Chapter-II

PLANT DESCRIPTION AND SITE SELECTION

Taxonomic Position

Class - Dicotyledonae
Sub Class - Polypetalae
Section - Monochlamydae
Order - Unisexualae
Family - Euphorbiaceae
Sub Family - Phyllanthoideae
Genus - Phyllanthus
Species - niruri

Common names


Etymology

The name Phyllanthus is derived from the Greek word- ‘Phullon’ means a leaf, ‘anthos’ means a flower. The whole meaning of Phyllanthus is ‘a flower on the leaves’.

Description of the Plant

General Habit – Mostly herb (Photoplate 2.2)
Stem – Herbaceous (Photoplate 2.1)
Leaf – Leaves are arranged in two rows so that each branch resembles with a compound leaf.
Inflorescence – The flowers are solitary and axillary.

Flower – Bracteate, usually bracteolate, generally unisexual, actinomorphic, hypogynous.

Perianth – 6 tepals are present in 2 whorls of 3 each.

Stamens – A whorl of 3 monadelphous stamens, forming a staminal column by fusion of the filaments; in male flowers, the disc is usually present in the form of intrastaminal or extrastaminal glands, sometimes staminodes are present in pistillate flowers.

Gynoecium – Usually tricarpellary; syncarpous, superior; trilocular; two anatropous ovules in each lócle; axile placentation; styles 3, each bifurcating apically into two feathery stigmas; a nectariferous disc is present at the base of the ovary; in staminate flowers; the gynoecium is sometimes present as a pistillode.

Fruits and Seeds – Fruit usually a capsule. Seeds endospermic; embryo straight.

Floral formulae–

Male flower: Br, Θ, P₃₊₃, A₃, G₀ or pistillode

Female flower: Br, Θ, P₃₊₃, A₀ or staminodes, G(3)

Phenology of Phyllanthus niruri

The seeds are dormant for 9-10 months. The plant is of common occurrence in monsoon and postmonsoon periods. The seedlings begins to appear at the end of June just after the first shower and continue upto August and September when temperature ranges between 25-35°C. After 3 days, seedlings takes form of juvenile stage and branching starts four days thereafter and on the tenth day the first female flower occurs, subsequently, the male flower opens next day. Fruit sets in soon after, thus the plant flowers in July and August, flowering and fruiting continues upto October and November, when the temperature becomes low. First
the falling of leaves takes place and subsequently branches and ultimately the whole stem dies. Thus, the life cycle of plant completed in about 3 months.

**Table 2.1: Phenological Events of *Phyllantus niruri* in general field**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Character</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Seedling emergence</td>
<td>25&lt;sup&gt;th&lt;/sup&gt; June – 12&lt;sup&gt;th&lt;/sup&gt; August</td>
</tr>
<tr>
<td>2.</td>
<td>Juvenile stage</td>
<td>29&lt;sup&gt;th&lt;/sup&gt; June – 19&lt;sup&gt;th&lt;/sup&gt; August</td>
</tr>
<tr>
<td>3.</td>
<td>Branching formation</td>
<td>5&lt;sup&gt;th&lt;/sup&gt; July – 26&lt;sup&gt;th&lt;/sup&gt; August</td>
</tr>
<tr>
<td>4.</td>
<td>Female flower initiation</td>
<td>12&lt;sup&gt;th&lt;/sup&gt; July – 5&lt;sup&gt;th&lt;/sup&gt; September</td>
</tr>
<tr>
<td>5.</td>
<td>Male flower initiation</td>
<td>13&lt;sup&gt;th&lt;/sup&gt; July – 6&lt;sup&gt;th&lt;/sup&gt; September</td>
</tr>
<tr>
<td>6.</td>
<td>Fruit formation</td>
<td>15&lt;sup&gt;th&lt;/sup&gt; July – 8&lt;sup&gt;th&lt;/sup&gt; September</td>
</tr>
<tr>
<td>7.</td>
<td>Time of death</td>
<td>October - November</td>
</tr>
</tbody>
</table>

**The Study Sites**

Present study was conducted in the district Varanasi of India, which is one of the ancient cities of the world and has conserved its cultural heritage. It has been a great religious centre of Hindu and also a sacred place of pilgrimage, being visited by millions of people from different corners of the world. Varanasi is also considered as one of the densely populated cities of India. Varanasi, which is situated in the eastern part of Uttar Pradesh, a province of India located in core of the Indian sub-continent. On the globe, Varanasi finds its location at 25°18' North, 83°1' East and 76.19 m. above the sea level.

Varanasi is one of the five largest towns of Uttar Pradesh grouped as “KAVAL” towns. It lies by rail at a distance of 696 km from Kolkata, 1505 km from Mumbai, 797 km from Delhi, 143 km from Allahabad and 301 km from Lucknow. The Grand Trunk road passes through the city and it’s environs connect all the major cities.
Meteorological Conditions of Varanasi

The level of pollution varies from place to place due to difference in the weather condition and local meteorological factors. The location of receptors relative to source, as well as atmospheric influences affect pollutant concentration and the sensitivity of receptors to these determine the effect (Holzworth, 1972).

Thus, in light of above it is evident that the prior knowledge of various meteorological factors is essential for the study of pollution. The important meteorological factors interferring in dispersal and transportation of the air pollutants are precipitation, relative humidity, temperature, wind velocity and the wind direction (Bowie, 1974), which ultimately reflects its impact through the vegetation cover (Auer, 1978).

Climate is a fundamental factor in determining the physical environment and land utilization. It exerts considerable influence upon the various productive activities. As the tropical region of the world, the climate of the Varanasi district, being mansoonic is characterized with three distinct seasons.

1. Summer season
2. Rainy season
3. Winter season

Summer season

The mild warm March month form the transitional period between winter and summer season. The summer season extends from April to late June. From March to April temperature rises slowly and gradually, but in June, it increases rapidly to the maximum temperature upto 42.02°C. Hot winds are prominent in this season. The westerly winds are hot and dusty, but the south-westerly winds, which blow in May, are little cooler and refreshing. The frequency of hot weather storms, mainly dry dust storms (Andhi) are remarkable characteristics of this season. Winds are dry and have a very low percentage of humidity (nearly 22.71
to 35.26% in April and May). The average rainfall from March to May was about 1.3 mm. The strong and scorching hot winds blow from the west and south-west. These winds are locally called ‘too’ which blowing every day, two or three hours before noon and continue throughout the day and gradually diminish in the evening after sun-set. Thus these are like some change in the continuation of hot and dry weather. Some little rainfall and sometime hail storms can also be visualized. Such weather causes delay in the arrival of the monsoon.

**Rainy season**

The rainy season extends from late June to September. Dust storms and thunder storms of May and June and the hot weather are abruptly replaced with the burst of heavy rains by the end of June and life pulsates with new vigour and freshness. The changing trends of falling temperature clearly noticed in this season. The mean daily average of temperature in July comes to nearly 34.48 to 27.64°C which in August further falls to 32.36°C maximum and 26.67°C minimum. In September and October, a slight gradual decrease in temperature was recorded except when it is actually raining. The humid and warm weather of the rainy season is more oppressive than the dry heat of the summer season. In July when south-west monsoon is effective then eastern winds dominate.

The unsteady character of the winds direction is a significant phenomenon of this season. Relative humidity also goes up suddenly during this season and reaches at its maximum in the month of August 85.71%. The minimum average relative humidity of this season is very high and goes up to 74.71%. Usually the monsoon comes in the third week of June and ends by the last week of September. In this way, the main period of rainfall is from mid July to mid August (Table 2.2). When the monsoon is retreated by the middle of September relatively most unhealthy season prevails similar to the summer season. After the retreat of monsoon, a small rise in temperature is marked up to the middle of October after
which a gradual fall in temperature is experienced, till the beginning of winter. The relative humidity is still high over 79.64%. In this season, the day and night are much warmer and cooler respectively. The fine weather arrives from November onwards when the mean monthly temperature falls. The north western high pressures are prevalent.

Rainfall

The annual rainfall of Varanasi was 40.2 mm (Table 2.2). In which over 60.8 mm of total rainfall was recorded in rainy months i.e. June to September. July is usually the rainiest month followed by August. It is important to note that wherever monsoon is vigorous in July or August, it leads to heavy rainfall and causing floods in low lying areas.

Winter season

The rainless October month form the transitional period between rainy and winter season. The winter season generally extends from November to February. The temperature in winter season decreases rapidly during the month of October to November reaching as low as 10.74°C during the month of January, while in February the temperature in this month ranges between 26.87 to 13.68°C. February shows a rapid increase in daily minimum temperature of this season which slowly blow down from the north-west during this season. December and January are the most cold months of the season. In the months of November and February, the air is dry and no rains generally take place. The average rainfall of the winter season was about 6.0 cm. Moderate temperatures, light winds, clear skies, dry and bracing atmosphere are the main characteristics of this period between October and mid December. Disturbed weather is of rare occurrence in this season. From mid December to January, the Varanasi is occasionally visited by cold weather depressions, which result in a short wet period characterized by clouds and showers.
Table 2.2: Meteorological data of study sites (June 2005 to May 2006)

<table>
<thead>
<tr>
<th>Month</th>
<th>Mean temperature (°C)</th>
<th>Mean relative humidity (%)</th>
<th>Total monthly rainfall in (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>June</td>
<td>42.02</td>
<td>26.25</td>
<td>61.21</td>
</tr>
<tr>
<td>July</td>
<td>34.48</td>
<td>27.64</td>
<td>76.20</td>
</tr>
<tr>
<td>August</td>
<td>32.36</td>
<td>26.67</td>
<td>85.71</td>
</tr>
<tr>
<td>September</td>
<td>32.15</td>
<td>23.94</td>
<td>79.64</td>
</tr>
<tr>
<td>October</td>
<td>31.78</td>
<td>21.07</td>
<td>72.94</td>
</tr>
<tr>
<td>November</td>
<td>29.58</td>
<td>16.56</td>
<td>70.36</td>
</tr>
<tr>
<td>December</td>
<td>26.12</td>
<td>11.36</td>
<td>79.04</td>
</tr>
<tr>
<td>January</td>
<td>24.57</td>
<td>10.74</td>
<td>81.51</td>
</tr>
<tr>
<td>February</td>
<td>26.87</td>
<td>13.68</td>
<td>71.57</td>
</tr>
<tr>
<td>March</td>
<td>31.31</td>
<td>16.64</td>
<td>50.16</td>
</tr>
<tr>
<td>April</td>
<td>36.40</td>
<td>22.98</td>
<td>42.20</td>
</tr>
<tr>
<td>May</td>
<td>39.16</td>
<td>29.53</td>
<td>57.65</td>
</tr>
</tbody>
</table>
Survey of study site

A general survey of the vegetation of agricultural fields of the Varanasi under different levels of pesticide and fertilizer pollution was conducted during the period of June 2005 to May 2006. For detailed investigation, after proper survey four study sites, i.e. Harahuan, Rameshwar, Mohansarai Chiraigaon within different vegetation different areas of out skirt of the city were selected and coded as site II, III, IV and V respectively (Photoplates 2.3, 2.4 and 2.5).

Except these, four sites located in different parts of the city were selected for the study of pesticides pollution and their effects on the selected medicinal herb i.e. *Pyllanthus niruri* of that site. In order to compare the results, one control site was also selected in the campus of S.B.P.G. College, Baragaon, Varanasi, which is free from such type of sources. This control site is coded as site I.
Photoplate 2.1 showing stem with roots and leaves of Phyllanthus niruri
Photoplate 2.2 showing habit of *Phyllanthus niruri*
Photoplate 2.3: *Phyllanthus niruri* with cereal crop i.e. Maize (*Zea mays*) field
Photoplate 2.4: *Phyllanthus niruri* with pulse crop i.e. Urd (*Vigna mungo*)
Photoplate 2.5: *Phyllanthus niruri* with vegetable crop i.e. Bhindi (Abelmoschus esculentus)