florea* (17.76 %) as flower visitors. Singh et al. (2006) who reported the foragers on litchi with high population during the early flowering stage than during the mature flower stage of the crop. Among the foragers *A. mellifera* was predominant species (35.08 %) of insect visitors followed by *A. cerana indica* (18.64 %) and Kumar et al. (2010) reported the relative abundance of pollinators in cotton hybrid and indicated that the honey bees, *A. carana, A. dorsata, A. florea* constituted 65 to 70 per cent on CMS line and 75 to 78 per cent on R lines, at different times and different flowering density. Mohapatra and Sontakke (2012) also recorded hymenopterans visiting on sesamum namely *A. indica, A. dorsata, A. florea, Trigon a iridipenis, Andrena* sp. *Bombus* sp. and *megachile* sp. as a regular visitors *dorsata* (13.38 %).

**Little bee (*Apis florea*) :**

The first appearance of *A. florea* was observed in the 2nd week of October (1.83 bees/5min/m²). It slightly increased in third week of October (2.16 bees/5min/m²) and decreased during 4th week of October (1.00 bees/5min/m²) and again increased during 1st week of November (3.33 bees/5min/m²) and decreased (1.66 bees/5min/m²) during second week of November and further increased (3.00 bees /5min/m²) in 3rd week of November. The maximum population of bees were recorded during 4th week of November (3.5 bees/5min/m²) and 1.5 bees/5min/m² were observed in 1st week of December. The average population of bees was 2.24 bees/5min/m².

These results corroborated the early findings of several workers on different crops Nidagundi and Sattagi (2005) recorded *Apis florea* was the most predominant sp. in bitter gourd constituting 43.00 per cent followed by *Apis cerana* (26.00 %) and *A. dorsata* (13.00 %). Saeed et al. (2012) reported that *Apis florea* and *A. dorsata* also exhibited the highest visitation rates and frequencies on bitter gourd.

**Monarch butterfly (*Danaus chrysippus*) :**

The activity of *Danaus chrysippus* was observed during 2011-12 with its first appearance in 2nd week of October, 2011 (0.66 monarch butterfly/5min/m²). The maximum population was recorded (0.83 monarch butterfly/5min/m²) during fourth week of October 2011. Thereafter, it disappeared during 1st week of November, 2011 with regain its population in 2nd, 3rd and 4th week i.e. 0.33 monarch butterfly/5min/m² with increasing trend in 1st week of December, 2011. The average population was 0.45 monarch butterfly/5min/m².

The present results are in line with the findings of Dhakal and Pandev (2003) who observed that the butterflies visited the niger flowers through the flowering span. Dhurve (2008) recorded *Danaus chrysippus* (15.71 %) as a pollinators on niger flowers followed by *Apis dorsata* (37.23 %), *A. florea* (28.74 %), and *A. cerana indica* (18.32 %). Nath and Viraktamath (2010) also recorded eight species of pollinators on sunflower and among these, five species belonged to Hymenoptera and three species to Lepidoptera. Among Lepidoptera, *Danaus chrysippus*, followed by *Pieris* sp. and *Papilio demoleus* were recorded as major pollinators.

**Syrophid (*Eristalis* sp.):**

The *Eristalis* sp. was observed first (1.33 syrphid flies/5min/m²) in 2nd week of October. It increased in 3rd and 4th week of October, 2011 with respective population of 2.66 and 4.00 syrphid flies/5min/m² with its peak population in 1st week of November, 2011 (5.16 syrphid flies/5min/m²) and decreased population was observed in 2nd week of November, 2011 (2.00 syrphid flies/5min/m²). Further, it disappeared in 3rd and 4th week of November, and 1st week of December 2011. The average population was 1.89 syrphid flies/5min/m².

These findings are in close conformity with the earlier reports of Atmowidi et al. (2007) who recorded the syrphid fly (2.07 %) on mustard. *Apis cerana* (43.11 %), *Ceratina* sp. (36.98 %) and *A. dorsata* (8.36 %) were found in high abundance.
Table 1: The succession of various insect pollinators/visitors on Niger flowers during 2011-12

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Pollinators/visitors</th>
<th>Scientific name</th>
<th>Order</th>
<th>Family</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Indian honey bee</td>
<td><em>Apis cerana indica</em></td>
<td>Hymenoptera</td>
<td>Apidae</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; appearance (7.5)</td>
<td>18.83</td>
<td>21.83</td>
<td>33.33Peak activity</td>
<td>30.8</td>
<td>26.16</td>
<td>13.33</td>
<td>6.5</td>
<td>20.46</td>
</tr>
<tr>
<td>2.</td>
<td>Little bee</td>
<td><em>A. florae</em></td>
<td>Hymenoptera</td>
<td>Apidae</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; appr (1.83)</td>
<td>2.16</td>
<td>1.00</td>
<td>3.33</td>
<td>1.66</td>
<td>3.00</td>
<td>3.5 Peak activity</td>
<td>1.5</td>
<td>2.24</td>
</tr>
<tr>
<td>3.</td>
<td>Monarch butterfly</td>
<td><em>Danaus chrysippus</em></td>
<td>Lepidoptera</td>
<td>Danainidae</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; appearance (6.66)</td>
<td>0.66</td>
<td>0.83Peak activity</td>
<td>0.00</td>
<td>0.33</td>
<td>0.33</td>
<td>0.33</td>
<td>0.33</td>
<td>0.45</td>
</tr>
<tr>
<td>4.</td>
<td>Syrph fly</td>
<td><em>Eristalis sp.</em></td>
<td>Diptera</td>
<td>Syrphidae</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; appearance (1.33)</td>
<td>2.66</td>
<td>4.00</td>
<td>5.16 Peak activity</td>
<td>2.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.89</td>
</tr>
<tr>
<td>5.</td>
<td>Rice skipper</td>
<td><em>Pediculus simplex</em></td>
<td>Lepidoptera</td>
<td>Hesperiidae</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; appearance (0.50)</td>
<td>0.50</td>
<td>0.50</td>
<td>0.60Peak activity</td>
<td>0.33</td>
<td>0.00</td>
<td>0.33</td>
<td>0.04</td>
<td>0.33</td>
</tr>
<tr>
<td>6.</td>
<td>Fock bee</td>
<td><em>Apis dorsata</em></td>
<td>Hymenoptera</td>
<td>Apidae</td>
<td>0.00</td>
<td>1st appearance (4.16)</td>
<td>Peak activity</td>
<td>3.83</td>
<td>3.00</td>
<td>3.33</td>
<td>0.40</td>
<td>0.04</td>
<td>4.43</td>
</tr>
<tr>
<td>7.</td>
<td>House fly</td>
<td><em>Musca domestica</em></td>
<td>Diptera</td>
<td>Muscidae</td>
<td>0.00</td>
<td>0.00</td>
<td>I&lt;sub&gt;1&lt;/sub&gt; appear</td>
<td>2.50</td>
<td>2.00Peak activity</td>
<td>0.83</td>
<td>1.13</td>
<td>2.04</td>
<td>1.20</td>
</tr>
<tr>
<td>8.</td>
<td>Green stink bug</td>
<td><em>Nezara viridula</em></td>
<td>Hemiptera</td>
<td>Pentatomidae</td>
<td>0.00</td>
<td>0.00</td>
<td>I&lt;sub&gt;2&lt;/sub&gt; appear (0.50)</td>
<td>0.00</td>
<td>0.83Peak activity</td>
<td>0.00</td>
<td>0.33</td>
<td>0.04</td>
<td>0.20</td>
</tr>
<tr>
<td>9.</td>
<td>Red cotton bug</td>
<td><em>Dyscepus crepulatus</em></td>
<td>Hemiptera</td>
<td>Pyrrhocoridae</td>
<td>0.00</td>
<td>0.00</td>
<td>I&lt;sub&gt;1&lt;/sub&gt; appr (0.33)</td>
<td>Peak activity</td>
<td>0.33</td>
<td>0.00</td>
<td>0.33</td>
<td>0.40</td>
<td>0.04</td>
</tr>
<tr>
<td>10.</td>
<td>Rice bug</td>
<td><em>Lepícoris acuta</em></td>
<td>Hemiptera</td>
<td>Myidiidae</td>
<td>0.00</td>
<td>0.00</td>
<td>I&lt;sub&gt;2&lt;/sub&gt; appr (0.50)</td>
<td>Peak activity</td>
<td>0.33</td>
<td>0.33</td>
<td>0.00</td>
<td>0.00</td>
<td>0.14</td>
</tr>
<tr>
<td>11.</td>
<td>Tiger moths</td>
<td><em>Amata pascuella</em></td>
<td>Lepidoptera</td>
<td>Arctiidae</td>
<td>0.00</td>
<td>0.00</td>
<td>I&lt;sub&gt;1&lt;/sub&gt; appr (0.50)</td>
<td>Peak activity</td>
<td>0.33</td>
<td>0.33</td>
<td>0.00</td>
<td>0.00</td>
<td>0.14</td>
</tr>
<tr>
<td>12.</td>
<td>Hoverfly</td>
<td><em>Choromyia bezziana</em></td>
<td>Diptera</td>
<td>Calliphoridae</td>
<td>0.00</td>
<td>0.00</td>
<td>I&lt;sub&gt;1&lt;/sub&gt; appr (1.16)</td>
<td>Peak activity</td>
<td>1.16</td>
<td>1.83Peak activity</td>
<td>0.66</td>
<td>1.46</td>
<td>0.04</td>
</tr>
<tr>
<td>13.</td>
<td>Ladybird beetle</td>
<td><em>Coccinella septempunctata</em></td>
<td>Coleoptera</td>
<td>Coccinellidae</td>
<td>0.00</td>
<td>0.00</td>
<td>I&lt;sub&gt;1&lt;/sub&gt; appear (0.50)</td>
<td>Peak activity</td>
<td>0.50</td>
<td>0.00</td>
<td>0.66Peak activity</td>
<td>0.56Peak activity</td>
<td>0.29</td>
</tr>
<tr>
<td>14.</td>
<td>Vasp</td>
<td><em>Vespula servilis</em></td>
<td>Hymenoptera</td>
<td>Vespidae</td>
<td>0.00</td>
<td>0.00</td>
<td>I&lt;sub&gt;1&lt;/sub&gt; appr (0.33)</td>
<td>0.33</td>
<td>0.56Peak activity</td>
<td>0.50Peak activity</td>
<td>0.13</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Tachinid fly</td>
<td><em>Sarcophaga sp.</em></td>
<td>Diptera</td>
<td>Sarcophagidae</td>
<td>0.00</td>
<td>0.00</td>
<td>I&lt;sub&gt;1&lt;/sub&gt; appr (0.50)</td>
<td>Peak activity</td>
<td>0.00</td>
<td>0.00</td>
<td>0.50Peak activity</td>
<td>0.13</td>
<td>0.20</td>
</tr>
</tbody>
</table>
Rice skipper (Pelopidas mathias) :

The Pelopidas mathias was first observed in 2nd week of October, 2011 (0.5 rice skipper/5 min/m²) and similar population was recorded during the 3rd and 4th week of October, 2011. Whereas, the maximum population was observed in first week of November, 2011 (0.66 rice skipper/5 min/m²) with decreased population in 2nd week of November, 2011 (0.33 rice skipper/5 min/m²). Further, it was disappeared during 3rd week of November, 2011. It again appeared during 4th week of November, 2011 and further disappeared during 1st week of December, 2011. During the same year the average population was observed 0.35 rice skipper/5 min/m².

These findings are in more or less conformity with the earlier results of Chaudhary (2002) who observed that the moths and butterflies visited on ber accounted for 12.38 per cent, whereas, the other insects contribution was 26.58 per cent of the total flower visitors.

Rock bee (Apis dorsata) :

The initial population of rock bee was recorded in the third week of October, 2011 and gradually increased in fourth week of October, 2011 with population ranged from 3.00 to 16.16 bees/5 min/m² with its maximum population of 16.16 bees/5 min/m² during fourth week of October, 2011. The population was disappeared in fourth week of November, 2011 and first week of December, 2011.

These findings are in conformity with the earlier workers on different crops, Chaudhary (2001) reported little bee, A. florea in most abundant form (42.8 %) on rapeseed followed by rock bee A. dorsata (16.6 %). Guruprasad (2001) reported the pollinators on niger in which A. dorsata (27.35 %) was the most prominent pollinators followed by A. mellifara (10.81 %), A. florea (4.88 %) and A. cerana (4.17 %).

House fly (Musca domestica) :

The activity of house fly was observed from fourth week of October to first week of December with the mean population of 1.20 house flies/5 min/m² and its population ranged from 0.50 to 2.5 house flies/5 min/m². The house fly was peak on fourth week of October.

These results are in close conformity with the findings of Saeed et al. (2008) who recorded the pollinators on onion with effective bee specie Apis dorsata and A. florea which were greater than true flies, Episyrphus balteatus, Euepodes sp., Musca domestica and Eristalinus aeneus.

Green sting bug (Nazaar virudula) :

The first appearance of green sting bug was recorded in the fourth week of October with the population ranged of 0.33 to 0.83 green sting bug/5 min/m² with its maximum population of 0.83 green sting bug/5 min/m² as observed during second week of November.

The present results are in close agreements with that of Thapa (2006) recorded green sting bug an insect visitor visiting on buckwheat, radish and rapeseed flowers. Navatha and Sreedevi (2012) who reported Nazara virudula as visitor of caster with its relative abundance of 4.80 per cent.

Red cotton bug (Dysdercus cingulatus) :

The first appearance of red cotton bug was recorded during 4th week of October, 2011 (0.33 red cotton bug/5 min/m²) with no population during 1st week of November, 2011, 2nd week of November, 2011 and 3rd week of November, 2011 whereas, it again appeared during 4th week of November, 2011 (0.33 red cotton bug/5 min/m²) with no population during last week of November, 2011.

Earlier reports support the observation by Thapa (2006) who reported the red cotton bug as a flower visitor on radish blooms.

Rice bug (Leptocorisa acuta) :

The first appearance of rice bug was recorded during 4th week of October, 2011 (0.33 rice bug/5 min/m²) with similar population trend during 1st week of November, 2011 (0.33 rice bug/5 min/m²). Further it disappeared during 2nd week of November, 2011 and it again appeared during 3rd week of November, 2011 (0.33 rice bug/5 min/m²). It disappeared during 4th week of November, 2011 and last week of November, 2011.

The present result corroborated the findings of Thapa (2006) who noticed rice earhead bug visiting on litchi flower.

Tiger moth (Amata passelis) :

The appearance of tiger moth was observed first time during 4th week of October, 2011 (0.50 tiger moth/5 min/m²) and decreased during 1st week of November, 2011 (0.33 tiger moth/5 min/m²) and same trend was recorded during 2nd week of November, 2011 (0.33 tiger moth/5 min/m²). Thereafter, it disappeared during 3rd week of November, 2011, 4th week of November, 2011 and last week of November, 2011.

The present results are in the line with the findings of Dharve (2008) who recorded the tiger moth as a visitor on niger flower.

Blow fly (Chrysomya bezziana) :

The blow fly appearance was first recorded during 4th week of October, 2011 (1.66 blow flies/5 min/m²) and same trend was recorded during 1st week of November, 2011 (1.16 blow flies/5 min/m²) with its peak population during 2nd week of November, 2011 (1.83 blow flies/5 min/m²) which decreased during 3rd week of November, 2011 (0.66 blow fly/5 min/m²), thereafter, its population was increased during 4th week of November, 2011 (1.66 blow flies/5 min/m²) and disappeared during last week of November, 2011. The average population was 0.80 blow fly/5 min/m².
The present results on blow fly is in conformity with Priti et al. (2001) who reported the pollinators like *Apis florea*, *A. mellifera*, *A. dorsata*, *Halictus* sp., *Chrysomya bezziana*, *Gasterophilus* sp. and *Sarcophaga* sp. on radish flower. Sajjad et al. (2008) who also reported various pollinators on onion blooms, among them the dipterans species composed 72 per cent of syrphid flies and 28 per cent non-syrphid flies i.e. *Musca domestica*, *Calliphoridae* sp. and *Sarcophaga* sp.

**Lady bird beetle (Coccinella septempunctata):**

The first appearance of lady bird beetle was recorded during 1st week of November, 2011 (0.50 lady bird beetle/5 min/m²), similar population was also observed during 2nd week of November, 2011 (0.50 lady bird beetle/5 min/m²) with disappearance of population during 3rd week of November, 2011 two peak population was recorded during 4th week of November, 2011 (0.66 lady bird beetle/5 min/m²).

The findings are in close agreements with the Thapa (2006) who reported the lady beetle as flower visitor on brinjal, broccoli, buckwheat, cucumber, litchi, radish, rapeseed and squash. Brar et al. (2009) also reported *Coccinella* sp. visiting on radish flower.

**Wasp (Vespa cincta):**

The first appearance of wasp was recorded during 1st week of November (0.33 wasp/5 min/m²) and similar population was recorded during 2nd week of November (0.33 wasp/5 min/m²) with its peak population during 3rd week of November, 2011 (0.50 wasp/5 min/m²) and same population was also noticed during 4th week of November, 2011 (0.50 wasp/5 min/m²) and decreased during last week of November (0.33 wasp/5 min/m²). The average population was 0.24 wasp/5 min/m².

The present findings are more or less conformity with the earlier reports of Dhurve (2008) who observed the wasp on niger flowers. Jadhav et al. (2010) recorded the *Vespa tropica* and *Polistine* sp. were visiting on hybrid sunflower.

**Tachinid fly (Sarcophaga sp.):**

The first appearance of tachinid fly was found during 2nd week of November (0.50 tachinid fly/5 min/m²) with similar trend was found during 3rd week of November, 2011. Further, it decreased during 4th week of November, 2011 (0.33 tachinid fly/5 min/m²) and similar trend was observed during last week of November (0.33 tachinid fly/5 min/m²). The mean population was 0.20 tachinidfly/5 min/m².

The present results are in close conformity with the findings of Saeed et al. (2012) who reported the *sarcophaga* sp. as a pollinator visiting on bitter gourd.

The above observations with regard to the succession of visitors/pollinators indicate that the population of visitors were very meager and the order of appearance of the visitors were *Apis cerana indica*, *Apis florea*, *Danaus chrysippus*, *Eristalis sp.*, *Pelopidas mathias*, *Apis dorsata*, *Musca domestica*, *Nazara virudula*, *Dysdercus cingulatus*, *Leptocorisa acuta*, *Amata passelis*, *Chrysomya bezziana*, *Coccinella septempunctata*, *Vespa cincta* and *Sarcophaga* sp.

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