CHAPTER V

ECOPHYSIOLOGICAL STUDY

1. Introduction
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ECOPHYSIOLOGICAL STUDY

The importance of ecological studies in weed science has been stressed by Harper (1958) and Misra (1968). In ecophysiological studies an approach is made to undertaking eradication programme of weed from farm land (Beechley, 1945). Misra (1968) in his discourse "Ecology in service of man" has commented that weeds are basically ecological and economic problems.

Ecophysiology of weed should be given an attention because, weeds are regarded as important research materials for biological studies. In order to determine best way of eradicating weeds, it becomes necessary to grow them experimentally (Dorton, 1962; Verma, 1981; Pathak, 1981; Sharma, 1983 and Sharma, 1984) still the research in weed ecology has received a meagre attention in this agricultural country. Studies of crop field weed in general and their ecology in particular are needed because as a newest field of efforts, it has still to receive a severe scientific attention. Position of weed research in India is already reviewed by (Pathak, 1981; Dubey, 1968; Sharma, 1983 and Sharma, 1984) etc.

Salisbury (1942) has pointed out that only by an intimate knowledge of diverse life histories of weeds, we can hope to diverse more valuable aspects of each of them. This will enable us to combat them successfully. More often certain herbaceous species, which are represented in flora of Indian

Other studies have been made on the reproductive capacity, seed morphology, seed germination, growth performance interaction between crop weed by the inhibition of plant part of weed to crop and other physiological processes (Prakash et al., 1961; Verma, 1981; Pathak, 1981; Babele, 1985 and Sharma, 1984 etc.).

**Morphological distribution - Habit and Habitat:**

*M. amarginata* is a common agricultural weed of bundelkhand region. It is reported to occur in many other regions of India and abroad (Plate 1). In India it is distributed in Deccan, Sarnath, Coimbatore, Gujrat, Kerala, west Bengal and Bombay. It has been also reported from tropical Africa, upper Verma, South Africa and west peninsular region (Fig. 2.1).

*M. amarginata* is an annual herb and common during rainy season and found in all places. The plant is diuretic and its juice is given in rabbit bite. In the area subjected to grazing *M. amarginata* acquires a small rosette like
structure, while in crop fields it competes with other species and spreads in all directions from the point of establishment.

**Synonyms:**

*Evolvulus emarginata, Ipomoea reniformis, Convolvulus gangotrias, C. reniformis.*

**Local names:**

- Durkunu - Bundelkhand (U.P. and M.P.).
- Undirkani - Malwa - Maharashtra.
- Elika jemndu - Tamil.
- Elika keeraj - Telgu.

**Systematic position, morphology and phenology:**

According to Bentham and Hooker's classification system the weed can be classified as follows:

- **Class** - Dicotyledons
- **Division** - Camptétales
- **Series** - Bicarpellatae
- **Order** - Polemoniales
- **Family** - Convolvulaceae
- **Genus** - *Herrenia*
- **Species** - *emarginata*

**Step:**

Green in early stages, much branched, elastic, cord like,
rooting occurs at most of the nodes, number of roots 1-3 and long.

**Leaves:**

3 cm broad, reniform or ovate, cordate obtuse
glabrous, often rust coloured, entire petiolate (1-2 cm long) with unicostrate reticulate venation.

**Flower:**

Yellow and violet coloured, branched bracts
inconspicuous acute, hairy, ovate, bisexual, pentamerous,
hypogynous and complete.

**Inflorescence:**

Solitary, axillary or in clusters.

**Calyx:**

Sepals 5, slightly hairy on the back margins, 2 outer
ovate, mucronate, 3 inner longer, subquadrate, 2 lobed
convex, enlarged in fruit, deeply divided at apex into two,
trunkated divericated lobes.

**Corolla:**

Petals 5, campamulate about 0.75 cm along and acute.

**Androecium:**

Stamens 5, unequal, included or exerted, filament
filiform, anthers usually twisted, pollen usually with longitudinal folds but smooth, hypogynous, free.

**Gynoecium:**

Tricarpellary, syncarpus, superior ovary with 4-11 ovulues, ovary globose tipie alternate into style and stigma.

**Fruit:**

Capsule of about 0.6 cm.

**Seeds:**

Generally 2 per capsule, some time 4-1.

**Pollination:**

Entomophilous.

**Dispersal:**

By contamination with crop seeds. In general plant completes the life cycle in five - six months. It starts with the germination of seeds after the rainy season as described below.

First leaf appears some time during the period begining from later half of June to first week of July, depending on the onset of rains. The fall of cotyledonary leaves takes place some time in the second to third week of July. Initiation of flowering begins from late September to
October seed formation takes place from mid October to November. Plants start dying from December to January. Most of these phenological events of *H. emarginata* depend on the availability of moisture.

**Seed morphology and physiology:**

Fruit is a capsule and contains two type of seeds (a) flattened (b) rounded. Flattened seeds are larger than rounded once. The seeds are of two colours, pale yellow and chestnut. Flattened seeds measured 2.23 x 1.50 mm and rounded seeds 2.18 x 1.15 mm in size (Plate 2-A). Table 4.1 indicates the weight of 10 seeds were 8.520 milligrams, 100 seeds 852.0 milligrams, 1000 seeds 8520.00 milligrams and number of 1 gms seeds was 113. Normally the rounded seeds were observed to be one seed per capsule, otherwise there were two flattened seeds per capsule.

Observation of seed germination pretreatments are given in table 4.11 to 4.12. It is clear from data that concentrated sulphuric acid scarification gave the best germination (80-90%). Other treatments like tap water, hot water, magnetic stirrer, temperature, growth hormones etc. (Table 4.11) but results could not found significant.

**Seed output and growth performance:**

Perusal of table 4.6 reveals that the average number
of seed out put at Minora site was heigher (760) than Dakor (184). Average length of shoot and root was also heigher at site Minora in comparison to Dakor, maximum shoot and root length in Minora and Dakor was 170 cm and 100 cm of shoot and 140 cm, respectively.

**Growth performance:** (Table 6.1 and 6.2)

In the present investigation best growth performance of *M. emarginata* was observed at Minora in comparison to Dakor. In Minora length of shoot and root was 170 cm and 100 cm, respectively.

**Soil type:**

Best growth of *M. emarginata* was influenced greatly with the increase or decrease of irrigation intervals (Table 4.1). The shoot and root length were maximum 11.6 cm and 10.0 cm (±2.37 and ±2.37) in plants irrigated daily, however it was found minimum in plants irrigated at 4 days intervals (4.17 cm and 4.5 cm as show in table 4.9).  

**Absorption of water:**

*M. emarginata* is a creeper, branches of which root at almost each node depending upon the substratum. Quite open the nodal root system develop profusely and becomes elaborate like parental main root. An attempt was made to study the role of nodal root system in water absorption.
In an experiment whole creeper along with its main root and nodal roots were uprooted carefully. These root system were dipped in beakers containing water coloured by adding a few drops of saffranin. After an interval of 24, 48, 72 hours free hand sections were cut. The following conclusions were drawn (Table 4.4).

(i) Main root was mainly responsible for absorption of water which is being supplied to lateral branches.

(ii) Nodal roots also absorb water and bulk of which is being translocated in the forward direction of branch.

(iii) A small quantity of backward (i.e., towards main stem) translocation also occurred.

The above rates were higher in plants collected from black cotton soil in comparison to parua soil.

DISCUSSION

*M. emarginata* is a notorious weed of both 'Rabi' and 'Kharif' seasons crops. Morphological, physiological, growth performance and control measures experiments gave clear indications that, it is a prominent weed of this agricultural region. Phenological observations clearly indicate that the weed commences growth with the 'kharif' crop and a good number of seedlings appear in later months i.e., November and December (Kodnoop et al., 1977; Kumar, 1980; Chaudhari et al., 1978; Efimora and Kryzko, 1982; Shrivastava and Gupta, 1982;
Marceno, 1985, 1986 and Shrivastava and Gupta, 1985). Seed production on black cotton soil and parua soil was in the decreasing order of 760 seeds and 162 seeds per plant, respectively out of these types of seed i.e. rounded and flattended shape it was found that fruit with rounded seeds contained one seed and the other fruit containing flattended seeds contained two seeds. This may be due to the availability of less food material in rounded seed plants and in addition to it they may be immature also (Dubey, 1968).

Seed germination by scarification with concentrated sulphuric acid 90% showed best percentage of germination (80-90%), when dipped for 60 mints. However % germination remain uneffected when treated with other chemicals like IAA and IBA and other physical treatments like tap water, chilling magnetic stirrer etc.

Seed germination by scarification with conc. sulphuric acid shows best % of germination (80-90%) Table (1.12)(Plate 3-A). It may be due to the presence of hard seed coat which is being softened quickly by the acid and hence a quick germination takes place. In natural field conditions seed is remain over soil surface for about six months and then germinated after 2-3 showers. Activity of soil microflora changes in temperature in winter and summer and soil acidity might be softening the seed coat to breaks dormancy and activate germination during the month of July.
In the present investigation best growth performance of *H. emarginata* was observed in black cotton soil in comparison to red sand, garden, black gravelly and red clay soil. This may be due to availability of more water and richer microflora in black cotton soil. Such soils are very rich in nutrients also. Observations given in table 4.1 reveal that plants which are subjected to daily irrigation showed better growth in comparison to plants which were subjected to long irrigation intervals. This indicates better performance of *H. emarginata* to more watering conditions. The results of the present studies are similar to those of Davis (1940, 42); Libbert, 1961; Sheechar, 1977; Jindal, 1977; Pathak, 1981; Shrivastava and Gupta, 1982 and Sharma, 1984.

Studies on translocation of water from main roots and nodal roots indicate that it will be interesting to study the role of leaves in photosynthesis by ramets and translocation of food material from parent plant to ramets and vice versa. But such experiments will be possible only such methods like tracer techniques.

Here in the present investigation both the roots including parent and runner root showed faster movement of water in both the direction. However runner root showed slow rate of absorption of water in comparison to parent root in both directions, indicating its ability to produce a new plant.