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OBSERVATIONS ON ECODEMES IN *GIRARDINIA DIVERSIFOLIA* (LINK.) FRIIS, (URTICACEAE) IN NEPAL

S.C. SINGH AND R. R. SHRESTHA

Research Centre for Applied Science and Technology,
Tribhuvan University Kirtipur, Kathmandu

Abstract

Two ecodemes of *Girardinia diversifolia* (Link.) Friis are recognized on the bases of certain morphological features, seed and seedling characteristics and amino acid contents.

Introduction

Girardima diversifolia (Link.) Friis, of the family Urticaceae, locally known as *allo* is distributed in Nepal from east to west in the altitudinal range of 1200 to 3500 meters. It is an important indigenous fibre yielding plant of Nepal and has long been used by several mountainous tribes in Nepal for making ropes, fishing-nets, sacks and even coarse clothing material. During the investigation of fibre from *G. diversifolia*, Singh & Shrestha (1985) observed two types of individuals which differed in their requirements for chemical treatment for extraction of the fibre. The purpose of the present investigations was to collect more evidences about the existence of two different types in *G. diversifolia*.

Materials and Methods

Comparative studies of the external morphology of the bracts, seed, cotyledonary leaves, seedling behaviour, fibres and amino acid contents of leaves and seeds of two types of *G. diversifolia* from different localities were made. The localities where collections were made represented two different habitats: the first being moist and shaddy place on the north-eastern slope of the Mahabharat hill (1,800 meters) supporting a mixed forest with *Quercus lanuginosa* and *Castanopsis indica* as the most conspicuous elements; and the other being moist and shaddy place on the south-western slope of the high hills (2,200 meters) of Himalayan belt, supporting a mixed forest (*Alnus nepalensis* and *Quercus semicarpifolia*). The former locality is at the Machchhegaon village in the disrict of Kathmandu and the latter is at the Jiri village in the disrict of Dolkha. Plant samples representing two types were designated as type 'M' and 'J', as they were collected from Machchhegaon and Jiri, respectively.

The lower most bracts from the terminal bud of main stem of *G. diversifolia* plants, growing wild in forest of Machchhegaon area in Kathmandu and those growing wild in

forest of Jiri, were examined for conspicuous morphological differences. Plants grown from seeds in the compound of RECAST were also examined for differences. The seeds of different individuals were collected, sun dried for about two months and weighed. The length, breadth, thickness and weight of seeds were noted. The length and breadth of the cotyledonary leaves of both the types were measured in millimeter with a linear scale and the area was determined graphically. The cotyledons were considered to have reached the constant stage suitable for measurements as soon as the first leaf on the seedling started unfolding. The seedling behaviour of two types were studied. The seeds of two types were sown in two different pots and grown under the same conditions for this study. The fibre yields of two types were determined on the dry weight basis. The length and breadth of ultimate fibre cells were examined with the help of a research microscope and measured with pre-calibrated micrometer. Amino acid contents of the leaves and seeds were determined qualitatively following paper chromatographic technique suggested by Harborne (1973) and Blackburn (1968). Hundred samples were examined for the calculation of mean values in each of the experiments.

Results

One of the most conspicuous visual differences between the two types include the density of the stinging hairs. Individuals of the type J were generally more hairy than those of the type M. The hairs are larger in the type J, even on the younger leaves. The hairs are with a more prominent bulbous base on younger leaves of the type J but they are without a bulbous base in the other type.

Bracts size: Observations on length and breadth of bracts of two types given in Table 1 shows that the bract of type J is longer and broader than the type M by 50.66 and 45.60%, respectively.

Seeds: Observations on the length, breadth, thickness and weight of seeds of two types given in Table 2 shows that the seed of type M is longer than that of the type J by 13.92%. Similarly, the breadth and thickness of the type M measured more than that of the type J by 21.61 and 14.29%, respectively. The weight of 100 seeds of the type M is 36.22% more than that of the type J.

Table 1. Measurements of bracts in *Girardinia diversifolia*.

		Minimum	Maximum	Mean
Length (cm)	M	2.0	2.4	2.23 ± 0.12
	J	4.0	5.0	4.52 ± 0.11
Breadth (cm)	M	1.5	1.9	1.73 ± 0.12
	J	3.0	3.5	3.18 ± 0.05

Table 2. Measurements of seeds in *Girardinia diversifolia*.

		Minimum	Maximum	Mean
Seed length (mm)	M	2.25	3.05	2.73 ± 0.03
	J	2.00	2.85	2.35 ± 0.02
Seed breadth (mm)	M	2.05	2.75	2.36 ± 0.02
	J	1.55	2.50	1.85 ± 0.03
Seed thickness (mm)	M	1.05	1.45	1.19 ± 0.01
	J	0.80	1.30	1.02 ± 0.01
Weight of 100 seeds (mg)	M	265.00	305.00	284.52 ± 1.36
	J	165.00	196.00	181.48 ± 0.94

Cotyledonal characteristics: Observations on length, breadth and area of cotyledonary leaves given in Table 3 shows that all the growth parameters of the type M are comparatively more than those of the type J.

Seedling morphology: Observations on seedling of two types are presented here.

M type: The juvenile leaves were obovate from the beginning of their appearance. The apex curved downward soon after. The apex was acute. The hairs were seen on dents and other portions of the margin and both the surfaces. The venation was reticulate with a conspicuous midrib and side veins. The leaves appeared slightly broader than those of type J. The hairs were of two sizes on the lower surface. Larger ones were seen on dents and smaller ones on midrib, side veins and marginal line. On the upper surface hairs were seen emerging from here and there and also from the midrib and side veins. Those emerging from the leaf tissue (not veins) were longer.

J Type: The juvenile leaves appeared in an opposite pair. At the very early stage the leaves were unequal in length. Soon these leaves appeared boat-like with the margins

Table 3. Measurements of cotyledonary leaves in *Girardinia diversifolia*.

		Minimum	Maximum	Mean
Length (mm)	M	4	5	4.7
	J	4	5	4.6
Breadth (mm)	M	4	5	4.2
	J	4	5	4.1
Area (sq. mm)	M	15	19	17.8
	J	14	20	16.2

Table 4. Percentage of fiber yield in *Girardinia diversifolia.*

	Dried stem (g)	Dried fibrous material (g)	Dried degummed fibre (g)	Fibre yield percentage
M type	51.67	7.36	3.34	7.05
J type	21.4	6.06	2.09	10.57

curving upwards. Then, the margins gradually flattened and the apex bent downwards. The margin was dentate with 5-6 dents at both the sides. The apex was shortly-acuminate and later became acute. The juvenile leaves were narrower, almost lanceolate at first and later becoming ovate. There were minute hairs all along the margin and both the surfaces. The hairs on the marginal dents were longer than those on the other portion of the margin. The venation was reticulate with a midrib and alternate side veins. The first pair of juvenile leaves appeared decussate to the cotyledons in both the cases. The second pairs were unequal and decusastely arranged over the first pair. The apex of the second pairs of the juvenile leaves was distinctly acuminate. In both of the cases juvenile leaves were borne on a minute stalk which also had hairs.

Fibre yield: Observations on the percentage of fibre yield of the two types presented in Table 4 shows that the yield of fibre per unit dry weight of stem is more in type J than type M by 33.30%.

Fiber characteristics: Microscopic observations on length and diameter of the fibres of two types presented in Table 5 shows that ultimate fibre lengths and diameters in the two samples varied to some extent. The ultimate fibre length of type J was longer by 21.33% than that of type M. Similarly, the diameter was also thicker by 8.71% in type J than that of the type M.

Amino acid: Observations on the amino acid detected in the leaf and seed samples of the two types are given in Table 6. Seven different amino acids were present in the leaf

Table 5. Measurements of fibres in *Girardinia diversifolia.*

		Minimum	Maximum	Mean
Length (mm)	M	106	525	287.20 ± 12.22
	J	146	733	354.66 ± 17.22
Diameter (μm)	M	6.66	126.66	67.06 ± 04.28
	J	10.00	136.66	73.46 ± 03.59

Table 6. Qualitative analysis of amino acids in *Girardinia diversifolia*.

Amino acid	Leaf		Seed	
	M type	J type	M type	J type
2-Amino-n-butyric acid	+	+	–	+
Arginine monohydrochloride	+	+	–	–
Cysteine hydrochloride	–	–	+	+
3, 4-Dihydroxyphenylalanine	–	+	–	–
Hydroxy-proline	+	+	–	–
Iso-Lencine	+	+	+	+
Lysine monohydrochloride	–	–	+	+
Methionine	+	+	+	+
Ornithine monohydrochloride	+	–	–	–
Serine	–	–	+	+
Tyrosine	–	–	+	+

Presence and absence are denoted by '+' and '–', respectively.

samples and among them five were common to both samples, Ornithine monohydrochloride was found in type M but not in type J whereas, 3, 4-Dihydroxyphenylalanine was found in type J but not in type M. Similarly, seven different amino acids were found to be present in the seed samples. All of the seven amino acids were present in type J whereas 2-Amino-n-butyric acid was found absent in type M. Altogether eleven amino acids were detected of which nine were common to the both, either in leaves or seeds. The presence of 3, 4-Dihydroxyphenylalanine in leaf is a distinctive feature for identification of type J and similarly Ornithine monohydrochloride for type M.

Discussion

Many species of plants have been shown to exhibit the variation. Several characters have been used to differentiate them either as ecotypes or ecodeme (Anderson, 1949; Ramakrishnan, 1960; Heywood, 1959; Srivastava & Misra, 1968). In the present study the specimens collected from two different localities differed in a number of morphological features and also in amino acid contents in leaf and seed. Sinskaja (1960) reported different population of *Onobrichis* species in mountain belts at different altitudes. Two types of *G. diversifolia* in the present study are from two altitudinally different localities. The two types also differed in the hairyness, bract size, seed characteristics, cotyledonal size, fibre size and yield, and amino acid contents. The differneces exhibited by the populations of *G. diversifolia* growing in two different localities indicate the reflections for different ecological situations. Gregor (1948) emphasized that the ecotype concept embraces all interspecific variation of ecological significance, the term ecotype being appli-

cable to any population which is different in respect to any feature which can be attributed to the selective action of environmental factors. Based on these facts and the marked differenes in certain characters between the two type of populations in *G. diversifolia*, the types M and J are designated conclusively as the ecotypes of *G. diversifolia*. Since the green house and transplant studies could not be conducted it seems therefore more logical to call these two population (M x J type) as ecodeme instead of ecotypes. Nonetheless experimental studies are needed to unravel the type of variation whether it has a genetical basis or not.

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