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Research Article

Phytosociological Analysis and Vegetation Structure in Tehsil Timergara, District Dir Lower, Pakistan: A Comprehensive Study of Five Distinct Plant Communities

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Abstract

Biodiversity is the variation of life on the soil surface and includes differences in biotic structure at every level, from genes to species and vary to every ecological system. This study explores the phytosociology and vegetation structure in Tehsil Timergara, District Dir Lower, Pakistan, focusing on five distinct plant communities. The investigation utilizes TWINSPAN classification to categorize these communities, revealing their composition, dominance, and ecological attributes. The identified communities include *Monotheca-Persicaria-Nerium* (MPN), *Punica-Indigofera-Isodon* (PII), *Myrtus-Dodonaea-Origanum* (MDO), *Berberis-Cornus-Teucrium* (BCT), and *Dodonaea-Salix-Pennisetum* (DSP). The dominance of Megaphanerophytes and the prevalence of Microphylls in leaf spectra highlight the ecological dynamics of the region. In each community, the study examines the importance of values, and soil characteristics, providing insights into the environmental conditions influencing plant distributions. Additionally, the study calculates similarity and dissimilarity indices between these communities, revealing the degrees of overlap and uniqueness. The highest similarity is observed between *Myrtus-Dodonaea-Origanum* and *Dodonaea-Salix-Pennisetum* communities. This comprehensive phytosociological analysis enhances our understanding of the vegetation dynamics in Tehsil Timergara, offering valuable insights for conservation and sustainable management. The findings underscore the significance of considering multiple plant communities to formulate effective environmental management strategies.

Keywords

Phytosociology, Vegetation Structure, Plant Communities, TWINSPAN Classification, Tehsil Timergara, Dir Lower, Pakistan

1. Introduction

Essentially, biodiversity is the variation of life on the soil surface and includes differences in biotic structure at every level, from genes to species to ecological settings. The biological, organismal, and hereditary ranges comprise the en-

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tirety of biodiversity [1]. Each component can be counted separately. Plant communities' ability to function is influenced by the diversity of species and genes within them. Climate change also has an impact on these ecological effects of biodiversity through increased greenhouse gas emissions, aerosols, and loss of land cover [2]. The most important physiognomic characteristic of flora that is frequently used in vegetation research is the biological spectrum. An important tool for illustrating plant communities is the elaboration of the leaf [3]. The general appearance of vegetation is referred to as physiognomy, and the types of plants that can exist in each ecosystem are determined by the climate. Individual species within a community can be classified into different life forms according to their growth performance and physiognomy. Biological spectra are significant physiognomic features that are frequently employed in vegetation analysis and the life form spectra are considered to be the markers of the macro- and microclimate [4].

There are roughly 6000 plant species, abundant natural resources, and a variety of ecological zones in Pakistan. Medicinal plants are naturally grown in many ecological zones across the nation, and some species are also cultivated on a small scale. Over 6000 plant species have been reported from Pakistan, of which over 1000 are known to be aromatic and medicinal [5]. Deforestation, overuse, excessive grazing, and the conversion of natural habitats into agricultural fields are the main causes of the shortage of medicinal plants. As a result, both natural and man-made factors pose serious threats to biodiversity. In phytosociology, analyzing species composition and ecological roles in varied landscapes like Khyber Pakhtunkhwa (KPK), Pakistan, is vital. Studies such as on the Hindu Kush range in KPK, shed light on the diverse plant communities and their crucial role in maintaining biodiversity and ecological balance [6].

Dir (Lower) is in Pakistan's KPK, in the Malakand Division. is located in the Hidukush mountain range and spans 35°10'–35°16' North latitude and 71°50'–71°84' East longitude as shown in Figure 1 (Rahman and Rehman, 2017). District Dir Lower is bordered internationally on the west by Afghanistan (Kunar province), on the east by Swat District, and the south by Malakand District. The valley was split in two by the Punjkora River, which runs through its centre. It rises and flows to the south side following the elevations in the north [7]. The majority of the year, as well as within a single month in various locations, the area experiences varying temperatures. Timargara experiences an average minimum temperature of 5.3°C in December and an extreme of 35.7°C in July. Hindu Raj, a magnificent mountain that is a part of the Hindukush range, is well-known for its height. In the "N" of Upper Dir, some mountains are essentially touched by sea level at five thousand metres [8]. Recent ecological studies in Khyber Pakhtunkhwa, especially Dir Lower, have deepened our understanding of the region's plant diversity highlighted the ethnobotanical significance of Swat Valley's flora, and detailed the floristic diversity in Banda Daud Shah and Upper Dir's alpine regions, respectively. Which addressed climate change impacts and conservation challenges, respectively, offering a comprehensive view of the area's ecological dynamics [9, 10]. The recent research was conducted to explore the plant varieties, communities, and the relationship between different plant types and environmental variables in Tehsil Timargara, District Dir Lower. This study was particularly significant as it addressed an aspect that had not been previously explored in this region. However, we thoroughly discussed the floristic alignment of Tehsil Timergara, plant.

Figure 1. *Map of the study area Tehsil Timergara Dir Lower.*

2. Materials and Methods

2.1. Sampling of Study Part

To classify different stands of vegetation, the study area was plotted based on different environments and the appearance of vegetation. Over all 15 stands were taken in the whole study area. GIS (Geological Information System) organizes as well as, latitude, longitude and altitude reserved after each stand.

2.2. Experimental Plan

In different stands of vegetation shape of the study part, 50 50-meter line transect order was applied to tape the phytoecological feature which is much significant and reliable procedure for the investigation of plant species [11]. According to the size of the stand different numbers of transects were applied randomly for sampling of vegetation to take the representative data. Process designated by [12]. Phytoecological features such as density, cover, frequency, relative density, relative cover and relative frequency were noted. Aimed at the way to record the physiographic attributes like gradient position, gradient exposure, height, longitude and latitude GPS and clinometer were used. During field work digital camera was used for plant photography.

2.3. Phenology Collection and Identification of Plant Specimens

Plant specimens were collected during field work tagged the plants, pressed them, and dehydrated with staining papers in the field presser. The newspaper changed rendering to plant and environmental conditions within 24 hours. For poisoning of dried specimens, three percent ethyl alcohol, mercuric chloride and copper sulphate were used. On a typical herbarium sheet of size (17.5"-11.5") different plant species were mounted and commended by the Herbarium of Hazara University, Pakistan. With the aid of present works and the flow of Pakistan, plants were acknowledged (Bege and Khan., 1977; Ali and Nasir, 1970; Stewart, 1967-1972; Alia and Qaiser, 1993-2007; Nasir and Robina, 1995). Voucher specimens were placed in the Herbarium of Hazara University, Pakistan.

2.4. Phytosociological Attributes

The phytosociological attributes were measured. For standing the species of plant in community IVI was used. Plants species having maximum Importance Value Index (IVI) in the stand was type the dominant species of plants [13]. Every plant community was termed based on their dominant specie. The dominant was followed by the plant species were grouped into co-dominant, associate and unusual. For each species dissimilar perimeter such as density, relative density, cover, relative cover, frequency and relative frequency were considered [14], by using the given formula where Importance Value Index =R. D+R. F +R. C.

$$Density = \frac{\text{Total number of individuals of a species in whole stand}}{\text{Total number of samples of a stand}}$$

$$R.Density = \frac{\text{Density of a specie}}{\text{s of all species}} \text{ x } 100$$

$$Frequency = \frac{Number\ of\ samples\ in\ which\ a\ species\ is\ present}{\text{number of sample}} s \text{ x } 100$$

$$R.Frequency = \frac{\text{Occurrence of a species in whole stand}}{\text{Total number of a sample of a stand}} \text{ x } 100$$

$$Cover = \frac{\text{Cover of a Specie}}{\text{Total sampled area}} \text{ x } 100$$

$$R.Cover = \frac{\text{Cover of specie}}{\text{s cover of all species in a stand}} \text{ x } 100$$

2.5. Similarity and Dissimilarity Indices and Community Structure

The interspecific relationship among types of species is established through similarity indices. Dissimilarity and Similarity indices were designed through a formula by way of Per Sorenson (1948), as follows:

Index of similarity

$$(IS) = 2C/(A+B)\times 100$$

Where, A=Numbers of plants in "A "community
B= Number of plants in "B" type community
C=Numbers of shared plants in mutual communities
ISs= 100-ISs

The phytosociological attributes for community structure were noted like plant density, cover, frequency, Relative frequency, Relative cover and Relative density. The total of Relative density, Relative frequency and Relative cover characterized the importance value. To recognize different plant communities TWINSPAN categorization was considered for the investigated sites.

2.6. Soil Analysis

From individual stand soils, analysts were dug out at a 16cm range of depth, mixed well-kept in polyethene bags and named with permanent marker. Of each soil sample chemical and physical properties were evaluated in Buffa Research Institute Mansehra (BRIM). According to the method defined in AOAC (1984), water holding capacity and texture of soil were designed. Using consort k520 a numeral conductivity meter electrical, the conductivity of soil was

measured. In soil, total nitrogen contents were examined according to methods [15]. Using the method of [16], the total amount of Phosphorus was analyzed. Through flame photometry technique magnesium (Mg), potassium (K)) and contents of sodium (Na) were evaluated giving to the method of [17].

2.7. Data Analysis

For different investigations the information was documented and calculated by using M. S Excel, PC- ORD-6 for classification by using TWINSPAN. CANACO-5 for the ordination of species and stand and ecological variables. TWINSPAN [18], for community classification, was used to determine a first estimate of the floristic facts. These groups designed the origin of the sketch of the plant communities recognized in this work. CCA and DCA techniques were applied for the ordination of plants, stands and ecological variables [19].

3. Results and Discussion

3.1. Floristic Composition and TWINSPAN Classification for Phytosociology

Quantitative study of vegetation helps in understanding the structure, configuration and tropic organization of any community. Species composition and diversity differ from habitat to habitat in the communities revealing identical physiognomic characteristics [20]. The recent study was confined to 206 species of plants belonging to 182 genera and 82 families which were *Apocynaceae, Fabaceae, Leguminosae, Malvaceae, Moraceae, Polygonaceae and Pteridaceae, Acanthaceae, Cyperaceae, Ranunculaceae and Scrophulariaceae, Asparagaceae, Aspleniaceae, Brassicaceae, Caryophyllaceae, Convolvulaceae, Nyctaginaceae, Onagraceae, Plantaginaceae, Primulaceae, Salicaceae, Verbenaceae.* Out of all families, *Lamiaceae* was dominant, followed by *Asteraceae* and *Poaceae*. Our result is in lined with [21, 22], they worked on Malamc Jaba, Swat, Pakistan from 2002 to 2004. They noted 200 plant species in the floristic composition of the study area in which *Lamiaceae* was the dominant family followed by *Asteraceae* and *Poaceae*. As a whole 206 plant specimens and 15 stands were examined by TWINSPAN Classification, and 5 different groups of communities were identified in the investigation area. The instructive picture of TWINSPAN classification is revealed in Figure 2. A similar result was also presented by Abiyou [23] who worked on Menagesha Amba Mariam Forest (Egdu), a dry evergreen Afro-montane forest in the central highlands of Ethiopia. Overall 219 species of plants belong to 182 genera and families of 76 were documented. They also stated that the top family was *Lamiaceae* surveyed by *Asteraceae* and *Poaceae.*

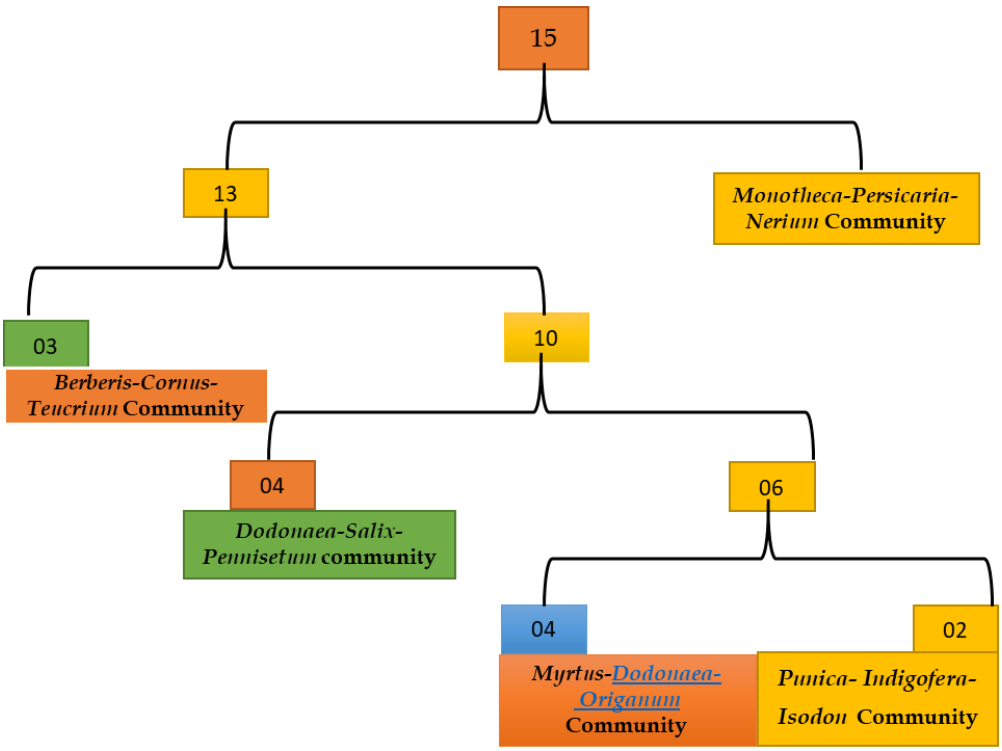

Figure 1. *Plant communities of vegetation of Tehsil Timergara through TWINSPAN classification.*

3.2. Monotheca-Persicaria-Nerium (MPN) Community

Monotheca-Persicaria-Nerium Community were noted at height from 580-612m. These types of communities were found at Manzai and Doda in Tehsil Timargara. The latitude ranges from (N=34 °42'46"-34 °44'48") and the longitude varies from (E=71 °46'0.9"-71 °46'51") at West, South-West exposure and (23°-42°) slope angle. This community included 63 total plants of which 37 were herbacious, 14 were tree plants, 8 plants of shrubs, 2 grasses and one fern observed. In such type of community, the most common species was *Monotheca buxifolia* 31.88 IVI along with *Persicaria barbata* and *Nerium oleander* having 17.46 IVI and 6.95 IVI respectively. In this type of community, the trees cooperate 90.24 IVI, appeared by herbs 85.64 IVI, 23.29 IVI by shrubs IVI, 5.93IVI by grasses, climber 1.53IVI and 1.37IVI by fern (Table 1). The dominant life form in "MPN" type community was Therophyte (38%), observed by Nanophanerophyte (17.46%), Megaphanerophyte (15.87%), Mesophanerophyte and Hemicryptophytes (7.93%) while Chamaephyte and Geophyte with 6.34% each (Figure 3a). The Soil chemistry of *the Monotheca-Persicaria-Nerium* (MPN) community exposed that such a community exists in Sandy Loam and Silty Clay. Loam soil, pH. (7.6-7.8), Soil organic matter was 0.6-0.65%, Electric conductivity (0.5-2.1) Phosphorus (6-6.2 mg/kg) and Potassium (110mg/kg). Therophytes were the most dominant life form class of the study area followed by Nanophanerophytes and Hemicryptophytes. Our result supported the result of [24], who worked in Azad Jammu and Kashmir. Based on the biological spectrum therophytes were prevalent followed by Hemicryptophytes. Therophytes are indicators of subtropical and desert climates whereas Hemicryptophytes" are the distinguishing character of cool and moist environments. Al-Yemeni and Sher, 2010 studied the" flora and vegetation of the Asier Mountains of SW' Saudi Arabian site and found that Therophytes were leading chased by Nanophanerophytes and Hemicryptophytes [25, 26].

Table 1. *Phytosociological Attributes of Monotheca-Persicaria-Nerium community.*

Species Names	Density	R. D	Frequency	R. F	Cover	R. C	IVI
Punica granatum L.	3.17	3.43	100	2.13	2031.00	16.12	21.68
Indigofera heterantha Brandis	6.17	6.68	100	2.13	1064.00	8.45	17.25
Pennisetum orientale Rich.	5.83	6.32	100	2.13	495.00	3.93	12.37
Morus nigra L	1.00	1.08	100	2.13	773.00	6.14	9.35
Isodon rugosus (Wall. ex Benth.) Codd	4.67	5.05	100	2.13	206.00	1.64	8.82
Ailanthus altissima (Mill.) Swingle	3.00	3.25	100	2.13	418.00	3.32	8.69
Ficus palmata Forssk.	2.00	2.17	100	2.13	549.00	4.36	8.65
Lepidium ruderale L.	4.17	4.51	100	2.13	198.00	1.57	8.21
Origanum vulgare L.	3.83	4.15	100	2.13	182.00	1.44	7.72
Monotheca buxifolia (Falc.) A. DC.	2.50	2.71	100	2.13	324.00	2.57	7.41
Actaea spicata L.	2.00	2.17	100	2.13	343.00	2.72	7.02
Cotoneaster microphyllus Diels	1.67	1.81	100	2.13	351.00	2.79	6.72
Celtis australis L.	2.50	2.71	100	2.13	222.00	1.76	6.60
Diospyros lotus L.	2.00	2.17	100	2.13	279.00	2.21	6.51
Cannabis sativa L.	3.17	3.43	100	2.13	112.00	0.89	6.45
Zanthoxylum armatum DC.	2.50	2.71	50	1.06	284.00	2.25	6.03
Dodonaea viscosa (L.) Jacq.	1.83	1.99	100	2.13	214.00	1.70	5.81
Hedera nepalensis K.Koch	1.17	1.26	100	2.13	262.00	2.08	5.47
Robinia pseudoacacia L.	0.83	0.90	50	1.06	414.00	3.29	5.25
Symphyotrichum grandiflorum (L.) G.L.Nesom	1.33	1.44	50	1.06	259.00	2.06	4.56
Pinus roxburghii Sarg.	0.67	0.72	50	1.06	336.00	2.67	4.45
Rumex hastatus D. Don	1.50	1.62	100	2.13	79.00	0.63	4.38

Species Names	Density	R. D	Frequency	R. F	Cover	R. C	IVI
Sarcococca saligna var. chinensis Franch	1.00	1.08	100	2.13	144.00	1.14	4.35
Phagnalon niveum Edgew.	1.17	1.26	100	2.13	95.00	0.75	4.15
Cynodon dactylon (L.) Pers.	1.50	1.62	50	1.06	150.00	1.19	3.88
Asplenium dalhousiae Hook.	1.33	1.44	100	2.13	32.00	0.25	3.83
Debregeasia salicifolia (D.Don) Rendle	1.17	1.26	50	1.06	179.00	1.42	3.75
Asparagus gracilis Salisb	0.67	0.72	100	2.13	109.00	0.87	3.71
Duchesnea indica (Jacks.) Focke	1.17	1.26	100	2.13	39.00	0.31	3.70
Artemisia scoparia Waldst. & Kitam.	1.33	1.44	50	1.06	146.00	1.16	3.67
Salix babylonica L	0.50	0.54	50	1.06	228.00	1.81	3.42
Quercus incana Bartram	0.50	0.54	50	1.06	227.00	1.80	3.41
Conyza bonariensis (L.)	1.67	1.81	50	1.06	40.00	0.32	3.19
Olea ferruginea Royle	1.33	1.44	50	1.06	84.00	0.67	3.17
Phlomis spectabilis Falc. ex Benth.	1.00	1.08	50	1.06	94.00	0.75	2.89
Nerium oleander L.	0.50	0.54	50	1.06	151.00	1.20	2.80
Oenothera speciosa Nutt.	1.17	1.26	50	1.06	54.00	0.43	2.76
Serratula pallida DC	1.17	1.26	50	1.06	52.00	0.41	2.74
Asclepias curassavica L.	0.67	0.72	50	1.06	101.00	0.80	2.59
Digitaria ciliaris (Retz.) Koeler	1.00	1.08	50	1.06	38.00	0.30	2.45
Eriophorum comosum (Wall.) Nees	0.67	0.72	50	1.06	82.00	0.65	2.44
Lespedeza juncea (*L.f.*) *Pers*	0.83	0.90	50	1.06	58.00	0.46	2.43
Heliotropium strigosum Willd.	0.50	0.54	50	1.06	103.00	0.82	2.42
Mentha longifolia (L.) L.	0.33	0.36	50	1.06	123.00	0.98	2.40
Andrachne cordifolia (Decne.) Müll.Arg.	0.83	0.90	50	1.06	40.00	0.32	2.28
Calamintha umbrosa (M.Bieb.) Rchb.	0.83	0.90	50	1.06	28.00	0.22	2.19
Ranunculus laetus Wall. ex D. *Don*	0.83	0.90	50	1.06	28.00	0.22	2.19
Rubus ulmifolius Schott	0.50	0.54	50	1.06	71.00	0.56	2.17
Berberis lycium Royle	0.50	0.54	50	1.06	65.00	0.52	2.12
Tribulus terrestris L.	0.33	0.36	50	1.06	81.00	0.64	2.07
Chenopodiastrum murale L.	0.67	0.72	50	1.06	32.00	0.25	2.04
Myrsine africana L.	0.33	0.36	50	1.06	75.00	0.60	2.02
Lactuca orientalis (Boiss.) Boiss.	0.67	0.72	50	1.06	27.00	0.21	2.00
Periploca aphylla Decne	0.50	0.54	50	1.06	44.00	0.35	1.95
Oxytropis humifusa Kar. & Kir.	0.50	0.54	50	1.06	38.00	0.30	1.91
Oxalis corniculata L.	0.67	0.72	50	1.06	14.00	0.11	1.90
Abutilon indicum (L.) Sweet	0.50	0.54	50	1.06	30.00	0.24	1.84
Ficus carica L.	0.50	0.54	50	1.06	28.00	0.22	1.83
Broussonetia papyrifera. (L.)	0.50	0.54	50	1.06	23.00	0.18	1.79
Campanula pallida Wall	0.50	0.54	50	1.06	23.00	0.18	1.79
Melia azedarach L.	0.50	0.54	50	1.06	23.00	0.18	1.79

Species Names	Density	R. D	Frequency	R. F	Cover	R. C	IVI
Grewia optiva J.R.Drumm. ex Burret	0.50	0.54	50	1.06	22.00	0.17	1.78
Pyrus pashia Buch.-Ham. ex D.Don	0.50	0.54	50	1.06	20.00	0.16	1.76
Micromeria biflora (Buch.-Ham. ex D.Don) Benth.	0.50	0.54	50	1.06	17.00	0.13	1.74
Sonchus asperr (L.) Hill	0.50	0.54	50	1.06	13.00	0.10	1.71
Oxytropis mollis A.Gray	0.33	0.36	50	1.06	33.00	0.26	1.69
Rubus caesius L.	0.33	0.36	50	1.06	29.00	0.23	1.66
Ophiopogon intermedius D.Don	0.33	0.36	50	1.06	22.00	0.17	1.60
Spergularia diandra (Guss.) Heldr	0.33	0.36	50	1.06	21.00	0.17	1.59
Eleusine indica (L.) Gaertn.	0.33	0.36	50	1.06	17.00	0.13	1.56
Ajuga bracteosaa Wall. Ex Benth	0.33	0.36	50	1.06	10.00	0.08	1.50

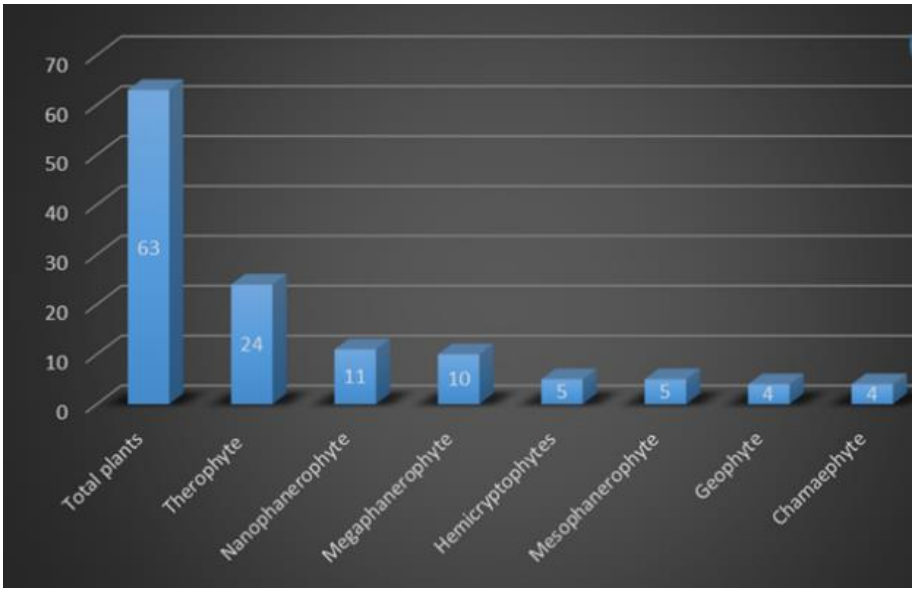

Figure 3. *Life form classes of Monotheca-Persicaria-Nerium community.*

3.3. Punica-Indigofera-Isodon (PII) Community

At a height 1236 towards 1390 *Punica-Indigofera-Isodon* community was established in Tehsil Timargara Dir Lower. The altitude of 34 °42'55"-34 °42'56" and longitude was 71 °48'35"-71 °49'45" exist at North-North West slope facing with 22-25° slope angle. Overall 71 plants were noted of which 38 plants were herbs species, 20 trees, 12 were shruby plants and one species of grasses. Top dominant species were *Punica granatum* with 21.67 IVI, followed by *Indigofera heterantha* with 17.25 IVI and *Isodon rugosus* with 8.81 IVI. Herbs supported in the plant community were 125.39 IVI, resulting in tree 99.38, shrub 73.55, and 1.69 IVI of grasses (Table 2). The dominant life form class in such type of community was Therophyte (25.35%), followed by Megaphanerophyte (19.71%), Nanophanerophyte 18.30%, Chamaephyte (12.67%), Mesophanerophyte 11.26 %, Hemicryptophytes 9.85% and Geophyte with 2.81 % (Figure 4a). Physico-chemical study of soil declared that this community is in loamy soil with pH. (7.4-7.5), Soil organic matter was 0.76-0.85%, Soil phosphorus contents (6-6.7mg/kg), Potassium contents (125-130 mg/kg), Calcium contents (2.9-5.7%) and Electrical conductivity stood at 0-0.194. [27], worked in Dhieri Baba Hills Guhati and Peer Tab graveyard in 2010, while Musharaf Khan, 2014 explored the diversity of Shahbaz Garhi, and Mardan, both found that the dominant leaf spectra of the study area were Microphyll, Mesophyll and Nanophyll respectively. Microphylls indicate a dry and hot area [28].

Table 2. *Phytosociological Attributes of Punica- Indigoferaa -Isodon Community.*

Species Names	Density	R. D	Frequency	R. F	Cover	R.C	IVI
Punica granatum L.	3.17	3.43	100	2.13	2031.00	16.12	21.68
Indigofera heterantha Brandis	6.17	6.68	100	2.13	1064.00	8.45	17.25
Pennisetum orientale Rich.	5.83	6.32	100	2.13	495.00	3.93	12.37
Morus nigra L	1.00	1.08	100	2.13	773.00	6.14	9.35
Isodon rugosus (Wall. ex Benth.) Codd	4.67	5.05	100	2.13	206.00	1.64	8.82
Ailanthus altissima (Mill.) Swingle	3.00	3.25	100	2.13	418.00	3.32	8.69
Ficus palmata Forssk.	2.00	2.17	100	2.13	549.00	4.36	8.65
Lepidium ruderale L.	4.17	4.51	100	2.13	198.00	1.57	8.21
Origanum vulgare L.	3.83	4.15	100	2.13	182.00	1.44	7.72
Monotheca buxifolia (Falc.) A. DC.	2.50	2.71	100	2.13	324.00	2.57	7.41
Actaea spicata L.	2.00	2.17	100	2.13	343.00	2.72	7.02
Cotoneaster microphyllus Diels	1.67	1.81	100	2.13	351.00	2.79	6.72
Celtis australis L.	2.50	2.71	100	2.13	222.00	1.76	6.60
Diospyros lotus L.	2.00	2.17	100	2.13	279.00	2.21	6.51
Cannabis sativa L.	3.17	3.43	100	2.13	112.00	0.89	6.45
Zanthoxylum armatum DC.	2.50	2.71	50	1.06	284.00	2.25	6.03
Dodonaea viscosa (L.) Jacq.	1.83	1.99	100	2.13	214.00	1.70	5.81
Hedera nepalensis K.Koch	1.17	1.26	100	2.13	262.00	2.08	5.47
Robinia pseudoacacia L.	0.83	0.90	50	1.06	414.00	3.29	5.25
Symphyotrichum grandiflorum (L.) G.L.Nesom	1.33	1.44	50	1.06	259.00	2.06	4.56
Pinus roxburghii Sarg.	0.67	0.72	50	1.06	336.00	2.67	4.45
Rumex hastatus D. Don	1.50	1.62	100	2.13	79.00	0.63	4.38
Sarcococca saligna var. chinensis Franch	1.00	1.08	100	2.13	144.00	1.14	4.35
Phagnalon niveum Edgew.	1.17	1.26	100	2.13	95.00	0.75	4.15
Cynodon dactylon (L.) Pers.	1.50	1.62	50	1.06	150.00	1.19	3.88
Asplenium dalhousiae Hook.	1.33	1.44	100	2.13	32.00	0.25	3.83
Debregeasia salicifolia (D.Don) Rendle	1.17	1.26	50	1.06	179.00	1.42	3.75
Asparagus gracilis Salisb	0.67	0.72	100	2.13	109.00	0.87	3.71
Duchesnea indica (Jacks.) Focke	1.17	1.26	100	2.13	39.00	0.31	3.70
Artemisia scoparia Waldst. & Kitam.	1.33	1.44	50	1.06	146.00	1.16	3.67
Salix babylonica L	0.50	0.54	50	1.06	228.00	1.81	3.42
Quercus incana Bartram	0.50	0.54	50	1.06	227.00	1.80	3.41
Conyza bonariensis (L.)	1.67	1.81	50	1.06	40.00	0.32	3.19
Olea ferruginea Royle	1.33	1.44	50	1.06	84.00	0.67	3.17
Phlomis spectabilis Falc. ex Benth.	1.00	1.08	50	1.06	94.00	0.75	2.89
Nerium oleander L.	0.50	0.54	50	1.06	151.00	1.20	2.80
Oenothera speciosa Nutt.	1.17	1.26	50	1.06	54.00	0.43	2.76

Species Names	Density	R. D	Frequency	R. F	Cover	R.C	IVI
Serratula pallida DC	1.17	1.26	50	1.06	52.00	0.41	2.74
Asclepias curassavica L.	0.67	0.72	50	1.06	101.00	0.80	2.59
Digitaria ciliaris (Retz.) Koeler	1.00	1.08	50	1.06	38.00	0.30	2.45
Eriophorum comosum (Wall.) Nees	0.67	0.72	50	1.06	82.00	0.65	2.44
Lespedeza juncea (*L.f.*) *Pers*	0.83	0.90	50	1.06	58.00	0.46	2.43
Heliotropium strigosum Willd.	0.50	0.54	50	1.06	103.00	0.82	2.42
Mentha longifolia (L.) L.	0.33	0.36	50	1.06	123.00	0.98	2.40
Andrachne cordifolia (Decne.) Müll.Arg.	0.83	0.90	50	1.06	40.00	0.32	2.28
Calamintha umbrosa (M.Bieb.) Rchb.	0.83	0.90	50	1.06	28.00	0.22	2.19
Ranunculus laetus Wall. ex D. *Don*	0.83	0.90	50	1.06	28.00	0.22	2.19
Rubus ulmifolius Schott	0.50	0.54	50	1.06	71.00	0.56	2.17
Berberis lycium Royle	0.50	0.54	50	1.06	65.00	0.52	2.12
Tribulus terrestris L.	0.33	0.36	50	1.06	81.00	0.64	2.07
Chenopodiastrum murale L.	0.67	0.72	50	1.06	32.00	0.25	2.04
Myrsine africana L.	0.33	0.36	50	1.06	75.00	0.60	2.02
Lactuca orientalis (Boiss.) Boiss.	0.67	0.72	50	1.06	27.00	0.21	2.00
Periploca aphylla Decne	0.50	0.54	50	1.06	44.00	0.35	1.95
Oxytropis humifusa Kar. & Kir.	0.50	0.54	50	1.06	38.00	0.30	1.91
Oxalis corniculata L.	0.67	0.72	50	1.06	14.00	0.11	1.90
Abutilon indicum (L.) Sweet	0.50	0.54	50	1.06	30.00	0.24	1.84
Ficus carica L.	0.50	0.54	50	1.06	28.00	0.22	1.83
Broussonetia papyrifera. (L.)	0.50	0.54	50	1.06	23.00	0.18	1.79
Campanula pallida Wall	0.50	0.54	50	1.06	23.00	0.18	1.79
Melia azedarach L.	0.50	0.54	50	1.06	23.00	0.18	1.79
Grewia optiva J.R.Drumm. ex Burret	0.50	0.54	50	1.06	22.00	0.17	1.78
Pyrus pashia Buch.-Ham. ex D.Don	0.50	0.54	50	1.06	20.00	0.16	1.76
Micromeria biflora (Buch.-Ham. ex D.Don) Benth.	0.50	0.54	50	1.06	17.00	0.13	1.74
Sonchus asperr (L.) Hill	0.50	0.54	50	1.06	13.00	0.10	1.71
Oxytropis mollis A.Gray	0.33	0.36	50	1.06	33.00	0.26	1.69
Rubus caesius L.	0.33	0.36	50	1.06	29.00	0.23	1.66
Ophiopogon intermedius D.Don	0.33	0.36	50	1.06	22.00	0.17	1.60
Spergularia diandra (Guss.) Heldr	0.33	0.36	50	1.06	21.00	0.17	1.59
Eleusine indica (L.) Gaertn.	0.33	0.36	50	1.06	17.00	0.13	1.56
Ajuga bracteosaa Wall. Ex Benth	0.33	0.36	50	1.06	10.00	0.08	1.50

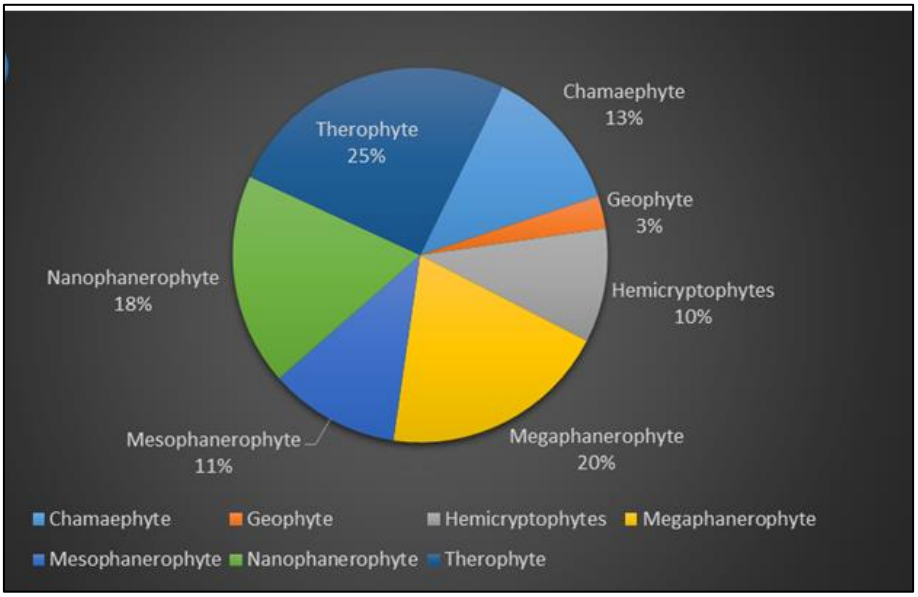

Figure 4. *Life form classes of Punica-Indigofera -Isodon Community.*

3.4. Myrtus-Dodonaea-Origanum (MDO) Community

Myrtus-Dodonaea-Origanum community was established at an elevation ranging from 955 to 1180 m in Kandwalo, Chinarono, Shar sar and Inzaro localities with 71°48'33"-71°48'53" E and 34°40'20"-34°48'45" N, gradient exposure close to North and North-West with 21-42° slope angle. In recent findings, 95 plant species were observed in this community where 48 plant species were herbaceous, 22 tree species, 17 shrubs, 5 grasses and 3 ferns Table 3. The dominant species was present as *Myrtus communis* with 24.44 IVI. *Dodonaea viscosa* (9.19) IVI and *Origanum vulgare* (6.73) IVI. Tree species contributed (126.27) IVI, followed by herbaceous plants with 97.02 IVI, shrubs (57.63) IVI, ferns (9.89) IVI and grasses with 9.19 IVI (Table 3). Therophyte was major with 33.68%, followed by Megaphanerophyte and Nanophanerophyte at 15.78%, Mesophanerophyte at 11.57%, 9.47% Hemicryptophytes and Chamaephyte each, Geophyte 4.21% and liana with one percent. The dominant leaf spectra were recorded as Microphyll with 44.21%, followed by Mesophylls (28.42%), Nanophyll (18.94%), Macrophyll (4.21%) and Leptophyll with 4% (Figure 5a). The result of soil chemistry revealed that the community was exibited in Clay Loam, Sandy Loam- Sandy Clay Loam soil having pH. (7.1-7.8), Organic matter (0.65-0.85%), Calcium contents (1.7-6.5%), Phosphorus (5-7.8mg/kg), Potassium content (110-123mg/kg) and values of Electric conductivity ranges (0.06-2.1). For various purposes, different plant species were recorded for economic uses in which more than half about 53% of plants were used for medicinal purposes, edible (32%) and decoction (13%). Our findings were in agreement with [29], who worked on Malakand Pass Hills, District Malakand, Pakistan and found 83.83% Medicinal plants. Deforestation and overgrazing are the main threats which have reduced the renewal of woody plant species. The same study was carried out by Adnan, 2012 which supported our study. Besides, excessive collection practices and the absence of selling capacity have declined the presence of certain medicinal plants [30].

Table 3. *Phytosociological' Attributes of Myrtus-Dodonaea-Origanum Community recorded in Tehsil Timergara.*

Species Names	Density	R.D.	Frequency	R.F	Cover	R. C°	IVI
Myrtus communis L.	6.25	5.50	100.00	2.23	4051.00	16.71	24.45
Punica granatum L.	4.25	3.74	75.00	1.68	2243.00	9.25	14.67
Olea ferruginea Royle	3.42	3.01	100.00	2.23	1046.00	4.32	9.56
Quercus incana Bartram	3.42	3.01	75.00	1.68	1095.00	4.52	9.20
Dodonaea viscosa (L.) Jacq.	3.17	2.79	100.00	2.23	1012.00	4.18	9.20
Diospyros lotus L.	3.17	2.79	75.00	1.68	1116.00	4.60	9.07

Species Names	Density	R.D.	Frequency	R.F	Cover	R. C°	IVI
Ficus palmata Forssk.	3.75	3.30	100.00	2.23	761.00	3.14	8.67
Ailanthus altissima (Mill.) swingle	4.42	3.89	75.00	1.68	712.00	2.94	8.50
Gymnosporia royleana Wall. ex M.A. Lawson.	3.83	3.37	75.00	1.68	679.00	2.80	7.85
Origanum vulgare L.	3.58	3.15	100.00	2.23	327.00	1.35	6.74
Sonchus asper (L.) Hill	3.25	2.86	100.00	2.23	297.00	1.23	6.32
Mentha longifolia (L.) L.	3.58	3.15	75.00	1.68	319.00	1.32	6.14
Calamintha umbrosa (M.Bieb.) Rchb.	3.17	2.79	100.00	2.23	239.00	0.99	6.01
Symphyotrichum grandiflorum	2.00	1.76	75.00	1.68	607.00	2.50	5.94
Melia azedarach L.	1.75	1.54	75.00	1.68	587.00	2.42	5.64
Indigofera heterantha Brandis	2.58	2.27	100.00	2.23	266.00	1.10	5.60
Juglans regia L.	0.67	0.59	50.00	1.12	811.00	3.35	5.05
Salix babylonica L	1.25	1.10	75.00	1.68	497.00	2.05	4.83
Celtis australis L.	1.83	1.61	75.00	1.68	335.00	1.38	4.67
Myrsine africana L.	2.00	1.76	50.00	1.12	389.00	1.60	4.48
Rubus caesius L.	1.42	1.25	75.00	1.68	333.00	1.37	4.30
Cotoneaster microphyllus Diels	1.50	1.32	75.00	1.68	230.00	0.95	3.94
Asplenium dalhousiae Hook.	1.92	1.69	75.00	1.68	135.00	0.56	3.92
Morus nigra L	1.17	1.03	75.00	1.68	258.00	1.06	3.77
Grewia optiva J.R.ex Burrete	1.67	1.47	75.00	1.68	139.00	0.57	3.72
Conyza bonariensis (L.)	1.58	1.39	75.00	1.68	137.00	0.57	3.63
Bidens pilosa L.	1.92	1.69	50.00	1.12	191.00	0.79	3.59
Rubus ulmifolius Schott	1.42	1.25	25.00	0.56	409.00	1.69	3.49
Arundo donax L.	1.42	1.25	50.00	1.12	247.00	1.02	3.38
Pyrus pashia Buch.-Ham. ex D.Don	0.67	0.59	75.00	1.68	232.00	0.96	3.22
Nerium oleander L.	0.75	0.66	75.00	1.68	178.00	0.73	3.07
Adiantum capillus-veneris f. rimicola (Sloss.) Fernald	1.67	1.47	50.00	1.12	114.00	0.47	3.05
Dicliptera roxburghiana Nees	1.58	1.39	50.00	1.12	113.00	0.47	2.98
Asplenium fontanum (L.) Bernh.	1.08	0.95	75.00	1.68	70.00	0.29	2.92
Hedera nepalensis K.Koch	1.42	1.25	25.00	0.56	244.00	1.01	2.81
Cyperus imbricatus Retz.	1.17	1.03	50.00	1.12	66.00	0.27	2.42
Convolvulus arvensis L.	0.67	0.59	50.00	1.12	167.00	0.69	2.39
Debregeasia salicifolia (D.Don) Rendle	0.75	0.66	50.00	1.12	143.00	0.59	2.37
Calotropis procera (*Aiton*) *Dryand*	0.58	0.51	50.00	1.12	166.00	0.68	2.32
Brachiaria ramosa (L.) Stapf	0.92	0.81	50.00	1.12	81.00	0.33	2.26
Ranunculus laetus Wall. ex D.*Don*	0.92	0.81	50.00	1.12	80.00	0.33	2.25
Euphorbia pilulifera L.	0.83	0.73	50.00	1.12	68.00	0.28	2.13
Onopordum acanthium L.	0.67	0.59	50.00	1.12	83.00	0.34	2.05
Eryngium billardierei F.Delaroche	0.67	0.59	50.00	1.12	82.00	0.34	2.04

Species Names	Density	R.D.	Frequency	R.F	Cover	R. C°	IVI
Euphorbia hirta L.	0.75	0.66	50.00	1.12	52.00	0.21	1.99
Ajuga bracteosa Wall. Ex Benth	0.75	0.66	50.00	1.12	47.00	0.19	1.97
Oxalis corniculata L.	0.75	0.66	50.00	1.12	45.00	0.19	1.96
Robinia pseudoacacia L.	0.25	0.22	25.00	0.56	286.00	1.18	1.96
Ziziphus nummularia (Burm.f.) Wight & Arn.	0.50	0.44	50.00	1.12	91.00	0.38	1.93
Eleusine indica (L.) Gaertn.	1.17	1.03	25.00	0.56	74.00	0.31	1.89
Teucrium stocksianum Boiss., Diagn	0.67	0.59	50.00	1.12	45.00	0.19	1.89
Micromeria biflora (Buch.-Ham. ex D.Don) Benth.	0.58	0.51	50.00	1.12	42.00	0.17	1.80
Cannabis sativa L.	1.08	0.95	25.00	0.56	64.00	0.26	1.78
Actaea spicata L.	0.50	0.44	50.00	1.12	44.00	0.18	1.74
Pennisetum orientale Rich.	0.83	0.73	25.00	0.56	66.00	0.27	1.56
Pseudoconyza viscosa (Mill.)	0.83	0.73	25.00	0.56	63.00	0.26	1.55
Duchesnea indica (Jacks.) Focke	0.83	0.73	25.00	0.56	55.00	0.23	1.52
Cynodon dactylon (L.) Pers.	0.83	0.73	25.00	0.56	54.00	0.22	1.51
Pseudogaillonia hymenostephana (Jaub. & Spach) Linchevskii	0.50	0.44	25.00	0.56	109.00	0.45	1.45
Epilobium hirsutum L.	0.67	0.59	25.00	0.56	73.00	0.30	1.45
Ehretia serrata Roxb.	0.33	0.29	25.00	0.56	141.00	0.58	1.43
Phagnalon niveum Edgew.	0.75	0.66	25.00	0.56	49.00	0.20	1.42
Taraxacum officinale (L.) Weber ex F.H.Wigg.	0.67	0.59	25.00	0.56	54.00	0.22	1.37
Pinus roxburghii Sarg.	0.50	0.44	25.00	0.56	84.00	0.35	1.35
Salvia moorcroftiana Wall. ex Benth	0.58	0.51	25.00	0.56	62.00	0.26	1.33
Sorghum halepense (L.) Pers.	0.50	0.44	25.00	0.56	67.00	0.28	1.27
Equisetum arvense L.	0.75	0.66	25.00	0.56	4.00	0.02	1.23
Alnus nitida (Spach) Endl	0.08	0.07	25.00	0.56	140.00	0.58	1.21
Plantago lanceolata L.	0.58	0.51	25.00	0.56	30.00	0.12	1.20
Abutilon indicum (L.) Sweet	0.42	0.37	25.00	0.56	62.00	0.26	1.18
Sarcococca saligna var. chinensis Franch	0.33	0.29	25.00	0.56	72.00	0.30	1.15
Lepidium ruderale L.	0.50	0.44	25.00	0.56	29.00	0.12	1.12
Asparagus gracilis Salisb	0.33	0.29	25.00	0.56	59.00	0.24	1.10
Spergularia diandra (Guss.) Heldr	0.33	0.29	25.00	0.56	55.00	0.23	1.08
Aloe vera	0.33	0.29	25.00	0.56	46.00	0.19	1.04
Dioscorea deltoidea Wall. ex Griseb.	0.33	0.29	25.00	0.56	45.00	0.19	1.04
Rumex hastatus D. Don	0.33	0.29	25.00	0.56	42.00	0.17	1.03
Broussonetia papyrifera. (L.)	0.33	0.29	25.00	0.56	40.00	0.17	1.02
Setaria viridis (L.) P.Beauv.	0.42	0.37	25.00	0.56	22.00	0.09	1.02
Salvia nubicola Wll. Ex Sweet	0.33	0.29	25.00	0.56	38.00	0.16	1.01
Lactuca serriola L.	0.42	0.37	25.00	0.56	20.00	0.08	1.01

Species Names	Density	R.D.	Frequency	R.F	Cover	R. C°	IVI
Zanthoxylum armatum DC.	0.25	0.22	25.00	0.56	54.00	0.22	1.00
Solanum villosum Miller	0.33	0.29	25.00	0.56	36.00	0.15	1.00
Nanorrhinum incanum (Wall.) Betsche	0.33	0.29	25.00	0.56	33.00	0.14	0.99
Heteropogon contortus (L.) P.Beauv. ex Roem, and Schult	0.08	0.07	25.00	0.56	82.00	0.34	0.97
Oxytropis humifusa Kar. & Kir.	0.33	0.29	25.00	0.56	28.00	0.12	0.97
Arabis saxicola Edgew.	0.33	0.29	25.00	0.56	24.00	0.10	0.95
Tagetes minuta L.	0.25	0.22	25.00	0.56	41.00	0.17	0.95
Ficus carica L.	0.25	0.22	25.00	0.56	40.00	0.17	0.94
Nepeta linearis Royle ex Benth.	0.25	0.22	25.00	0.56	37.00	0.15	0.93
Andrachne cordifolia (Decne.) Müll.Arg.	0.25	0.22	25.00	0.56	26.00	0.11	0.89
Aerva javanica (Burm.f.) Juss. ex Schult.	0.25	0.22	25.00	0.56	18.00	0.07	0.85
Lespedeza juncea (L.f.) Pers	0.25	0.22	25.00	0.56	13.00	0.05	0.83
Otostegia limbata (Benth.) Boiss	0.08	0.07	25.00	0.56	48.00	0.20	0.83
Colebrookea oppositifolia Sm.	0.08	0.07	25.00	0.56	33.00	0.14	0.77

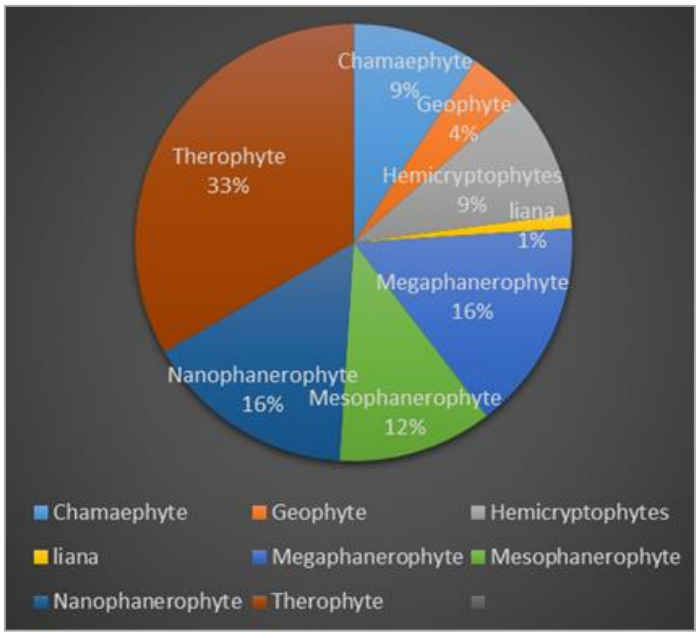

Figure 5. *Life form classes of Myrtus-Dodonaea-Origanum Community.*

3.5. Berberis-Cornus-Teucrium (BCT) Community

Berberis-Cornus-Teucrium community was observed at 1486 to 1621m altitude in Darmo, Qol and Sar Chinarono. It was lie in 71 °44'56"-71 °49'35" E and 34 °41'43"-34 °43'47" N to North-West slope facing have 30-36° slope angle. In this community 103 different plants species were documented with 69 herb species, 13 shrubs, 10 trees, 6 grasses, 3 climbers and 2 species of fern. *Berberis lycium* was the major plant species in this type community with 24.22 IVI, followed by *Cornus macrophylla* 21.19 IVI and *Teucrium royleanum* 13.43 (Table 4). The IVI participation of herbacious plants 147.62, followed by tree 73.13, shrub 61.88, grasses 9.58, climber 4.20 and fern with 3.60 (Table). The leading life form class in the community was Therophyte (43.68%), followed by Hemicryptophytes (11.65%), Megaphanerophyte and Nanophanerophyte

(10.67%) respectively. Chamaephyte and Geophyte (8.73%) each and Mesophanerophyte with 5.82% (Figure 6a). Physico' chemical investigation of soil exposed that community was recognized at Loam-Sandy, Clay Loam soil posses' pH. (7.1-7.7), Soil organic matter (0.7-0.83%), Calcium contents (4.4-6.2%), Potassium contents (100-118mg/kg), Phosphorus contents (6.2-8 mg/kg) and Electrical conductivity were 0.22-1.12.

Table 4. *Phytosociologicalb Attributes of Berberis-Cornus-Teucrium Community recorded in Tehsil Timergara.*

Species Names	Density	R. D	Frequency	R. F	Cover	R.C	IVI
Berberis lycium Royle	8.78	9.01	66.67	1.39	2852.00	13.82	24.22
Cornus macrophylla Wall.	0.33	0.34	33.33	0.69	4160.00	20.16	21.20
Pinus roxburghii Sarg.	1.44	1.48	100.00	2.08	3259.00	15.80	19.36
Teucrium royleanum Wall. ex Benth	8.56	8.78	100.00	2.08	613.00	2.97	13.83
Punica granatum L.	2.89	2.96	100.00	2.08	1414.00	6.85	11.90
Salvia nubicola Wall. ex Sweet	5.78	5.93	100.00	2.08	400.00	1.94	9.95
Indigofera heterantha Brandis	2.78	2.85	66.67	1.39	778.00	3.77	8.01
Galium asperuloides Edgew.	3.11	3.19	100.00	2.08	210.00	1.02	6.29
Origanum vulgare L.	3.00	3.08	100.00	2.08	190.00	0.92	6.08
Ficus palmata Forssk.	2.56	2.62	100.00	2.08	249.00	1.21	5.91
Isodon rugosus (Wall. ex Benth.) Codd	1.89	1.94	66.67	1.39	475.00	2.30	5.63
Oxalis corniculata L.	2.67	2.74	100.00	2.08	102.00	0.49	5.31
Sarcococca saligna var. *chinensis* Franch	2.56	2.62	33.33	0.69	267.00	1.29	4.61
Cannabis sativa L.	2.11	2.17	66.67	1.39	185.00	0.90	4.45
Rumex hastatus D. Don	1.56	1.60	100.00	2.08	155.00	0.75	4.43
Ficus carica L.	1.56	1.60	66.67	1.39	270.00	1.31	4.29
Heteropogon contortus (L) P.Beauv. ex Roem. and Schult	1.56	1.60	66.67	1.39	202.00	0.98	3.96
Viola canescens Wall. ex Roxb	1.67	1.71	66.67	1.39	87.00	0.42	3.52
Myrtus communis L.	0.44	0.46	66.67	1.39	338.00	1.64	3.48
Buddleja crispa Benth	1.11	1.14	66.67	1.39	189.00	0.92	3.45
Myosotis caespitosa Schultz	0.78	0.80	66.67	1.39	218.00	1.06	3.24
Conyza bonariensis (L.)	1.33	1.37	66.67	1.39	59.00	0.29	3.04
Taraxacum officinale (L.) Weber ex F.H.Wigg.	1.22	1.25	66.67	1.39	63.00	0.31	2.95
Ipomoea eriocarpa R. Br	1.22	1.25	33.33	0.69	199.00	0.96	2.91
Daphne mucronata Royle	1.00	1.03	66.67	1.39	69.00	0.33	2.75
Bergenia ciliata (Haw.) Sternb.	1.00	1.03	66.67	1.39	66.00	0.32	2.74
Rosa canina L.	0.78	0.80	33.33	0.69	238.00	1.15	2.65
Solanum nigrum L.	0.78	0.80	66.67	1.39	49.00	0.24	2.42
Phagnalon niveum Edgew.	0.78	0.80	66.67	1.39	37.00	0.18	2.37
Androsace rotundifolia Hardw.	0.67	0.68	66.67	1.39	49.00	0.24	2.31
Lespedeza juncea (L.f.) Pers	0.67	0.68	66.67	1.39	34.00	0.16	2.24
Debregeasia salicifolia (D.Don) Rendle	0.33	0.34	33.33	0.69	240.00	1.16	2.20

Species Names	Density	R. D	Frequency	R. F	Cover	R.C	IVI
Galium elegans Wall	0.56	0.57	66.67	1.39	46.00	0.22	2.18
Pseudoconyza viscosa (Mill.)	0.56	0.57	66.67	1.39	46.00	0.22	2.18
Pteris cretica. *L*.	0.56	0.57	66.67	1.39	44.00	0.21	2.17
Morus nigra L	0.33	0.34	33.33	0.69	219.00	1.06	2.10
Sonchus asper (L.) Hill	0.56	0.57	66.67	1.39	23.00	0.11	2.07
Cotoneaster microphyllus Diels	0.89	0.91	33.33	0.69	95.00	0.46	2.07
Clematis grata Wall	0.89	0.91	33.33	0.69	78.00	0.38	1.98
Duchesnea indica (Jacks.) Focke	0.78	0.80	33.33	0.69	98.00	0.47	1.97
Aster alpinus L.	1.00	1.03	33.33	0.69	49.00	0.24	1.96
Actaea spicata L.	0.67	0.68	33.33	0.69	119.00	0.58	1.96
Hypericum perforatum L.	0.78	0.80	33.33	0.69	74.00	0.36	1.85
Euphorbia serpens Kunth	0.89	0.91	33.33	0.69	42.00	0.20	1.81
Scrophularia polyantha Royle ex Benth	0.22	0.23	66.67	1.39	37.00	0.18	1.80
Ajuga bracteosa Benth. Wall ex. Benth	0.56	0.57	33.33	0.69	88.00	0.43	1.69
Rubia manjith Roxb. ex Fleming	0.67	0.68	33.33	0.69	58.00	0.28	1.66
Sorghum halepense (L.) Pers.	0.56	0.57	33.33	0.69	79.00	0.38	1.65
Smilax glaucophylla Klotzsch	0.33	0.34	33.33	0.69	123.00	0.60	1.63
Mirabilis jalapa L.	0.44	0.46	33.33	0.69	96.00	0.47	1.62
Cleome aculeata L.	0.56	0.57	33.33	0.69	57.00	0.28	1.54
Lactuca serriola L.	0.67	0.68	33.33	0.69	31.00	0.15	1.53
Periploca aphylla Decne	0.56	0.57	33.33	0.69	53.00	0.26	1.52
Quercus incana Bartram	0.56	0.57	33.33	0.69	49.00	0.24	1.50
Eleusine indica (L.) Gaertn.	0.56	0.57	33.33	0.69	46.00	0.22	1.49
Lepidium ruderale L.	0.56	0.57	33.33	0.69	40.00	0.19	1.46
Adiantum capillus-veneris f. rimicola (Sloss.) Fernald	0.56	0.57	33.33	0.69	34.00	0.16	1.43
Arisaema flavum (Forssk.) Schott	0.56	0.57	33.33	0.69	34.00	0.16	1.43
Boerhavia procumbens Banks ex Roxb.	0.43	0.46	33.33	0.69	54.00	0.26	1.41
Verbascum thapsus L.	0.44	0.45	33.33	0.69	52.00	0.25	1.40
Ajuga parviflora Benth	0.56	0.57	33.33	0.69	21.00	0.10	1.37
Hedera nepalensis K.Koch	0.33	0.34	33.33	0.69	66.00	0.32	1.36
Onopordum acanthium L.	0.44	0.46	33.33	0.69	36.00	0.17	1.33
Strobilanthes urticifolia Wall. ex Kuntze	0.33	0.34	33.33	0.69	59.00	0.29	1.32
Salvia moorcroftiana Wall. ex Benth	0.44	0.46	33.33	0.69	34.00	0.16	1.32
Andrachne cordifolia (Decne.) Müll.Arg.	0.33	0.34	33.33	0.69	57.00	0.28	1.31
Polygonum polycnemoides Jaub. & Spach	0.44	0.46	33.33	0.69	30.00	0.15	1.30
Aster altaicus Willd	0.44	0.46	33.33	0.69	29.00	0.14	1.29
Artemisia vulgaris Burm.f.	0.44	0.46	33.33	0.69	24.00	0.12	1.27
Barleria cristata L.	0.44	0.46	33.33	0.69	23.00	0.11	1.26

Species Names	Density	R. D	Frequency	R. F	Cover	R.C	IVI
Chenopodium album L.	0.44	0.46	33.33	0.69	21.00	0.10	1.25
Euphorbia heterophylla L.	0.44	0.46	33.33	0.69	20.00	0.10	1.25
Symphyotrichum grandiflorum	0.33	0.34	33.33	0.69	35.00	0.17	1.21
Lotus corniculatus L.	0.33	0.34	33.33	0.69	34.00	0.16	1.20
Myriactis nepalensis Less	0.33	0.34	33.33	0.69	33.00	0.16	1.20
Achyranthes aspera L.	0.33	0.34	33.33	0.69	31.00	0.15	1.19
Ailanthus altissima (Mill.) Swingle	0.33	0.34	33.33	0.69	31.00	0.15	1.19
Monotheca buxifolia (Falc). A.DC	0.22	0.23	33.33	0.69	52.00	0.25	1.17
Pteridium aquilinum (L.) Kuhn	0.33	0.34	33.33	0.69	26.00	0.13	1.16
Sonchus oleraceus (L.) L	0.33	0.34	33.33	0.69	25.00	0.12	1.16
Brachiaria ramosa (L.) Stapf	0.33	0.34	33.33	0.69	23.00	0.11	1.15
Launaea secunda (c.b Klarke) Hook. f.	0.34	0.33	33.33	0.69	22.00	0.11	1.14
Campanula pallida Wall.	0.33	0.34	33.33	0.69	19.00	0.09	1.13
Malva parviflora L.	0.33	0.34	33.33	0.69	19.00	0.09	1.13
Viola aberrans Greene	0.33	0.34	33.33	0.69	19.00	0.09	1.13
Viscum cruciatum Sieber ex Boiss	0.33	0.34	33.33	0.69	18.00	0.09	1.12
Dicliptera roxburghiana Nees	0.33	0.34	33.33	0.69	17.00	0.08	1.12
Valeriana wallichii DC.	0.33	0.34	33.33	0.69	17.00	0.08	1.12
Geranium rotundifolium: L..	0.33	0.34	33.33	0.69	14.00	0.07	1.10
Micromeria biflora (Buch-Ham. ex D.Don) Benth.	0.33	0.34	33.33	0.69	13.00	0.06	1.10
Asplenium dalhousiae Hook.	0.33	0.34	33.33	0.69	12.00	0.06	1.09
Cyperus imbricatus Retz.	0.33	0.34	33.33	0.69	12.00	0.06	1.09
Arundo donax L.	0.22	0.23	33.33	0.69	21.00	0.10	1.02
Onychium japonicum (Thunb.) Kunze	0.22	0.23	33.33	0.69	21.00	0.10	1.02
Stachys emodi Hedge	0.22	0.23	33.33	0.69	17.00	0.08	1.00
Pennisetum orientale Rich.	0.22	0.23	33.33	0.69	15.00	0.07	1.00
Setaria viridis (L.) P.Beauv.	0.22	0.23	33.33	0.69	15.00	0.07	1.00
Euphorbia hirta L.	0.22	0.23	33.33	0.69	14.00	0.07	0.99
Paspalum distichum L.	0.22	0.23	33.33	0.69	13.00	0.06	0.99
Teucrium stocksianum Boiss., Diagn	0.22	0.23	33.33	0.69	12.00	0.06	0.98
Eryngium billardierei F.Delaroche	0.22	0.23	33.33	0.69	10.00	0.05	0.97
Nepeta praetervisa Rech.f.	0.11	0.11	33.33	0.69	14.00	0.07	0.88
Oxytropis humifusa Kar. & Kir.	0.11	0.11	33.33	0.69	8.00	0.04	0.85

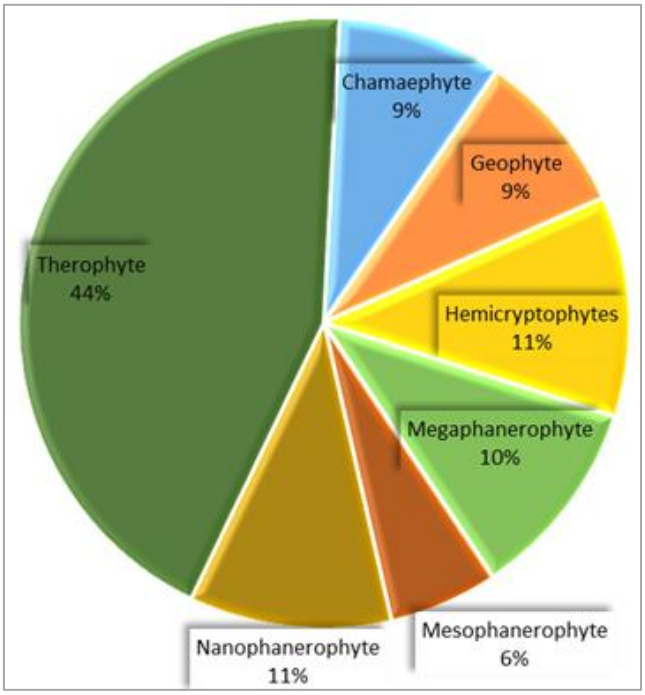

Figure 6. *Life form classes of Berberis-Cornus-Teucrium Community.*

3.6. Dodonaea-Salix-Pennisetum (DSP) Community

The *Dodonaea-Salix-Pennisetum* community was recognized from 770 to 1377 altitude at Goro, Shahi khail, Tangy and Tara locality lies 71 °49'21"-71 °75'3.4" E and 34 °43'3"-34 °45'51" N with North, East, North-East and North-West direction and 20-38° degree slope position. This kind of community contains 88 species of plants of which 39 were herbs, observed by shrubs 20, 21 trees, 5 grasses and 3 species of ferns. The dominant plant species in the community was *Dodonaea viscosa* with 23.13 IVI, observed by *Salix babylonica* with 20.23 IVI and *Pennisetum orientale* with 7.89 IVI. The life form of herbaceous plants holds 103.52 IVI, Shrubs species 97.50 IVI, trees 86.11 IVI, grasses 17.68 IVI and ferns 5.35 IVI (Table 5). The dominant life form class in this community was was Therophyte with 34.09 %, followed by Hemicryptophytes value 17.04 %, Megaphanerophyte 13.63%, Nanophanerophyte12.5%, Mesophanerophyte 10.22%, Chamaephyte 7.95 % and Geophyte with 5.45% (Figure 7a). Physicochemical exploration of soil specified that this type of community has Loam-Silty Clay Loam soil with pH. (7.1-7.6), Organic matter (0.6-0.86%), Calcium contents (2.9-5.8%), Phosphorus (6-8.2mg/kg), Potash contents (106-148mg/kg) and Electrical conductivity remained 0-1.96.

Table 5. *Phytosociological Attributes of Dodonaea-Salix-Pennisetum Community recorded in Tehsil Timergara.*

Species Names	Density	R. D	Frequency	R. F	Cover	R.C	IVI
Dodonaea viscosa (L.) Jacq	8.75	9.41	75.00	1.90	2766	11.83	23.13
Salix babylonica L.	0.42	0.45	50.00	1.27	4333	18.53	20.24
Indigofera heterantha Brandis	4.08	4.39	100.00	2.53	1567	6.70	13.62
Gymnosporia royleana Wall. ex M.A.Lawson	3.42	3.67	75.00	1.90	873	3.73	9.30
Ficus palmata Forssk.	2.08	2.24	50.00	1.27	1324	5.66	9.17
Origanum vulgare L.	4.08	4.39	100.00	2.53	453	1.94	8.86
Pennisetum orientale Rich.	2.75	2.96	25.00	0.63	1008	4.31	7.90
Micromeria biflora (Buch.-Ham. ex D.Don) Benth.	3.50	3.76	100.00	2.53	348	1.49	7.78
Oxalis corniculata L.	3.42	3.67	100.00	2.53	368	1.57	7.78

Species Names	Density	R. D	Frequency	R. F	Cover	R.C	IVI
Cotoneaster microphyllus Diels	2.08	2.24	100.00	2.53	591	2.53	7.30
Heteropogon contortus (L) P. Beau. ex Roem. and Schult.	2.42	2.60	100.00	2.53	460	1.97	7.10
Rumex hastatus D. Don	2.66	2.87	75.00	1.90	453	1.94	6.70
Isodon rugosus (Wall. ex Benth.) Codd	1.92	2.06	75.00	1.90	601	2.57	6.53
Acacia modesta Wall	1.83	1.97	25.00	0.63	863	3.69	6.29
Monotheca buxifolia (Falc.) A. DC.	0.92	0.99	75.00	1.90	683	2.92	5.80
Pinus roxburghii Sarg	0.42	0.45	25.00	0.63	1090	4.66	5.74
Ailanthus altissima (Mill.) Swingle	2.75	2.96	75.00	1.90	168	0.72	5.57
Ajuga bracteosa Wall. Ex Benth	2.08	2.24	100.00	2.53	164	0.70	5.47
Robinia pseudoacacia L.	1.42	1.52	75.00	1.90	466	1.99	5.41
Limonium cabulicum (Boiss.) Kuntze	2.58	2.78	75.00	1.90	152	0.65	5.33
Arundo donax L.	1.25	1.34	100.00	2.53	315	1.35	5.22
Punica granatum L.	0.75	0.81	75.00	1.90	550	2.35	5.06
Morus nigra L	0.83	0.90	50.00	1.27	541	2.31	4.47
Phagnalon niveum Edgew.	1.67	1.79	75.00	1.90	167	0.71	4.40
Otostegia limbata (Benth.) Boiss	1.67	1.79	50.00	1.27	304	1.30	4.36
Cannabis sativa L.	1.42	1.52	75.00	1.90	139	0.59	4.02
Quercus incana Bartram	1.08	1.16	50.00	1.27	367	1.57	4.00
Olea ferruginea Royle	0.67	0.72	50.00	1.27	381	1.63	3.61
Gypsophila alsinoides Bunge	1.42	1.52	50.00	1.27	72	0.31	3.10
Conyza bonariensis L.	0.75	0.81	75.00	1.90	49	0.21	2.91
Viola canescens Wall. ex Roxb	1.25	1.34	50.00	1.27	70	0.30	2.91
Lespedeza juncea (L.f.) Pers	1.08	1.16	50.00	1.27	106	0.45	2.88
Salvia moorcroftiana Wall. ex Benth	1.17	1.25	25.00	0.63	232	0.99	2.88
Asplenium dalhousiae Hook.	1.25	1.34	50.00	1.27	62	0.27	2.87
Buddleja crispa Benth	0.58	0.63	50.00	1.27	226	0.97	2.86
Chenopodium album L.	1.08	1.16	50.00	1.27	99	0.42	2.85
Asplenium fontanum (L.) Bernh.	0.75	0.81	50.00	1.27	325	1.39	3.46
Scrophularia polyantha Royle ex Benth	1.08	1.16	50.00	1.27	85	0.36	2.79
Bidens pilosa L.	1.08	1.16	50.00	1.27	83	0.35	2.79
Teucrium royleanum Wall. ex Benth	1.50	1.61	25.00	0.63	113	0.48	2.73
Sonchus asper (L.) Hill	0.92	0.99	50.00	1.27	58	0.25	2.50
Asparagus gracilis Salisb	0.67	0.72	50.00	1.27	120	0.51	2.50
Diospyros lotus L.	0.08	0.09	75.00	1.90	78	0.33	2.32
Duchesnea indica (Jacks.) Focke	0.67	0.72	50.00	1.27	45	0.19	2.18
Rhus punjabensis J.L.Stewart Ex. Brandis	0.33	0.37	50.00	1.27	81	0.35	1.97
Berberis lycium Royle	0.33	0.36	50.00	1.27	64	0.27	1.90
Tagetes minuta L.	0.83	0.90	25.00	0.63	74	0.32	1.85

Species Names	Density	R. D	Frequency	R. F	Cover	R.C	IVI
Cyperus imbricatus Retz.	0.83	0.90	25.00	0.63	52	0.22	1.75
Rubus ulmifolius Schott	0.42	0.45	25.00	0.63	144	0.62	1.70
Calamintha umbrosa (M.Bieb.) Rchb.	0.75	0.81	25.00	0.63	53	0.23	1.67
Celtis australis L.	0.83	0.90	25.00	0.63	18	0.08	1.61
Sophora mollis (Royle) Graham ex *Baker*.	0.42	0.45	25.00	0.63	107	0.46	1.54
Commelina agraria Kunth	0.58	0.63	25.00	0.63	44	0.19	1.45
Pyrus pashia Buch.-Ham. ex D.Don	0.17	0.18	25.00	0.63	148	0.63	1.44
Actaea spicata L.	0.33	0.36	25.00	0.63	105	0.45	1.44
Mentha longifolia (L.) L.	0.50	0.54	25.00	0.63	63	0.27	1.44
Brachiaria ramosa (L.) Stapf	0.42	0.45	25.00	0.63	81	0.35	1.43
Taraxacum officinale (L.) Weber ex F.H.Wigg.	0.50	0.54	25.00	0.63	44	0.19	1.36
Adiantum capillus-veneris f. rimicola (Sloss.) Fernald	0.50	0.54	25.00	0.63	37	0.16	1.33
Debregeasia salicifolia (D.Don) Rendle	0.17	0.18	25.00	0.63	105	0.45	1.26
Polygala abyssinica R.Br. ex Fresen.	0.42	0.45	25.00	0.63	40	0.17	1.25
Populus nigra L.	0.25	0.27	25.00	0.63	81	0.35	1.25
Chrozophora tinctoria (L.) A.Juss.	0.33	0.36	25.00	0.63	60	0.26	1.25
Adenostemma lavenia var.	0.33	0.36	25.00	0.63	45	0.19	1.18
Fragaria vesca L.	0.33	0.36	25.00	0.63	33	0.14	1.13
Rubus caesius L.	0.25	0.27	25.00	0.63	51	0.22	1.12
Hedera nepalensis - K.Koch	0.25	0.27	25.00	0.63	49	0.21	1.11
Vincetoxicum arnottianum (wight).	0.25	0.27	25.00	0.63	45	0.19	1.09
Myriactis nepalensis Less	0.25	0.27	25.00	0.63	44	0.19	1.09
Plantago lanceolata L.	0.33	0.36	25.00	0.63	22	0.09	1.09
Broussonetia papyrifera. (L.)	0.17	0.18	25.00	0.63	63	0.27	1.08
Chenopodium botrys L.	0.25	0.27	25.00	0.63	41	0.18	1.08
Chenopodium ambrosioides L.	0.25	0.27	25.00	0.63	41	0.18	1.08
Cheilanthes bicolor Fraser-Jenk	0.25	0.27	25.00	0.63	40	0.17	1.07
Solanum villosum Miller	0.25	0.27	25.00	0.63	40	0.17	1.07
Polygonum aviculare L.	0.25	0.27	25.00	0.63	38	0.16	1.06
Verbena officinalis	0.25	0.27	25.00	0.63	38	0.16	1.06
Arabis saxicola Edgew.	0.33	0.36	25.00	0.63	15	0.06	1.06
Cyperus rotundus L.	0.25	0.27	25.00	0.63	33	0.14	1.04
Periploca aphylla Decne	0.08	0.09	25.00	0.63	65	0.28	1.00
Dicliptera roxburghiana Nees	0.25	0.27	25.00	0.63	23	0.10	1.00
Galium elegans Wall	0.17	0.18	25.00	0.63	43	0.18	1.00
Polygonum polycnemoides Jaub. & Spach	0.25	0.27	25.00	0.63	19	0.08	0.98
Grewia optiva J.R.Drumm. ex Burret	0.25	0.27	25.00	0.63	15	0.06	0.97
Viscum cruciatum Sieber ex Boiss	0.25	0.27	25.00	0.63	14	0.06	0.96
Lepidium ruderale L.	0.17	0.18	25.00	0.63	28	0.12	0.93

Species Names	Density	R. D	Frequency	R. F	Cover	R.C	IVI
Symphyotrichum grandiflorum	0.08	0.09	25.00	0.63	32	0.14	0.86
Melia azedarach L.	0.08	0.09	25.00	0.63	13	0.06	0.78

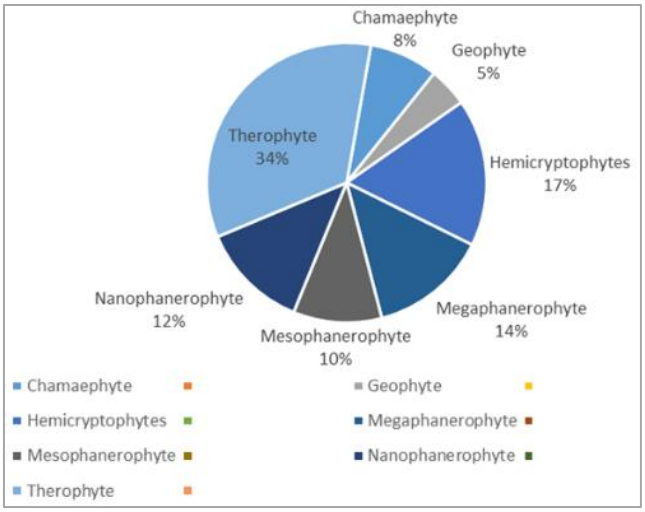

Figure 7. *Life form classes of Dodonaea-Salix-Pennisetum Community.*

3.7. Indexed of Similarity and Dissimilarity

The maximum value for I.S recorded between *Myrtus-Dodonaea-Origanum* and *Dodonaea-Salix-Pennisetum* communities was 60.10% followed by *Punica-Indigofera-Isodon* and *Myrtus-Dodonaea-Origanum* communities with 54.21%, and minimum I. S was found in *Monotheca-Persicaria-Nerium* and *Berberis-Cornus-Teucrium* communities with 16.86% (Table 6). The Index of Dissimilarity' (ID) Calculated, the highest ratio was established between *Berberis-Cornus-Teucrium* and *Monotheca-Persicaria-Nerium* communities with 83.14% successively *Punica-Indigofera-Isodon* and *Monotheca-Persicaria-Nerium* communities with 73.14%. Similarly minimum I.D was established between *Dodonaea- Salix-Pennisetum* and *Myrtus-Dodonaea-Origanum* Communities nearby 39.9% (Table 6). Phytosociology deals with the investigation of the structure, composition and origins of dispersion of communities of plants. On the earth's surface, all the plants that are present are termed vegetation, which comprises a massive diversity of thousands of different types of plant species. Vegetation can be further divided into populations, and communities [30]. The vegetation structure of Tehsil Timergara Dir lower exhibited that a total of five different communities were recorded by using TWINSPAN classification. The current discoveries were similar to Ahmad *et al.*, 2014 who used the Detrended Correspondence Analysis technique to ordinate plant communities and suggested that an active supervision program would be publicized in the area to save feasible species. Similarly observed by [8] who conducted out phytosociological survey of Tehsil Mankei Sharef District Nowshera and noted five communities. Based on importance values, Megaphanerophytes govern the study area. The maximum similarity found between the two communities was 60.10 followed by 54.2 [31]. Our result is similar to Ram ́ırez - Trejo *et al.*, 2004 who worked in three vegetation sites found North-East of the state of Hidalgo, Mexico in 1999. They found a maximum similarity index which was 61.2% between the Xerophilous shrubland and the montane rain forest, and a minimum showed 16.9% [9, 11].

Table 6. *Soil of various communities verified fromTehsil Timergara.*

S.NO	MPN	PII	MDO	BCT	DSP
Altitude	580-612	1236-1390	955-1180	1486-1621	770-1377
Soil texture	Loam and Silty Clay Loam.	Loamy.	Sandy Loam-Sandy Clay Loam.	Loam-Sandy Clay Loam.	Loam-Silty Clay Loam.

S.NO	MPN	PII	MDO	BCT	DSP
PH	7.6-7.8	7.4-7.5	7.1-7.8	7.1-7.7	7.1-7.6
Organic matter%	0.6-0.65	0.76-0.85	0.65-0.85	0.7-0.83	0.6-0.86
calcium contents%	2.7-3.14	2.9-5.7	1.7-6.5	4.4-6.2	2.9-5.8
Phosphorus (mg/kg)	6-6.2	6-6.7	5-7.8	6.2-8	6-8.2
Potassium (mg/kg)	110	125-130	110-123	100-118	106-148
Electric conductivity	0.5-2.1	0-0.194	06-2.1	0.22-1.12	0-1.96

Note: MPN= Monotheca-Persicaria-Nerium 2. PII= Punica- Indigofera- Isodon 3. MDO=Myrtus-Dodonaea- Origanum 4. BCT=Berberis-Cornus-Teucrium 5. DSP= Dodonaea-Salix-Pennisetum

4. Conclusion

The phytosociological analysis of Tehsil Timergara, District Dir Lower, Pakistan, has provided a comprehensive understanding of the vegetation structure and ecological dynamics in the region. The utilization of TWINSPAN classification has revealed five distinct plant communities, each characterized by unique dominance patterns, life form classes, and leaf spectra. Megaphanerophytes emerged as the dominant life form, underscoring the significance of larger woody plants in shaping the local plant communities. The study's focus on ecological attributes, such as soil characteristics and leaf spectra, has contributed valuable insights into the environmental factors influencing the distribution and composition of these plant communities. The prevalence of Microphylls suggests adaptations to drier and hotter conditions, reflecting the local climate in Tehsil Timergara. Furthermore, the calculation of similarity and dissimilarity indices has highlighted the degrees of overlap and dissimilarity between these communities, aiding in the identification of unique and shared ecological features. The highest similarity observed between Myrtus-Dodonaea-Origanum and Dodonaea-Salix-Pennisetum communities emphasizes the importance of considering multiple aspects of biodiversity for effective conservation planning.

This study's findings contribute to the broader understanding of biodiversity in the region, providing a foundation for informed conservation and management strategies. The insights gained can guide sustainable practices that balance ecological preservation with the needs of local communities in Tehsil Timergara. Overall, this research enhances our knowledge of the intricate relationships within plant communities and sets the stage for future investigations in this ecologically diverse region.

Abbreviations

MPN	Monotheca-Persicaria-Nerium
PII	Punica-Indigofera-Isodon
MDO	Myrtus-Dodonaea-Origanum
BCT	Berberis-Cornus-Teucrium
DSP	Dodonaea-Salix-Pennisetum

Conflicts of Interest

The authors declare no conflict of interest.

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