



Morphological variability in Giloya [*Tinospora cordifolia* (willd) Miers] under changing scenario of climate in North Western Himalaya

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Abstract

A study of morphological variability in Giloya under mid-hill condition of Himachal Pradesh was carried out during 2008-2009. Survey was conducted in different locations of District Kangra (Himachal Pradesh) during April-May, 2008. Stems pieces of Giloya were collected from twelve different altitudes of district Kangra (Himachal Pradesh). Collections containing stem pieces of equal length and uniform diameter. These collections were vegetatively propagated in pots in the month of May-2008 for morphological parameters.

Key words: Survey, collections, stems pieces of Giloya, uniform, morphological, altitudes

Introduction

Giloya [*Tinospora cordifolia* (Willd) Miers ex Hook. F. & Thoms] is a large, glabrous, climbing perennial shrub belonging to the family Menispermaceae (Stanley *et. al.*, 2000). The Sanskrit name Guduchi means the one, which protects the body. It is also called as amrita or nectar, as it is extremely useful in strengthening the immune system of the body. Giloya is native to India, grows throughout India in deciduous as well as dry forests. It is also found in Burma, Sri Lanka, Bangladesh, Pakistan, Malaysia, Indonesia, and Thailand etc. In Himachal Pradesh it is found in Kangra, Una, Chamba, Hamirpur and Mandi regions (Chauhan, 1999). The plant climbs spirally and clinging on to big trees and sometimes even to electricity poles, and to throw out aerial roots which reach the length of 30 feet. It is a perennial deciduous twiner with succulent stem and papery bark. Generally Giloya grows wild in forest and other areas. Mostly Giloya is vegetatively propagated through stem cuttings. The plant grows well in all types of soils ranging from acid to alkaline and partial to full sun with moderate moisture. The flowers are yellow, axillary, long-

stalked racemes. The fruit of 3 shortly stalked, pea-sized, subglobose drupes, red in colour. The plant flowers in June and fruiting occurs in November.

Materials and Methods

Plant material, experimental site and Morphological Parameters

Survey was conducted in different locations of District Kangra (Himachal Pradesh) during April-May, 2008. Stem cuttings from base region of Giloya were collected from twelve different altitudes of district Kangra (Himachal Pradesh) as presented in table 1. Stem cuttings of Giloya from different altitudes of district Kangra, of equal length and uniform diameter were taken. The length and diameter of the cuttings were measured with the help of meter rod and Vernier calliper. These stem cuttings from different altitudes were vegetatively propagated in the pots at the main campus of Himachal Pradesh Krishi Vishwavidyalaya, Palampur is situated at 32.6¹ N latitude and 76.3¹ E longitude and at an altitude of 1290 m above mean sea level. The area falls in humid sub-temperate in the mid hills of Shivalik range of Himalayas. These stem cuttings from different altitudes were vegetatively propagated in the pots under similar conditions in order to find out the variability in morphological characters. The pots were prepared by filling the mixture of soil and FYM in equal proportions in all the pots. The stem

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Table 1 Collections of Giloya at different altitudes of district Kangra (Himachal Pradesh)

S. NO.	Collections	Collections Altitude (m)
1	Collection-1	442.00
2	Collection-2	996.00
3	Collection-3	464.00
4	Collection-4	400-500
5	Collection-5	400-500
6	Collection-6	982.12
7	Collection-7	850.00
8	Collection-8	456.00
9	Collection-9	466.34
10	Collection-10	750-900
11	Collection-11	400-500
12	Collection-12	1200-1300

Table 2 Stem bark colour of vegetatively propagated plants of Giloya at different growth intervals

Bark colour			
Collections	50 Days	125 Days	200 Days
Collection-1	Green	Creamy white	Grey
Collection-2	Green	Creamy white	Creamy white
Collection-3	Green	Creamy white	Creamy white
Collection-4	Green	Creamy white	Creamy white
Collection-5	Green	Creamy white	Creamy white
Collection-6	Green	Creamy white	Creamy white
Collection-7	Green	Creamy white	Creamy white
Collection-8	Green	Creamy white	Creamy white
Collection-9	Green	Creamy white	Grey
Collection-10	Green	Creamy white	Creamy white
Collection-11	Green	Creamy white	Creamy white
Collection-12	Green	Creamy white	Creamy white

Table 3 Plant length of vegetatively propagated plants of Giloya at different growth intervals

Plant length (cm)							
Collections	50 Days	80 Days	110 Days	140 Days	170 Days	200 Days	230 Days
Collection-1	10.33 ± 0.98	31.33 ± 2.68	99.00 ± 7.59	174.33 ± 5.97	185.00 ± 6.80	187.00 ± 6.80	187.00 ± 6.80
Collection-2	9.00 ± 1.89	26.33 ± 5.42	87.00 ± 14.17	145.00 ± 9.74	148.33 ± 9.96	150.00 ± 10.21	150.00 ± 10.21
Collection-3	8.00 ± 0.94	24.00 ± 3.09	77.00 ± 8.29	142.67 ± 8.64	152.33 ± 8.91	154.67 ± 9.44	154.67 ± 9.44
Collection-4	8.00 ± 1.25	24.00 ± 3.30	75.00 ± 9.29	129.33 ± 8.72	135.00 ± 11.09	138.00 ± 11.34	138.00 ± 11.34
Collection-5	8.00 ± 1.89	23.33 ± 5.42	63.67 ± 9.22	123.33 ± 7.98	133.33 ± 8.76	136.00 ± 8.83	136.00 ± 8.83
Collection-6	9.00 ± 2.87	27.00 ± 8.65	76.67 ± 17.48	134.00 ± 14.44	145.33 ± 13.99	146.67 ± 14.35	146.67 ± 14.35
Collection-7	9.67 ± 1.44	25.67 ± 3.47	74.00 ± 10.68	133.67 ± 10.14	145.00 ± 10.87	146.67 ± 11.14	146.67 ± 11.14
Collection-8	7.33 ± 1.96	21.33 ± 4.46	59.33 ± 9.69	112.67 ± 11.76	123.00 ± 9.98	125.33 ± 9.98	125.33 ± 9.98
Collection-9	12.00 ± 1.25	32.67 ± 2.60	105.67 ± 5.30	147.00 ± 7.79	154.00 ± 1.89	155.33 ± 1.66	155.33 ± 1.66
Collection-10	9.67 ± 1.78	24.67 ± 3.41	77.00 ± 5.91	128.33 ± 5.97	138.00 ± 7.26	140.33 ± 6.95	140.33 ± 6.95
Collection-11	12.33 ± 1.66	38.67 ± 4.10	113.33 ± 4.72	176.33 ± 9.36	187.33 ± 10.14	190.33 ± 9.44	190.33 ± 9.44
Collection-12	8.33 ± 0.98	22.33 ± 3.07	72.00 ± 5.19	123.00 ± 6.18	132.33 ± 5.50	134.67 ± 5.19	134.67 ± 5.19
CD (5%)	5.93	16.15	34.52	32.84	33.01	33.21	33.21

Table 4 Number of shoot branches per plant of vegetatively propagated plants of Giloya at different growth intervals

Number of branches per plant			
Collections	50 Days	125 Days	200 Days
Collection-1	2.00 ± 0	3.33 ± 0.27	3.33 ± 0.27
Collection-2	1.67 ± 0.54	3.00 ± 0.82	3.00 ± 0.82
Collection-3	1.67 ± 0.27	4.33 ± 0.72	4.33 ± 0.72
Collection-4	1.00 ± 0	3.33 ± 0.27	3.33 ± 0.27
Collection-5	1.33 ± 0.27	4.00 ± 0.47	4.00 ± 0.47
Collection-6	1.33 ± 0.27	3.33 ± 0.54	3.33 ± 0.54
Collection-7	2.00 ± 0.47	4.00 ± 0.82	4.00 ± 0.82
Collection-8	1.33 ± 0.27	4.33 ± 0.27	4.33 ± 0.27
Collection-9	2.67 ± 0.27	5.67 ± 0.72	5.67 ± 0.72
Collection-10	1.67 ± 0.27	5.33 ± 0.54	5.33 ± 0.54
Collection-11	2.00 ± 0.47	6.00 ± 0.47	6.00 ± 0.47
Collection-12	1.67 ± 0.27	3.67 ± 0.27	3.67 ± 0.27
CD (5%)	1.16	1.98	1.98

Each value represented as mean ± Standard Error (n=3) CD: Critical difference

Table 5 Number of Leaves per plant of vegetatively propagated plants of Giloya at different growth intervals

Number of Leaves per plant			
Collections	50 Days	125 Days	200 Days
Collection-1	6.33 ± 0.72	57.67 ± 4.53	52.67 ± 6.99
Collection-2	7.00 ± 0.47	46.00 ± 2.50	46.00 ± 5.19
Collection-3	6.67 ± 0.98	49.00 ± 6.16	46.67 ± 5.97
Collection-4	7.33 ± 0.54	51.67 ± 4.46	50.33 ± 5.30
Collection-5	8.00 ± 0.94	48.00 ± 5.89	39.33 ± 4.00
Collection-6	8.33 ± 1.44	53.67 ± 1.66	49.00 ± 0.82
Collection-7	8.67 ± 1.44	44.33 ± 2.18	35.33 ± 2.13
Collection-8	8.67 ± 0.72	39.67 ± 3.78	31.67 ± 2.84
Collection-9	10.00 ± 0.47	60.67 ± 6.15	52.00 ± 5.25
Collection-10	6.67 ± 0.72	48.00 ± 3.56	40.67 ± 3.54
Collection-11	9.67 ± 1.19	66.00 ± 4.24	53.00 ± 4.32
Collection-12	6.67 ± 0.54	40.00 ± 3.10	29.33 ± 1.96
CD (5%)	3.26	15.25	15.65

Each value represented as mean ± Standard Error (n=3) CD: Critical difference

cuttings, 20 cm of length each of Giloya were planted in 36 pots. The experiment was set up on 10th May, 2008 by planting stem cuttings of different collections. Data was analyzed statistically by using Analysis of Variance following complete randomized block design (CRBD).

Morphological Parameters

Stem Bark colour

Stem bark colour of vegetatively propagated collections of Giloya were observed visually at different growth intervals.



Shape of the stem

Shape of the stem of different collections of Giloya were observed visually at different growth intervals and compared with already known shape.

Plant length

The plant length was measured with the help of thread from the soil level up to the tip of youngest leaf. Finally the length of thread was measured with the help of meter rod and their mean values were used for statistical analysis.

Number of shoot branches per plant

The counting of shoot branches per plant was done manually in the field at 50, 125 and 200 days after vegetative propagation and their mean values were used for statistical analysis.

Shape of leaf

Shape of the leaves of different collections of Giloya were observed visually and compared with already known shape.

Number of leaves per plant

The number of leaves was counted manually in the field during three stages of plant growth i.e. on 50, 125, and 200 days after vegetative propagation and their mean values were used for statistical analysis.

All these parameter were recorded firstly at 50 days after vegetative propagation and afterward 75 days intervals. This is due to because first shoot bud appear at 40 days and leaves appear at 44 days after vegetative propagation and growth start at this period. The entire data was analyzed statistically by using analysis of variance as given by Panse and Sukhatme (1984) and Standard Error.

Results and Discussion

In the present investigation, Morphological variability in Giloya [*Tinospora cordifolia* (Willd) Miers] under Mid-hill condition of Himachal Pradesh was studied under field conditions. The data pertaining to the morphological variability of different collections of Giloya are presented in Table 2, 3, 4 and 5. Vegetatively propagated collections of Giloya showed green colour stem bark at 50 days this is due to because first shoot bud appear at 40 days after vegetative propagation so newly arisen shoot showed green bark colour. At 125 days all collections showed creamy white stem bark colour. At 200 days bark colour of Giloya showed variation from grey to creamy white Singh *et al.* (2003) also reported the same bark colour.

The stem bark colour of collection-1 and collection-9 were grey whereas, rests of the collections were creamy white coloured. This is due to because mostly one seasonal growth of the plant showed creamy-white colour and as the age of plant increased the stem bark colour turn into grey.

Shape of the stem of all vegetatively propagated collections of Giloya at different growth intervals was cylindrical. Plant length increased with time in all collections. Analysis of variance indicated significant variations in mean length of different collections of Giloya after 140, 170, 200 and 230 days, while variations were non-significant after 50, 80 and 110 days. The mean plant length showed wide variability ranging from 125.33 to 190.33 cm. After 200 days leaves shedding increased rapidly, finally plant shed all their leaves and undergo dormant stage and further growth occur when the dormant period over and active period come. Maximum plant length was recorded in Collection-11 (190.33 cm) followed by Collection-1 (187.00 cm) which were at par with each other. Minimum length was recorded in Collection-8 (125.33 cm) followed by Collection-12 (134.67 cm), Collection-5 (136.00 cm), Collection-4 (138.00 cm) and Collection-10 (140.33 cm) which were found to be at par with each other. Number of shoot branches per plant, increased gradually in all the collections but analysis of variance indicated non-significant variations in number of branches per plant after 50, 125, and 200 days. Maximum number of shoot branches per plant was recorded in collection-11 (6.00) and minimum number of shoot branches per plant was recorded in collection-2 (2.00). This is due to because in first seasonal growth of Giloya new shoots arise early stage and onward growth of these shoots occur but latter stages newly shoot are not arise before second seasonal growth. Shape of the leaves was cordate in all the vegetatively propagated collections of Giloya. These findings are in accordance with Singh *et al.* (2003) who also reported the same shape of the leaves in Giloya. Number of leaves increased in all the collections with time. The difference in the number of leaves become significantly more after 125 and 200 days in all the collections. Significant variation in number of leaves was noticed to range from 29.33 to 53.00. Maximum number of leaves was recorded in Collection-11 (53.00) and minimum number of leaves was recorded in collection-12 (29.33). The

number of leaves decreased at and after 200 days due to shedding of leaves. Conclusively, the study has revealed presence of significant differences among different vegetatively propagated collections of Giloya for different morphological variability. Based on the overall performance between different parameters, for first seasonal growth collection-11, collection-9 and collection-1 have emerged to be the best collections. This is may be due to because all three collections belonging to lower altitudes and condition of these areas were sub-tropical.

References

- Stanely P, Prince M and Menon VP** (2000) Journal of Ethnopharmacology, pp 9-15.
- Chauhan NS** (1999) Medicinal and aromatic plants of Himachal Pradesh. Indus publishing, New Delhi.
- Panse, VG and Sukhatme, PV** (1984) Statistical Methods for Agricultural Workers, ICAR, New Delhi.
- Singh SS, Pandey SC, Srivastava S, Gupta VS and Patro B** (2003) Chemistry and medicinal properties of *Tinospora cordifolia* (Guduchi). Indian Journal of Pharmacology, pp 83-91

