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Monitoring the Spread of Water Hyacinth (*Pontederia crassipes*): Challenges and Future Developments

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Water hyacinth (*Pontederia crassipes*, also referred to as *Eichhornia crassipes*) is one of the most invasive weed species in the world, causing significant adverse economic and ecological impacts, particularly in tropical and sub-tropical regions. Large scale real-time monitoring of areas of chronic infestation is critical to formulate effective control strategies for this fast spreading weed species. Assessment of revenue generation potential of the harvested water hyacinth biomass also requires enhanced understanding to estimate the biomass yield potential for a given water body. Modern remote sensing technologies can greatly enhance our capacity to understand, monitor, and estimate water hyacinth infestation within inland as well as coastal freshwater bodies. Readily available satellite imagery with high spectral, temporal, and spatial resolution, along with conventional and modern machine learning techniques for automated image analysis, can enable discrimination of water hyacinth infestation from other floating or submerged vegetation. Remote sensing can potentially be complemented with an array of other technology-based methods, including aerial surveys, ground-level sensors, and citizen science, to provide comprehensive, timely, and accurate monitoring. This review discusses the latest developments in the use of remote sensing and other technologies to monitor water hyacinth infestation, and proposes a novel, multi-modal approach that combines the strengths of the different methods.

Keywords: remote sensing, synthetic aperture radar, ground sensor network, unmanned aerial vehicle, citizen science, machine learning, aquatic weeds, wetlands

INTRODUCTION

Originating from the Amazon Basin, water hyacinth (*Pontederia crassipes*) has spread to more than 80 countries over the past century (Jafari, 2010). This monocotyledonous macrophyte reproduces asexually using stolons and sexually by seeds (Havel et al., 2015), with a rapid reproductive capacity enabling it to double its biomass in 6–14 days under conducive growth conditions (Keller and Lodge, 2009). Researchers have estimated that over 8 months, 10 water hyacinth plants can reproduce into 655,360 plants, covering approximately half a hectare

(III)

Peristylus parishii (Orchidaceae); A New Record to Kerala

Western Ghats region is considered as the repository and center of diversity of biological resources. Expeditions in the interior forests of these Ghats usually have to be resulted in the findings of new taxon. Botanical explorations in the forests of Wayanad part of south Western Ghats during 2014–2019 have yielded some interesting specimens of a ground orchid is subsequently identified as *Peristylus parishii*, a taxon hitherto unknown from Western Ghats. A detailed description of the species along with its colour photographs is provided.

Species Description

Peristylus parishii Rchb.f., Trans. Linn. Soc. London 30: 139 (1874), *Habenaria parishii* (Rchb. f.) Hook. f. Fl. Brit. India 6(1): 161 (1890) (King and Pantl., 1898; Rao, 1995, 2010; Luckson, 2007; Govaerts *et al.*, 2013; Verma *et al.*, 2013; Chowlu *et al.*, 2014).

Plant erect, ca. 60 cm tall. Tubers 2, unequal, ovoid-oblong. Stem 21–30 cm tall, with 3–5 tubular sheaths at base, 4–5-leaved. Leaves with size of 7–9 × 2.9–3.6 cm, ovate-elliptic, acute, clustered on the middle of the stem, undulate at margin, sheathing at base; petiole 0.5–1.5 cm long, channelled. Inflorescence 7–19 cm long, laxly many flowered; floral bracts 10–12 × 2.5 mm, lanceolate, acuminate, green. Pedicellate ovary 5–7 mm long. Flowers green to yellow; ca. 1 cm across, dorsal sepal erect, ovate, concave, 1-veined, apex obtuse; lateral sepals spreading, 6–7 × 1.6–1.8 mm, oblong to lanceolate, oblique, 1-veined, apex obtuse; petals spreading, ovate, oblique, 1-veined, 6–

7 × 2 mm; lip spreading to deflexed, 6–7 × 2.3–2.5 cm, ovate, ecallose, base shallowly concave, 3-lobed near middle, lateral lobes ca. 2 × 0.5 mm, shorter than midlobe, oblong, obtuse; mid lobe ca. 3.5 × 1.5 mm, triangular-oblong, sub-acute, longer than side lobes; spur pendulous, fusiform; viscidia oblong; rostellum with short arms. Pollinia 2, sectile, pyriform, with short caudiles.

Distribution: India [Arunachal Pradesh, Manipur, Meghalaya, Sikkim, Andaman and Nicobar Islands], China, Myanmar, Nepal, Thailand and Vietnam.

Habitat and ecology. Found in grassy hilltops (alt. ± 1250 m) of the Elimbilery Hills, Wayanad District, Western Ghats, Kerala, India. Grows in association with *Strobilanthes* sp., *Arisaema nilamburensense* Sivad. and *Ariopsis peltata* Nimmo. A population of 10 plants was observed at the locality.

Flowering and fruiting: June–July

Specimen examined : INDIA, Kerala: Southern Western Ghats, Wayanad District, near Elimbilery water fall, 27 July 2011, *Pichan M Salim* 0415 (Deposited in the herbarium MSSRF), Fig. 1 and 2.

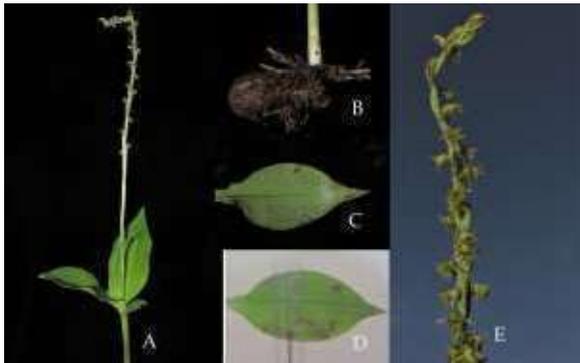


Fig. 1: *Peristylus parishii*. A. Flowering twig. B. Tuber. C–D. Leaf, E. Inflorescence.



Fig. 2: *Peristylus parishii*. A. Young inflorescence. B–C. Flower. D. Dorsal sepal. E. Lateral sepals, foot and column. F. Petals. G. Flowers in inverted position. H. Dissected flower showing pollinia.

Chiloschista confusa (Orchidaceae), a new species from the southern Western Ghats, Kerala, India

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Chiloschista confusa M.J. Mathew, J. Mathew, P.M. Salim & Szlach. (Orchidaceae), a new species from the southern Western Ghats, Kerala, India, is described and illustrated based on morphological data. It has long been misidentified as *C. fasciata*, an Indo-Sri Lankan species. However, *C. confusa* differs from *C. fasciata* by its denser inflorescence with comparatively smaller flowers, glabrous inflorescence, pedicel and ovary, flattened callus disc with eglandular hairs, and protuberance of the spur. A key to the three species of *Chiloschista* known from south India (*C. confusa*, *C. fasciata*, *C. glandulosa*) is also provided.

The orchid genus *Chiloschista* comprises about 30 species distributed in the Indian subcontinent, Himalaya, China, Taiwan, Thailand, Indonesia, Australia, New Guinea, Fiji and Micronesia (Seidenfaden & Wood 1992, Comber 2001, Averyanov *et al.* 2018, Gyeltshen 2020; see also <http://www.plantsoftheworldonline.org/>). Hitherto available collections from south India have been identified as *C. fasciata* (Figs. 1 and 2) and *C. glandulosa* (Fig. 3). The basionym of *C. fasciata*, *Sarcophilus fasciatus* (von Mueller 1866) was based on Wight's (1852: 1741) description and illustration (as "*S. usnioides*") of a specimen collected from Malabar. The description reads "Malabar, on branches of trees, flowering in April. Low herbaceous, hairy, leafless, epiphytes: roots flattened, green, as if to supply

the absence of leaves by performing their functions. Spikes erect, flowers whitish or somewhat cream-coloured. The lip of this plant is curious and difficult to represent. I am not sure that this is the species named, but I have no means of satisfying myself on that point". Later Hooker (1890: 37) described *Sarcophilus wightii* based on the same illustration by Wight. Hooker (1890: 37) also described *S. minimifolius*, a morphologically similar species from Sri Lanka. Seidenfaden (1995a) solved the problem by validating *C. fasciata* and including the above-mentioned names in it. Thus *C. fasciata* is considered an Indo-Sri Lankan species.

Seidenfaden (1995b) pointed out that Hooker (1890) was probably misled by Lindley's (1833: 237) note on *Oeceoclades retzii* when using



Phyllanthus sanatanadharmae (Phyllanthaceae): a new species from southern Western Ghats, India

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Abstract

A new species of *Phyllanthus* (Phyllanthaceae: *Eriococcus*), *P. sanatanadharmae*, from the southern part of Western Ghats, India is described. Detailed taxonomic description and colour photographs are provided along with key to the section *Eriococcus* in Kerala region of Western Ghats.

Keywords: Kerala, *Phyllanthus* sect. *Eriococcus*, Taxonomy

Introduction

Phyllanthus Linnaeus (1753: 981) is recognized as largest genus in the family Phyllanthaceae, comprises about 1000 species (Bouman *et al.* 2018; POWO 2021), distributed mainly in tropical and subtropical regions (Radcliffe-Smith 2001; Webster 2014). Among them, more than 50 species occur in India and of which, 28 species in Kerala region of south India (Balakrishnan & Chakrabarty 2012; Sasidharan 2013; Naveen *et al.* 2015; Sunil *et al.* 2016).

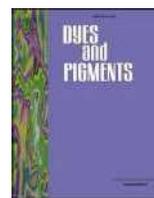
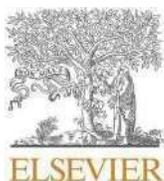
While exploring the floristic diversity of Vellarimala Forests of Kozhikode District, Kerala the authors came across an unknown species of *Phyllanthus*. Critical analysis of the literature (Roxburgh 1832, Hooker 1887, Trimen 1898, Gamble 1925, Webster 1994, 2002, Airy Shaw 1969, 1981, Rossignol *et al.* 1987, Govaerts & Radcliffe-Smith 1995, Philcox 1997, 1999, Chen & Wu 1997, Govaerts *et al.* 2000, Chaudhary & Rao 2002, Viswanathan *et al.* 2002, Balakrishnan & Chakrabarty 2007, 2012, Murukan *et al.* 2008, Sasidharan 2013; Sunil *et al.* 2016), as well as from the scrutiny of vouchers deposited in K, NY, PE, MH, CAL, TBGT and CUBH revealed that the specimens do not match any of the previously described species. These specimens are sufficiently distinct to warrant taxonomic recognition as new species and is here described as *P. sanatanadharmae* sp. nov.

Taxonomy

Phyllanthus sanatanadharmae J.Mathew & Yohannan, sp. nov. (Fig. 1)

TYPE: India, Kerala, Kozhikode District, Vellarimala, Way to REC Para, altitude 2250 m a.s.l., 14 April 2016, Jose Mathew 5041 (holotype: MH; isotype: MH.)

Diagnosis: *Phyllanthus sanatanadharmae* sp. nov. is morphologically shows some affinities with *P. megacarpus* (Gamble 1925: 332) Kumari & Chandrab. (1987:238), but differs by its diffusely branched growth habit up to 300 cm in height (vs. undershrub habit up to 100 cm high), coriaceous leaves with recurved margins (chartaceous leaves without recurved margins), pinkish white sepals with fimbriate margins (vs. purple sepals with deep ridged dentate margins), and depressed globose capsule (vs. inflated globose capsule).



Light emitting, segmented block copolymers containing distyrylbenzene blocks connected through α,ω -nonamethylenedioxy chain spacer for applications in polymer light emitting diodes

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ABSTRACT

Two novel, soluble, semiconducting and light emitting segmented block copolymers, termed as NPPV1 and NPPV2 are synthesized using Horner-Emmons condensation polymerization. The chromophoric groups present in the copolymers are distyrylbenzene (DSB) units substituted with rigid, bulky cyclohexylmethoxy and cyclohexylethoxy groups. The rigid blocks are linked to flexible α,ω -nonamethylenedioxy chain spacer through ether linkage. The structural, morphological, thermal and photo-physical characteristics of the synthesized polymers are studied in detail. Noticeable differences in properties arising through the substituent effects are observed for both the polymers. Detailed studies bring out quite interesting structure-property relationships between the substituents introduced in the synthesized copolymers and their crystalline properties, thermal characteristics, optical properties, photoluminescence emission and fluorescence quantum yield. Polymer light emitting diodes (PLEDs) employing these segmented polymers as emissive layers are assembled and characterized to establish their suitability for lighting applications. Using the architecture, ITO/PEDOT:PSS/NPPV1/LiF-Al, polymer light emitting diodes (PLEDs) are assembled and as the first step of device characterization, their current-voltage characteristics are studied to establish the device behavior and find out the onset voltage. The emission characteristics of the devices are then studied using Ocean Optics USB 2000 spectrometer integrated to a computer using a dedicated program. The assembled devices show Schottky junction like behavior in the current-voltage characteristics and electroluminescence emission in the blue green region with appreciable intensity at the onset voltage of 8.8 V. It is highly desirable to develop polymers showing emission in the high frequency, blue region, using cost-effective synthesis routes. The novel approaches adopted in the synthesis of the monomers and the corresponding copolymers to achieve the anticipated structure-property relationships suitable for the effective designing of polymer light emitting diodes are the highlights of the present work.

1. Introduction

Research on light emitting polymeric systems is gaining momentum since they constitute a new class of materials possessing the advantages of the potential to develop thin, flexible and light weight displays for portable electronics with high brightness, low operating voltage, color

tunability over the entire visible spectrum, wide operating temperature range and authentic image quality, using comparatively simpler and cost effective synthesis routes. Light emitting conjugated polymers such as polythiophenes (PT), polyphenylene vinylenes (PPV), polyphenylene ethynyls (PPE) and polyfluorenes (PF) are being screened for potential applications [1–4] and PPVs find applications in various fields

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A STUDY ON FUZZY MONOTONICALLY NORMAL SPACE

M. S. JISHA¹ AND R. SREEKUMAR

ABSTRACT. The concepts like stratifiable space, semi-stratifiable space and monotonically normal space were studied by Gary Gruenhage, in Hand Book of Set Theoretic Topology. In this paper we establish a relation between fuzzy monotonically normal space and fuzzy stratifiable space. Also we prove a necessary and sufficient condition for a fuzzy topological space to become a fuzzy monotonically normal space and study some of its properties.

1. INTRODUCTION

Generalized metric space is closely related to metrization theory. Metrizable space is a very nice but restrictive property of topological spaces. The concept like stratifiable space and monotonically normal space were studied by Gary Gruenhage. For a detailed discussion reference may be made of [3]. In this paper we establish a relation between fuzzy monotonically normal space and fuzzy stratifiable space. Also we prove a necessary and sufficient condition for a fuzzy topological space to become a fuzzy monotonically normal space and study some of its properties.

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2020 Mathematics Subject Classification. 54A40, 54E35, 03E72.

Key words and phrases. Fuzzy stratifiable space, fuzzy semi-stratifiable space, fuzzy monotonically normal space.

A RELATION BETWEEN FUZZY Σ -SPACE AND FUZZY σ -SPACE

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Abstract

A class of generalized metric spaces is any class of spaces defined by a property possessed by all metric spaces. They characterize metrizable in terms of weaker topological properties. The concept like Σ -space, strong Σ -space and σ -space were extensively studied by various authors as a part of theory of generalized metric spaces. In this paper we establish a relation between fuzzy Σ -space and fuzzy σ -space.

Keywords: Fuzzy σ -space, fuzzy Σ -space and fuzzy strong Σ -space.

AMS Subject Classification- Primary 54A40, Secondary 54E35, 03E72



A study on fuzzy semi-stratifiable and fuzzy stratifiable spaces

M.S. Jisha ^{1*} and R. Sreekumar²

Abstract

The notion of stratifiable space and semi-stratifiable space were studied by Gary Gruenhagen [4]. Alexander P. Sostak extended the concept of stratifiable space to the fuzzy case [1]. In this paper we investigate some properties of fuzzy closure-preserving collection, fuzzy stratifiable space and fuzzy semi-stratifiable space.

Keywords

Fuzzy closure-preserving collection, fuzzy stratifiable space, fuzzy semi-stratifiable space and fuzzy M_1 -space.

AMS Subject Classification

54A40, 54E35, 03E72.

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1. Introduction

The concepts like stratifiable space and semi-stratifiable space were extensively studied by Gary Gruenhagen. For a detailed discussion reference may be made of [4]. The class of stratifiable spaces does not differ too much from the class of metrizable spaces. Alexander P. Sostak extended the concept of stratifiable space to the fuzzy case [1]. In this paper we establish some properties of fuzzy closure-preserving collection, fuzzy stratifiable space and fuzzy semi-stratifiable space.

2. Preliminaries

We use the term fuzzy topological space in Chang's sense [2]. A fuzzy point x_α is a fuzzy set which takes every element in X to 0 except one element $x \in X$ and its value at x is α where $(0 < \alpha \leq 1)$. $\underline{0}$ is the fuzzy set which maps all element in X to 0 and $\underline{1}$ is the fuzzy set which maps every element in X to 1. The closure of a fuzzy set U in a fuzzy topological space

is denoted by \bar{U} . In this paper each fuzzy topological space is assumed to be T_1 and regular. \mathbb{N} denotes set of all natural numbers. We list some of the definitions which we are using in this paper.

Definition 2.1. [11] A collection \mathcal{A} of fuzzy subsets of a fuzzy topological space (X, F) is called discrete if for each fuzzy point x_α , there is a $G \in F$ with $x_\alpha \leq G$ and $G \wedge A \neq \underline{0}$ holds for at most one element A of \mathcal{A} .

Definition 2.2. [9] Let \mathcal{A} be a cover of a fuzzy topological space (X, F) . For $\alpha \in (0, 1]$ and a fuzzy point x_α , $\mathcal{A}(x_\alpha) = \bigvee \{B : B \in \mathcal{A}, B(x) \geq \alpha\}$ and for a fuzzy set G , $\mathcal{A}(G) = \bigvee \{B : B \in \mathcal{A} \text{ and } B \wedge G \neq \underline{0}\}$

Definition 2.3. [9] Let (X, F) be a fuzzy topological space. A fuzzy point x_α , $\alpha \in (0, 1]$ is called a cluster point of the set $\{(x_n)_\alpha : n \in \mathbb{N}\}$, where $(x_n)_\alpha$ is a fuzzy set with support x_n and value α , if for each fuzzy set $G \in F$ such that $x_\alpha \leq G$, there exists $n_0 \in \mathbb{N}$ with $x_{n_0} \neq x$ and $(x_{n_0})_\alpha \leq G$.

Definition 2.4. [7] Let (X, F) be a fuzzy topological space and let $F_0 \subset F$. Then F_0 is called a fuzzy base of F if $F = \{\bigvee \mathcal{A} : \mathcal{A} \subset F_0\}$.

3. Fuzzy closure-preserving collection

In this section we define fuzzy closure-preserving collection and fuzzy σ -closure-preserving collection.

Research Article

**THE SAGA OF COMMONS IN KUTTANAD: REPRESENTATIONS OF MARUTHA
PORUL IN THAKAZHI SIVASANKARA PILLAI'S RANDIDANGAZHI**

Dr. N. SARASWATHY ANTHARJANAM

Abstract

Thakazhi Sivasankara Pillai's Rantidangazhi (Two Measures of Rice) is a novel about the agricultural workers of Kuttanad, in South Kerala. Kuttanad region's past, present, and future are implied in the course of the novel. Since Rantidangazhi tells the story of the agricultural workers of Kuttanad and the setting is strictly rural, and the problems related to the conflicts between landed workers and landless labourers in the context of the rural economy, the novel can be very well connected to Maruthatinai. Expansive paddy fields and fertile landform the marutham landscape which becomes the space of prosperous and happy life of upper- and middle-class landowners of Kuttanad. This paper argues that the driving force of epochal changes in Kuttanadu was the transformations of the commons; different regimes that ruled Kuttanadu have actively engaged in the appropriation, distribution, and production of commons along with and for the dominant sections in the region.

Keywords: Maruthatinai; Kuttanad; landless wage labourers; Pariahs; Pulayas

1. INTRODUCTION

Kerala is a narrow strip of land lying between the Arabian Sea and the Western Ghats in the southwest corner of India, with a population of over twenty million who speak Malayalam, a language of the Dravidian stock. Very few writers in this language, which has literature nearly a thousand years old, have so far won any recognition outside India, except perhaps Vallathol Narayana Menon, the poet, and Thakazhi Sivasankara Pillai, the novelist. Thakazhi may be called a regionalist in the best sense of the term. His major works deal with the people of a small region in Kerala. He is at his best when he writes about the people of Kuttanad. The village of Thakazhi is part of Kuttanad, the water-logged complex in the delta of the Manimalai, Pampa, and other rivers which flow into Vembanad backwaters to turn a 100-150 square mile area into what was once the rice bowl of Kerala. Kuttanad in the old days had its own geographical and socio-economic identity, which marked it off from other parts of the state. There was very little landmass; even the rice fields had been reclaimed from the backwaters in recent times. There were at least two floods every year to synchronize with the monsoon rains. All rice fields would be underwater unless the water had been pumped out for sowing and harvesting. The floods would submerge even the land where houses and temples stood. But the people would make celebrate the season

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THE DIVINERS AS A PRAIRIE TINAI: SIGNIFICANCE OF LANDSCAPES IN TINAI AESTHETICS

Dr. N. Saraswathy Antharjanam

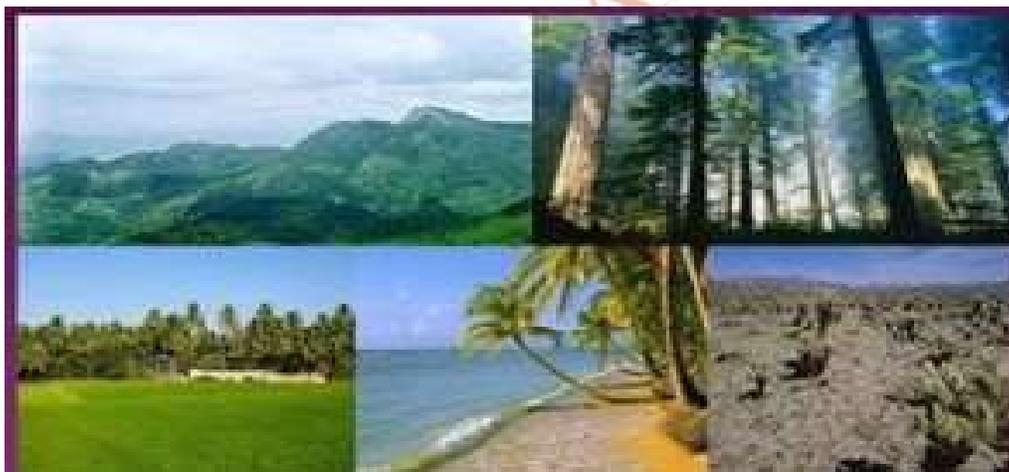
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Abstract

The ancient Tamil literature has considerably contributed to the eco-friendly literary theory in the name of tinai poetics. The ancient Cankam poets, who belonged to pre-Christian era, termed as Cankam poets because of their association with literary academies of those days were remarkably successful in nurturing their creative minds with the elements of landscape, which they belonged to. They drew their creative energy from the space that nature had provided for everyone. They believed that poetry is the means of communication and the images and metaphors in their poems evolve from the natural subjects that may be studied as cultural objects. These objects always locate the poet's self in his traditional as well as social space. The concept of tinai is a Dravidian literary critical concept. It encompasses landscape, timescape, bioscape and mindscape. Tolkappiyar's spatio-temporal dichotomy as a literary concept. This study gives new insights for studying of Margaret Laurence novel The Diviners

Keywords: Prairie tinai, river, water, existence, Manawaka



The term 'tinai' has four distinct, but inter-connected meanings all of which originate from the basic meaning, 'to join'. Earth is tinai because it is an unbroken continuum out of the compacting of sand, rock, soil and other substances. By extension, tinai can also refer to any specific place on earth, especially, a house with its own land surrounding it, a homestead. By further semantic extension tinai has come to mean family, particularly family that occupies a specific place and also family with kin member. Earth and household are tinai because the constituents that go to make these entities, namely, earth and household are so compacted as to produce a hard, firm unit. The first and second meanings combine to yield a third, namely human community indigenous to a specific ecoregion. By extension, when tinai refers to non-materials, it means 'conduct'. Here also there are farmhouse, homesteader and a homestead. Morag muses:

If the farmhouse had upstairs ceilings, the bird feet would not be quite so thundering. But

THE RIVER FLOWED BOTH WAYS: VOYAGE TOWARDS SELF-REALISATION IN MARGARET LAURENCE THE DIVINERS*

BY

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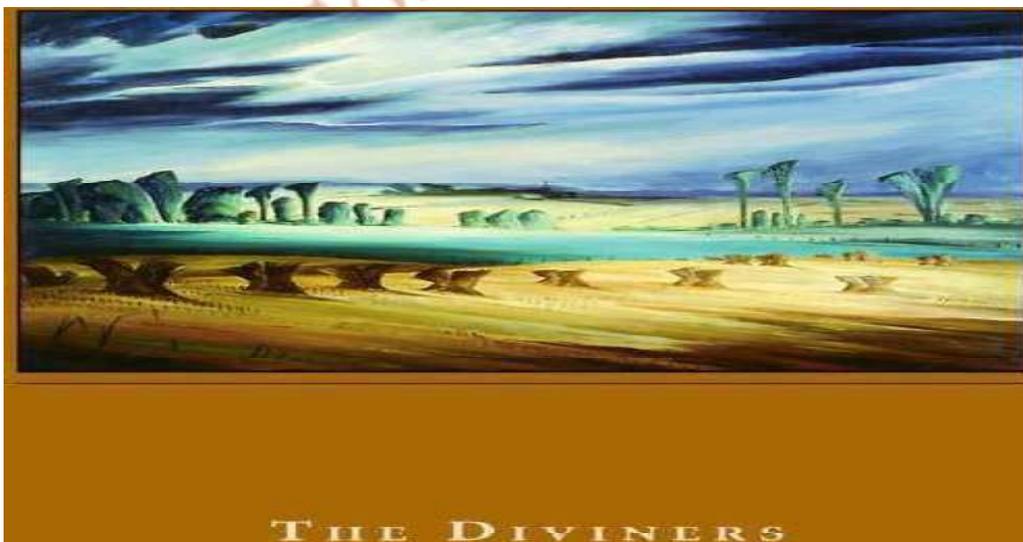
Abstract

The Diviners emphasizes the extent to which we use the past as a way of understanding the present, a concept that is suggested in Laurence's famous opening line, "The river flowed both ways" (11). The line suggests both that our contemporary culture has been determined by history-that is, the past flows into the present-and that we are constantly revising history from our contemporary perspective-that is, the present flows into the past. The novel presents a complex perspective of time, then, in which the past and the present are inextricably linked and consequently determine each other; this is the conclusion that Morag herself draws at the close of the novel, when she looks again at the river flowing both. This paper offers a reading of Margaret Laurence's The Diviners that highlights the interior landscape of the protagonist in her struggle to come to terms with herself.

Keywords: Manawaka, Identity, nature, culture, modern existence

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THE REVISED TAXONOMY STRUCTURE BASED ON COGNITIVE PROCESS AND KNOWLEDGE DIMENSION

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Abstract- The need for the taxonomies and how educators use taxonomy are discussed in this article. The two-dimensional arrangement of the taxonomy table for the knowledge dimension and cognitive process dimensions is provided. The article deals with the importance of objectives for facilitating communication in the classroom. The noun and verb indicators are also discussed. The four main categories of the knowledge dimension and their associated subcategories were also discussed here. The importance of differentiating among these four types of knowledge is also mentioned.

Keywords: Taxonomy, Knowledge dimension, Cognitive process, Factual knowledge, Conceptual knowledge

I. INTRODUCTION

Taxonomy is a special kind of framework in which the categories lie along a continuum. This continuum is one of the organizing principles of the framework. In the taxonomy of education, we are classifying objectives. A statement of an objective contains a verb and a noun. The verb generally describes the intended cognitive process. The noun describes the knowledge that the students are expected to acquire or construct as a result of teaching.

In education, objectives indicate what we want students to learn: they are explicit formulations of how students are expected to be changed by the educative processes (Handbook, 1956, p.26). Objectives are especially important in teaching because teaching is an intentional and reasoned act. Teaching is intentional because we always teach for some purpose, primarily to facilitate student learning. Teaching is reasoned because what teachers teach their students is judged by them to be worthwhile.

It is high time to find the answer to the question: What is worth learning? At an abstract level, the answer defines what it means to an educated person. At a more concrete level, the answer defines the meaning of the subject matter being taught. While looking through the lens of the Taxonomy Table, teachers can see more clearly the array of possible objectives as well as relationships among them. A more complete understanding of the curriculum will be obtained when we analyze all parts of a curriculum in terms of the Taxonomy Table. The Taxonomy framework helps teachers to translate standards into a common language for comparison with what they hope to achieve, and by presenting the variety of possibilities for consideration, the Taxonomy may provide some perspective to guide curriculum decisions.

Categories of the knowledge Dimension

Factual, Conceptual, Procedural, and Metacognitive are the four general types of knowledge. Factual knowledge is the knowledge of discrete, isolated content elements-‘bits of information’. It includes knowledge of terminology and knowledge of specific details and elements. Conceptual knowledge is the knowledge of more complexes, organized knowledge forms including knowledge of classification and categories, principles and generalizations, theories, models, and structures. Procedural knowledge is knowledge of how to do something. It includes knowledge of skills and algorithms, techniques, and methods. Metacognitive knowledge is knowledge about cognition in general as well as awareness of and knowledge about one's cognition. It encompasses strategic knowledge, knowledge about cognitive tasks including contextual and conditional knowledge, and self-knowledge.

Figure 1 depicts the analytic approach from the statement of an objective to its place in the Taxonomy Table. The approach begins by locating the verb and noun in the objective. The verb is examined in the context of the six categories of the cognitive process dimension: remember, understand, apply, analyze, evaluate and create. The noun is examined in the context of the four types in the knowledge dimension: factual, conceptual, procedural, and metacognitive.

**REPRESENTATION OF MULLAI TINAI IN THOMAS HARDY'S THE WOODLANDERS
AND TESS OF THE D'URBERVILLES**

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Abstract

The correlation of time and place (mutal porul) with natural settings (karu porul) helps to achieve the right projection of human emotions (uriporul). In this context it is possible to conclude that the Wessex landscape in The Woodlanders acts as a tinai. These landscapes and their natural milieu serve as a background for expressing the appropriate phase of love associated with them which helps to rightly convey the mood of the lovers. The description of human emotions in relation to nature and great love and concern for nature connect the English writer Thomas Hardy with the South Indian Cankam poets. This paper attempts to explain the conventional mullai tinai and its echoes in Thomas Hardy's The Woodlanders and Tess of the D'Urbervilles. The idealized landscape known as tinai, in which akam poetry is based is nucleus to the design of the poems. There are five such landscapes in akam proper, kurinji, marutam, mullai, neytal and palai. Each landscape is named after a flower or tree native to it and each is associated with a season, time of day, specific God, animals, birds, trees, occupation, food, musical instrument, raga, community and hero. Most significantly each landscape is associated with an aspect of love.

Keywords: Mullai tinai, Hollybush, Cankam, uri porul- emotion, Hintock

The Cankam (pronounced as sangam) poets never lost sight of the landscape that they knew and their poems were full of concrete and unforgettable details of the flora and fauna of their region. These songs not merely portray the natural beauty of each region but the people's day-to-day life lived close to nature. The scenic splendour of nature provides the background for Cankam poems. The splendid description of nature in the poems shows the poets' great concern for nature and shows how nature and human beings are interconnected. This interrelation between man and nature is first identified by Wordsworth and it is he who introduced it to the English world. Thomas Hardy "the observant painter of rural scenes" (H. Willaims, Jstor org) makes it more expressive and celebrates it in his novels and poems. It is difficult to dissociate people from their environment in his novels. The moods of earth and sky enter into human life, colour it and even play their roles in the story.

A tinai is not just literal topography. It is a stylized notion of landscapes conditioned and conventionalized for the purpose of aesthetic communication. It is a means of bringing together aspects of nature and human society for achieving artistic coherence. The correlation of time and place (mutal porul) with natural settings (karuporul) helps to achieve the right projection of human emotions (uriporul). In this context the chapter elucidates that, the Wessex landscape in The Woodlanders acts as a tinai. The landscape and its natural milieu serve as a background for expressing the appropriate phase of love associated with them which help to rightly convey the mood of the lovers.

Mullai is a forest region representing evening time when the lady love is patiently waiting for her

AN ECOLOGICAL READING OF HARDY'S THE WOODLANDERS

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Abstract

Present study aims to discover the thematic relationship between man and nature in The Woodlanders of Thomas Hardy. Hardy's treatment of nature reveals the foundations of thinking that has contributed to our contemporary environmental crisis. Hardy shares affinity philosophically reconstructing culture through presenting the truth value of literary art and nature in the heart of natural elements and images. The Woodlanders is, perhaps, the most balanced and satisfying work. The very title of the novel echoes its predilection for ecological concerns and hence its susceptibility to an ecocritical reading. The atmosphere of the woodlands pervades the whole novel. The woods at once divide the lovers and bring them together. The trees are there as a vague but dominating presence in the life of the Hintock folk. The decline of Grace's love for Fitzpiers is reflected in the dying woodlands, and the winter of her despair, as the summer of her hopes is in sympathy no less with her surroundings.

Keywords: nature, wood, agriculture, anti-Nature, culture

Hardy is much interested in the natural milieu and in the occupation of agriculture, he naturally makes nature the background of his poems and novels. However, his love and veneration for the world of nature largely differs from that of William Wordsworth and Robert Frost. Hardy doesn't make nature the main theme of his works, but it provides a background. Hardy's love for the Wessex country side, the topography, nomenclature, folk culture, music and life, makes him a profound thinker of the old and valuable country-culture and tradition. Hardy thinks about nature in terms of man-nature kinship. He ponders over nature's explicit attitude towards the working of lives. He thinks about man's love and respect for nature and nature's benevolence to human beings. Hardy longs for nature and man always to be in perfect harmony with each other, for their benevolent co-existence. He doesn't think that man will lead a harmonious life with nature if he treats her as a mere mass of biological objects.

The Woodlanders was published in 1887. Thomas Hardy mentioned in the biography that he thought of writing about the woodlanders more than two years ago. The Woodlanders is, in fact, no idle title: the atmosphere of the woodlands pervades the whole novel. Old South's fate is bound up with the sympathetic life of an elm: no one plants trees like Giles Winterbourne; and to Marty South the sighing firs are human in their sorrow. The woods, like the "wood near Athens" at once divide the lovers and bring them together; and the rites of Midsummer-Eve are carried out among the Hintock groves. But it is no elfish puck that first leads the wanderers astray and then unravels their complications; rather the trees are there as a vague but dominating presence in the life of the Hintock

THE ART OF NARRATION IN SOMERSET MAUGHAM'S "THE FACTS OF LIFE"

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William Somerset Maugham is widely well-known for his short stories about everyday life. The study emphasizes the significance of thematic, aesthetic, and structural analysis of the text, pinpointing the dominant themes in the story. The paper also analyzes the interconnectedness of such components to serve the thematic essence of the story in the context of the plot that the writer formulates to present his characters and themes. The paper pays special attention to the analysis of the major characters and ideas, specifically Nicky Garnet and his struggle with the narrator-character based on prejudice, racism, and ethnicity. The paper will focus on narrative in its designation as game and contest, as play and as war, using the story "The Facts of Life." In the story "The Facts of Life" the account of a young man's first experience of life outside parental control is presented in terms of the metaphor of game. In "The Facts of Life" the metaphor of game pervades the story in an occupancy that reveals narrative itself as a game.

Keywords: game, mock-war, co-exist, loser, fear

Like any other literary form that serves as an interpretation of life the literary genre short story also enjoys a dignified position in the world of letters. William Somerset Maugham's stories have a unity of purpose and execution which is the result of the channeling of narrative energies into basic framing structures which in turn direct and focus the movement of the stories. Maugham is also one among these celebrities who enjoys a worldwide readership. Maugham always saw that his stories were compact, dramatic, well-knit, and having a sharply characterized ending. He was capable of writing stories of varied length. He wrote both very short and very long stories such as "Mr. Know-All" and "Red" respectively. For this study, the researcher selected "The Facts of Life". The reading of "The Facts of Life" attempts to explore how the metaphor of the game is manipulated as a narrative device. A game is a space or field where restrictions, as well as freedom of play, co-exist. This ambivalence makes the metaphor of the game function as an indication of freedom as well as of restraint. As a rule-based-closed system, it upholds the system against chaos. But as the focus of rules, it offers the possibility of breaking the rules and subverting the system. The game as a rule-determined system represents rationality; as the possibility of violating the sanctity of rules, it represents the unpredictability of chance. In human terms, rationality contrasts with instinct. The father in the story plays by rules whereas the son plays by instinct.

The story opens with a reference to Henry Garnet's propensity for games: "It was Henry Garnet's habit on leaving the city of an afternoon to drop in at his club and play bridge before going home to dinner" (2). He knows the game of bridge very well. The text makes very clear that though he worked hard to win, he was a good loser too. In this opening paragraph, one reads also that whenever he won again he was content to attribute it to luck rather than to skill. He was tolerant of other people's mistakes and would even come up with good excuses on their behalf. The overall impression of Henry Garnet that we get is that of a sober, rule-abiding, pleasant, and gentlemanly partner in a game. Having done this the narrative quickly shifts into a situation in which Henry Garnet behaves unpredictably. Normally Henry Garnet's game behavior is a predictable one. When one sees him chiding his partner for playing badly, making mistakes and unreasonably defending them, and generally presenting an irritable temperament thereby, one senses that something is wrong. If Henry Garnet's usual sportsman spirit represents the rule, his erratic behaviour on this day represents a failure of rules and system.

Henry Garnet's badly played game of bridge becomes a psychological indicator of a potentially pathological state of mind. Playing bridge badly presents a narrative situation that calls for various interpretations: the correct interpretation calls forth the master narrative. Garnet appears before his friends as a patient in front of his doctor. He declares the symptoms of his diseased state of mind but

**RETELLING NATURE: TRACING THE GREENCRITICAL CONSCIOUSNESS IN
MARGARET LAURENCE'S THE DIVINERS**

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Abstract

Nature and literature have always shared a close relationship as is evidenced in the works of poets and other writers down the ages in almost all cultures of the world. Today the intimate relationship between the natural and social world is being analysed and emphasized in all branches of knowledge and development. Ecocriticism is the study of representations of nature in literary works and of the relationship between literature and the environment. As a separate movement or school of literary criticism, ecocriticism started developing in the 1990s. There is a close relation between ecocriticism and literature. Ecocriticism is an interdisciplinary study of Ecology and Literary Criticism which is unusual as a combination of a natural science and a humanistic discipline. The geo- physical factors of Canada made it an entirely different country from any of the typical European countries the inhabitants of which had migrated to Canada to settle there on permanent basis. Margaret Laurence, a representative novelist of Canada, not only exhibits a distinct and deep awareness of the social, economic and cultural realities around her, but she also succeeds in effectively transmuting them into her literary experiences and assimilating the same in her writings. This paper discusses the term ecocriticism and the role of ecocriticism in literature. It cites examples of how the theme of ecocriticism can be interpreted through the reading of Margaret Laurence's *The Diviners*. An attempt has been made in this paper, to analyze the influence of the prairies on the characters in one of her major novels, *The Diviners* so as to reinforce the proposition of ecocriticism being one of the predominant aspects of her literary perspectives.

Keywords: Ecocriticism, Manawaka, social, cultural, political

Though Ecocriticism or green criticism is a recent interdisciplinary field in literary and cultural studies, writers have unwittingly been doing ecocriticism for centuries. The publication of the canonical text *The Ecocriticism Reader Landmarks in Literary Ecology* by Cheryll Glotfelty and Harold Fromm provided the right direction to this genre. Apart from raising questions such as how is nature represented in a work of art, what side does the physical setting play in the plot of a novel etc. ecocriticism also analyses the role played by the natural environment in the imagination of a cultural community. As an outcome of this influence the text becomes a place where different visions of nature and varying images of culture are played out. Therefore, ecocritics study the environmental conditions of an author's life, mapping out the influence of place on the imagination demonstrating that where an author grew up, travelled and wrote is pertinent to an understanding of his or her work. This chapter aims at tracing such interconnections of nature and culture in Margaret Laurence's *The Diviners*, a novel that has been based on Laurence's studies in a summer home she established on the Ontobee River, which she named Manawaka cottage.

"Nature and culture do not exclude each other but be entangled with each other in multiple ways", writes Glotfelty in her introduction to *The Ecocriticism Reader* (xv-xxxii). Ecocriticism takes as its subject the interconnection between nature and culture. This chapter aims at tracing the man-nature relationships, which is what we are calling the Prairie Tinai, in Margaret Laurence's *The Diviners*. Though this

A DIVINING OF MEMORY STUDIES IN MARGARET LAURENCE'S THE DIVINERS

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ABSTRACT

Margaret Laurence a celebrated writer has made use of the first-person narration, flashback and the associative memory narration excavating the past. *The Diviners* is accepted for its profound search of the functions of the role of the memory and its functions and the processing. It is due to the mesmerising effects of the memory that the narration becomes effective, stressing the incidents, highlighting the pleasant and hiding the rest. The protagonist Morag Gunn lives in a riverside farmhouse in Eastern Ontario. The assumption here is that human emotions are conditioned by environmental factors. The physical landscape affects and reacts with the mindscape of the characters. This is evident from very ancient times even in the epics. Through a series of flashbacks, she reviews her earlier life. Memory studies enable literary scholars to approach literature from a new vantage point that brings together various types of knowledge gathered by literary studies and memory studies. Every reader of this novel is bound to ask himself or herself, which story is the most significant, whether of the woman seeking independence or of the writer desiring self-expression. The main, powerful, and fascinating story of the struggles of an independent woman and her urgent need for love is told through extended flashbacks which Laurence calls Memory Bank Movies. This paper aims at tracing such interconnections of Memory and culture in Margaret Laurence's *The Diviners*, a novel that has been based on Laurence's studies in a summer home she established on the Ontobee River, which she named Manawaka cottage.

Keywords: *Kunsterroman*, Memory Bank Movies, Snapshots, Tradition, Fragmentation, Divine

Memory Studies is a recent interdisciplinary tool in the field of literary and cultural studies. Writers have unwittingly been doing Memory Studies for the past few years. Apart from raising questions like how is memory represented in a work of art, what role does the physical memory play in the plot of the novel, etc. Memory Studies also analyses the role played by the memory in the imagination of a cultural community. As an outcome of this influence, the text becomes a place where different visions of Memory Studies and varying images of culture are played out. Therefore, critics study the environmental conditions of an author's life, mapping out the influence of the place on the imagination demonstrating that where an author grew up, traveled, and wrote is pertinent to an understanding of his or her work.

Among the literature of various countries, Canada has its own way of treating the features of post modernism with its long-routed travelling into the path of history through the memory of the people, enabling a structural delineation of the embedded historical accounts and its powerful aboriginal thoughts and feelings. The import of bilingualism and multiculturalism has afforded Canada the inclusion of two dominant cultures namely the British and the French, along with the aboriginal. The major contribution of the writers is on sharing the heavy impact and the influence of international immigration in the recent years. Writers engage themselves in bringing an outlook on the environment, socio-political issues and largely the significance of the history that has been lost in the discussion.

Margaret Lawrence the widely reputed regional writer has been the nominee for the Nobel Prize in 1982. She has won innumerable prestigious awards like Beta Sigma, Governor General Award. She caters the need of post war nationalism with the imaginary creation of Manawaka partly based on her native town of Neepawa, Manitoba, which has become the region of all her novels. Laurence places in her novel, the fictional town Manawaka, which is simply a fictional town of her mind. Laurence's work is completely understood with an eye on her region and its physical, mental, spiritual, historical and the cultural features. Hagar's pride in *The Stone Angel*, Rachel's



EXPERIENCES AND COINCIDENCES: ANALYSIS ON THE TYPICAL WRITING STYLE OF SOMERSET MAUGHAM'S "THE UNCONQUERED"

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ABSTRACT

This paper aims to provide a sense of William Somerset Maugham's art of writing short stories with an assessment of the vital elements that make a short story successful in the case of Maugham and also to explore how his work exposes the experience. The study attempts to concentrate on the dominant narrative framework peculiar to the story discussed. For this study, the researcher selected the victim of a rapist in "The Unconquered" who avenges both the violator of her virginity and the violator of the sovereignty of her country through a contest of contraries that ultimately tilts in favour of the moral judgment. As a metaphor, a game can be as playful as it is serious. An entirely new perspective is attempted through the hypothesis that this dominant narrative emphasis is related to the basic framing ideas of the story. Thus, the interface between the form and the content of the story forms the main focus here. The shortness of the short story and Maugham's skill in the genre together produce an economy of effect that functions through a narrow but intense range of narrative strategies. These strategies may be worked into an argument that links the perennial themes of human interest, though, and anxiety—beauty, youth, growing up, cure, violation, loss, and death-- with techniques of narration that contribute to the significance and urgency of these themes.

Keywords: judgment, power, guilt, culture, narration

The attempt to rescue human freedom entails struggle, and this is what forms the implicit as well as an explicit theme in "The Unconquered". The economy of meaning in the narrative of this story functions through a series of interrelated and mutually reflexive dichotomies. It is the constant reversal of the relations of dominance that obtain between the two members of a dichotomy that propels the movement of the narrative. It is like all binary oppositions that one term is privileged over the other: therefore, the relationship between the two terms is always already a relationship of power. The goal of the narrative then involves the reversal of power roles. However, the narrative cannot afford to upset all power relations if it is to effect change since change becomes visible only against the backdrop of invariant categories. The maintenance of the status quo in the relationship between the two terms of

Construction of Some Betweenness Uniform Graphs

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Abstract. The betweenness centrality of a graph measures the tendency of a single vertex to be more central than all other vertices in the graph. It is based on differences between the centrality of the most central vertex and that of all others. In many real world situations it has quite a significant role. In this paper , we initiate the study of betweenness uniform centrality of some graphs and investigate how to construct a betweenness uniform graph for a given betweenness centrality .

INTRODUCTION

Let $G(V,E)$ be a simple connected undirected graph with vertex set V and edge set E , n and m denote the number of its vertices and edges respectively. For every vertex $v \in V$, the open neighbourhood of v is the set $N(v) = \{u \in V : uv \in E\}$ and the closed neighbourhood of v is the set $N[v] = N(v) \cup \{v\}$. The degree of a vertex $v \in V$ is $deg(v) = |N(v)|$. For any two vertices $u, v \in V$, the distance $d(u, v)$ between u and v is the length of a shortest path between u and v in G . The eccentricity of a vertex u is the number $e(u) = \max \{d(u, v) : v \in V\}$. The maximum eccentricity of the vertices of G is called the diameter of G and is denoted by D .

The betweenness centrality of a graph measures the tendency of a single vertex to be more central than all other vertices in the graph. It is based on differences between the centrality of the most central vertex and that of all others [5].

Definition .1 Let $G(V,E)$ be a simple connected undirected graph with vertex set V . The betweenness centrality of a vertex $v \in V$ is given by

$$C_B(v) = \sum_{s \neq v \neq t} \frac{\sigma_{st}(v)}{\sigma_{st}}$$

where σ_{st} is the number of shortest paths with vertices s and t as their end vertices and $\sigma_{st}(v)$ is the number of those shortest paths that include the vertex v .

High centrality scores indicate that a vertex lies on a considerable fraction of shortest paths connecting pairs of vertices [5].

Definition .2 [1] :The relative betweenness centrality of a vertex $v \in V$ is defined as

$$C'_B(v) = \frac{2C_B(v)}{(n-1)(n-2)}$$

Definition .3 [5] : The betweenness centrality of a graph G is defined as

$$C_B(G) = \frac{\sum_{i=1}^n C'_B(v_i^*) - C'_B(v_i)}{(n-1)}$$

where $C'_B(v_i^*)$ is the largest value of $C'_B(v_i)$ for any vertex v_i in the graph.

Definition .4 [4]: Graphs with vertices having the same betweenness centrality are called betweenness uniform graphs .

In this paper we investigate how to construct a betweenness uniform graph for a given betweenness centrality .

Theorem .1 [4] Let G be a graph of diameter 2. Then for every vertex $v \in V$

$$C_B(v) = \sum_{\substack{s \neq v \neq t \\ s, t \in N(v) \\ st \notin E(G)}} \frac{1}{\sigma_{st}}$$