STUDY OF GROWTH CYCLE OF BHUIAVLI (PHYLLANTHUS NIRUR) AND ITS PHYTOCHEMISTRY DURING GROWTH

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ABSTRACT: In view of the growing interest in Phyllanthus niruri, it was felt necessary to undertake a study of the growth cycle of the herb along with qualitative phytochemical observation in terms of active principle, its distribution in different parts of the plant and effect of storage and the active principle. The main purpose of the study was to develop guidelines for cultivation of the plant, rich in the active principle.

INTRODUCTION

Bhuiavali generally referred to as Phyllanthus urinaria in many of the Ayurvedic texts has been used in numbers of Ayurvedic preparations, including Chyavanprash Avleha and belongs to Shwasakashar gana, as per Charak Samhita. The preparations containing the roots of this plant are recommended for use in jaundice, seeds in menoregia, inflammation of liver and spleen and as diuretic. During the last ten years a species of Bhuiavali viz. Phyllanthus niruri / amarus has been studied for its antiviral and antigen surface binding activity of hepatitis B Virus, notably by prof. Blumberg in U.S.A. and Prof. Thyagarajan at P.G.M.S. Madras. Both the groups independently and jointly studies these properties of Phyllanthus niruri which was later confirmed to be Phyllanthus amarus.

In view of the growing interest in this plant almost scientists and the user as well, it was felt necessary to undertake a study of growth cycle of the plant along with qualitative phytochemical observations in terms of active principle, its distribution in different parts of the plant and effect of storage on the active principle. The main purpose of the study was to develop guidelines for cultivation of the plant enriched with the active principle.

MATERIALS AND METHODS

The species that is availed around Bombay was identified to be mainly Phyllanthus niruri, mainly in the sense with respect to seeds and stipules structure, as the leaf and floral design was observed to be comparable with Phyllanthus amarus.

The sapplings of this plant with estimated age of 5 days were collected from the field and 20 sapplings were planted in earthen pots and were allowed to grow naturally with normal rain water supply and without fertilizers. Simultaneously the samples were also observed from the field.

The growth of the roots, stem, leaves in number, flowering stages and fruiting were followed for 12 weeks. The moisture content of the whole plant and dry weight ratios of different parts of the plant and TLC picture for active principle of the plant at
different stages of growth were followed. For TLC studies the procedure described by Thyagarajan et al\textsuperscript{2} was followed during the study (Fig.1). The growth of the plants in earthen pots was observed to be very slow as compared to that in the field. For analysis purpose samples from the field were chosen.

RESULTS AND DISCUSSION

Table 1
Moisture content during growth

| Sample Number | Wet Weight in gms | Dry Weight in gms | % Moisture |
|---------------|-------------------|-------------------|------------|
| 1             | 10 gm             | 2.75              | 72.5       |
| 2             | 13 gm             | 3.5               | 73.0       |
| 3             | 15 gm             | 4.0               | 73.3       |
| 4             | 17 gm             | 4.4               | 74.1       |
| 5             | 23.5 gm           | 6.3               | 73.2       |
| 6             | 34.5 gm           | 8.5               | 75.2       |
| 7             | 40 gm             | 11.0              | 72.5       |

The moisture content as judged by LOD ranged between 72 to 75\% (Table 1). The dry weights ratios of different parts of the plant are shown in Table 2. Obviously the major weight is concentrated in leaves and stems to the extend of 37\% in each, lowest being in the roots i.e., 9.5\%.

Table 2
Dry Weight ratio of individual part of the plant to the total weight of plant with reference to sample No.5 in Table. 1

|   | Weight of dry roots | Weight of dry seeds | Weight of dry leaves | Weight of dry stem portions |
|---|---------------------|---------------------|----------------------|----------------------------|
| 1 | 0.596 gms.         | 0.969 gms.         | 2.328 gms.          | 2.406 gms.                 |
| 2 | 9.5 %               | 15.4 %             | 36.9 %              | 38.2 %                     |
| Total | 6.299 gms | pg.                         | 100 %               |                            |
# Table 3
Observation on Growth Cycle of *Phyllanthus niruri* Measurements in Cms.
Average of 6 plants.

| PARTS          | Weeks | I  | II | III | IV | V  | VI | VII | VIII | IX  | X   | XI | XII |
|----------------|-------|----|----|-----|----|----|----|-----|------|-----|-----|----|-----|
| **1. Roots**   |       |    |    |     |    |    |    |     |      |     |     |    |     |
| Length of main root in cms | 1 cm. | 1 cm. | 3 cm. | 5 cm. | 8 cm. | 8 cm. | 8 cm. | 8 cm. | 10 cm. | 11 cm. | 11.5 cm. | 12 cm. |
| **2. Stem**    |       |    |    |     |    |    |    |     |      |     |     |    |     |
| Length in cms. | 6 – 7 cm | 6 – 7 cm | 8.5 cm | 10 cm. | 23 cm. | 30 cm. | 33 cm. | 34 cm. | 41 cm. | 46.5 cm | 50 cm. | 53 cm. |
| **3. Branches**|       |    |    |     |    |    |    |     |      |     |     |    |     |
| i. Number      | 6     | 6  | 10 | 13  | 22 | 22 | 26 | 27  | 27   | 28  | 28  | 30 |
| ii. Distance between apical & Lowest | 2.5 cm  | 2.5 cm  | 5 cm  | 6 cm  | 18 cm | 27 cm. | 31 cm. | 31 cm. | 32 cm. | 33 cm. | 33 cm. | 34 cm. |
| iii. Number of axillary branches | -- | -- | 4  | 8   | Allover in all branches | Allover in all branches | in all | in all | in upper branch | -- | -- | -- |
| **4. Leaves**  |       |    |    |     |    |    |    |     |      |     |     |    |     |
| i. Number      | 10    | 10 | 14 | 20  | 28 | 32 | 32 | 34  | 34   | 34  | 36  | 36 |
| ii. Colour     | Pale Green | Pale Green | Slightly dark green | Dark Green | Dark Green | Dark Green | -- | Yellowish Green | -- | -- | -- | -- |
| **5. Flowering Stages** |       |    |    |     |    |    |    |     |      |     |     |    |     |
| i. Buds        | Absent | Absent | Buds seen | -- | Buds seen | -- | -- | -- | -- | -- | -- | -- |
| ii. Flowers    | Absent | Absent | -- | Flowers seen | -- | -- | -- | -- | -- | Flowers seen on apex of branches | -- | -- |
| iii. Fruits    | --     | --     | -- | Fruiting in some plant | -- | Frush fruits seen | -- | Fruits turning brown | -- | -- | -- | -- |
| iv Maturation of fruits | -- | -- | -- | -- | Fruits turning brown | Some are maturing | Fruits turning brown | -- | Matured fruits seen | -- | -- | -- | -- |
It will be seen that the plant grows in the two phases. The appearance of buds in 3rd week followed by flowering, fruiting and their maturation in the 6th week completes the first phase. The growth of roots, stem, branches and leaves are also gradual but slow and few axillary branches are observed, except at the end of the 6th week when they are present in all branches. From 6th week onwards the growth is vigorous. The buds are seen again in 8th week in axillary branches, which also grow in number in subsequent weeks. In 10th week subaxillary branches are also observed. After 8th week, flowering fruiting and their maturation follows upto 11th week and in the 12th week matured fruits all over the plant are seen with very few flowers, reaching the full grown stage. The growth of other parts like stem, branches and leaves are vigorous. It was felt whether by effecting one more phase of budding in growth cycle, still vigorous vegetative growth could be achieved.

TLC profile followed during the growth cycle indicates that the active principle appears in the 3rd week i.e. after budding. (Fig. 1). It was also found that the active principle is not destroyed or effected even after storing the materials for one year.

Now in order to find out which parts of the plant is rich in active principle, TLC study was carried out with root seeds, stems and leaves. It can be seen from TLC pictures that stem is rich in active principle (Fig.2).

Attempts are in progress to divert vegetative growth to stem say by way of removing buds / flowers at suitable time during the cycle, so as to improve the active ingredient picture of the plant
**GROWTH IN WEEKS**

|    | I | II | III | IV |
|----|---|----|-----|----|
| 0.85 | * |     |     |    |
| 0.50 |   |     |     |    |

Fig 1. TLC profile of P.niruri during growth. The spot at rf-value 0.85 is the active principle which appears in III week.
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