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Pioneer inventory of tracheophytes of Sathan Gali, district Mansehra, Khyber Pakhtunkhwa, Pakistan

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Key words: Floristic inventory, Angiosperms, Gymnosperms, Pteridophytes, Tracheophytes.

Abstract

This study was designedfor first ever exploration of floristic composition of Sathen Gali, district Mansehra. The study area being the part of western Himalayas shows rich floristic diversity. In the present study, effort was made to document firsthand information and prepare the floristic inventory of the area. The study was initiated to assess the vegetation structure qualitatively. The study area was visited frequently during flowering and fruiting seasons of plants in 2013 and 2014. Plants were collected from a range of localities, identified, preserved and deposited with Herbarium of Hazara University,Mansehra. This first investigation revealed a total of 168 plants species belonging to 76 families. Angiosperms were represented by 156 species (92.85%), Gymnosperms by 5 species (2.97%) and Pteridophytes by 7species (2.16%). The dominant family was found to be Asteraceae represented by 20 species, followed by Rosaceae by 14 species, Poaceaeby 12 species,Primulaceaeby 4 species and caryophyllaceae and Moraceae by 3 species each. Thispioneer floristic inventory represents the floristic diversity and will serve as base line for the future researches.

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Introduction

Pakistan being the part of western Himalaya harbors rich floral diversity owing to important geographical position. More than 6000 species of Tracheophytes have been recorded in the region (Stewart, 1972). Northern parts of Pakistan Show higher species diversity including 80%of the endemic flora (Ali and Qaiser, 1986). The study area Sathan Gally lies in district Mansehra, situated between 34° – 14´ to 35° – 11´ north latitudes and 72° – 49´ to 74° – 08´east longitudes (Fiaz *et al.,* 2012).The area receives maximum rain fall during early spring and monsoon. The climate of an area remains pleasant in summer while winter is too harsh. Snow often occurs in the temperate forest particularly near its upper limits during the months of December to February. Most snow break is caused by wind when the trees are over laden with snow (Saddozai, 1996). According to the standard classification of forest types of Pakistan (Champion *et al.,* 1965) the forests of the area fall in sub-tropical and Himalaya moist temperate forests types.

Plant inventory of an area is a prerequisite of any floristic assessment. Various floristic studies have been conducted in different regions of Pakistanand contributed a lot not only to local floras but also to the flora of Pakistan, Such as Parker (1956),Stewart (1972), Shah and Khan(2006), Qureshi (2008), Zaheer and Sardar, (2008), Haq *et al.,*(2010), Fazal *et al.,*(2010), Qureshi and Bhatti, (2010), Saeed *et al.*,(2012), Waris *et al.,*(2013), Khan *et al.,*(2013b), Ilyas *et al.,*(2013), Shaheen *et al.,* (2011), Tanvir *et al.,* (2014) and Zulfiqar *et al.*,(2015).The area under investigation being the part of western Himalayas showing rich floristic diversity therefore, an effort is made to document firsthand information and prepare the check list of the area.

Materials and methods

The study was initiated to assess the vegetation structure qualitatively. The study area was visited frequently during flowering and fruiting seasons of plants in 2013 and 2014.

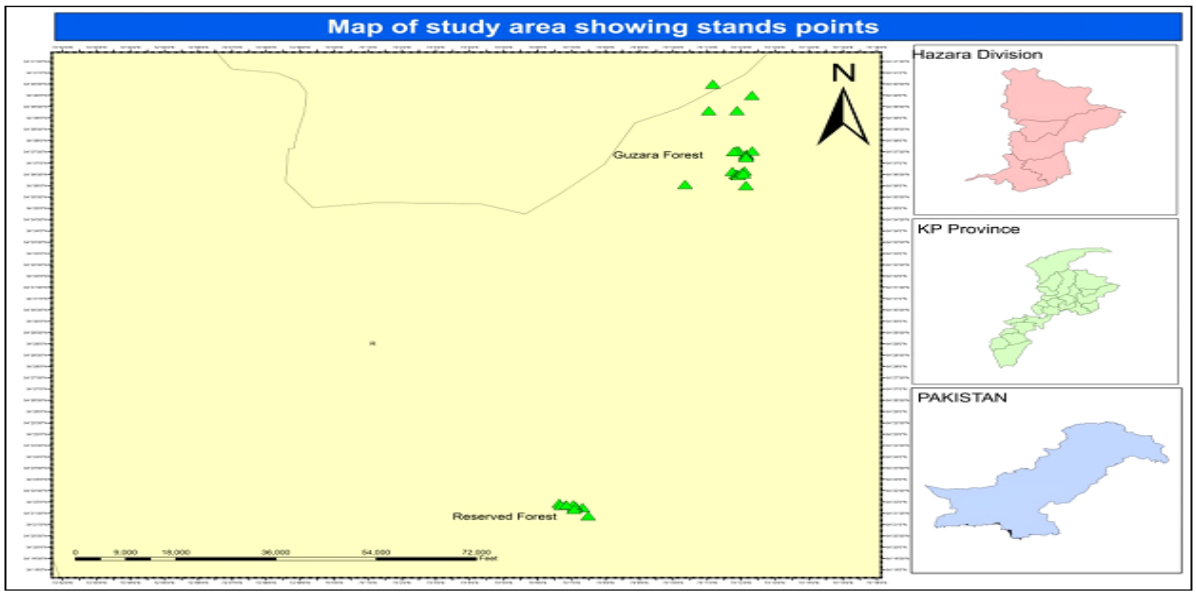

Fig. 1. Map of the investigated area.

During plant collection cutter, gloves, collection bags, blotting papers, soil digger, scissors and plant presser were used. Plants collected from various altitudes of the area under investigation, coordinates and altitude were recorded by using GPS (Gorman etrax 10). Plants specimens were shifted to blotting papers for drying. The specimens were poisoned using Mercuric Chloride, Copper sulphate and absolute alcohol in the ratio of 1:2gm/L of alcohol. The plants were identified with the help of flora of Pakistan (Nasir and Ali,

1970– 1994; Ali and Qaisar, 1995– 2011) and deposited with Herbarium Hazara University Mansehra. The data was statistically analyzed using MS Excel 2013.

Results and discussion

This first investigation revealed a total of 168 plants species belonging to 76 families. (Table 1).Angiosperms were represented by 156 species (92.85%), Gymnosperms by 5 species (2.97%) and Pteridophytes by 7 species (2.16%) (Fig.2). The dominant family was found Asteraceae contributing 20 species, followed by Rosaceae having 14 species, Poaceae by 12 species, Primulaceae by 4 species and caryophyllaceae and Moraceae by 3 species each (Fig. 3).

Our findings revealed a total of 168 plants species of 76 families. Angiosperms were represented by 156 species,Gymnosperms by 5 species and Pteridophytes by species 7 (Table 1).

Table 1. Pioneer inventory of tracheophytes of Sathan Gali district Mansehra.

S.No	Botanical name	Family	Habit	Flowering
1	*Arisaema jacquemontii Blume*	Araceae	Herb	June – September
2	*Abies pindrow Royle.*	Pinaceae	Tree	April – May
3	*Achillea mellefolium Linn.*	Asteraceae	Herb	July – September
4	*Adiantum capillus veneris Linn.*	Adiantaceae	Herb	September – December
5	*Adiantum caudatum Linnaeous.*	Adiantaceae	Herb	May – July
6	*Aegopodium burttii E. Nasir*	Apiaceae	Herb	July – September
7	*Aesculus indica (comb.) Hook*	Hippocastinaceae	Tree	May– July
8	*Agrostis stolonifera L.*	Poaceae	Herb	July– August
9	*Ajuga bracteosa Wall.ex Benth*	Labiatae	Herb	March – June
10	*Ajuga parviflora Benth*	Labiatae	Herb	April – June
11	*Alianthus althesema(Mill.)Swingle*	Simaroubaceae	Tree	March– June
12	*Alnus nitida (Spach.) Endl*	Betulaceae	Tree	August – October
13	*Anagalis arvensis Linn.*	Primulaceae	Herb	April – June
14	*Anaphalis busa D.C.*	Asteraceae	Herb	July – September
15	*Andrachne cordifolia (Wall.ex Dec) Muell.*	Euphorbiaceae	shrub	April – July
16	*Androsace rotundifolia Hardw.*	Primulaceae	Herb	May – July
17	*Apluda spp.*	Poaceae	Herb	July – October
18	*Aquilegia pubiflora Wall.ex Royle*	Ranunculaceae	Herb	May – August
19	*Arisaema flavum Forssk.*	Araceae	Herb	June – September
20	*Arisaema utile Hook.fex.schott*	Urticaceae	Herb	May – July
21	*Aristida spp.*	Poaceae	Herb	July – October
22	*Arum spp.*	Areaseae	Herb	June– August
23	*Asparagus filicinus Bunch –Ham.ex. D.Don*	Asparagaceae	Herb	May – June
24	*Aster himalaicus C.B.Clarke*	Asteraceae	Herb	August – October
25	*Bauhinia variegata Linn.*	Caesalpinaceae	Tree	March – April
26	*Berberis lycium Royle*	Berberidaceae	shrub	March – June
27	*Bergenia ciliata Sternb.*	Saxifragaceae	Herb	April – June
28	*Bidense pilosa L*	Asteraceae	Herb	September – October
29	*Bistorta amplexicaule (D.Don) Greene.*	Polygonaceae	Herb	June – August
30	*Brachiaria ramose(L) Stapf*	Poaceae	Herb	July – October
31	*Bromus japonicus Thunb.*	Poaceae	Herb	May – June
32	*Buddleja crispa Bth*	Buddlejaceae	shrub	March – May
33	*Bupleurum lanceolatum Wall. ex DC.*	Apiaceae	Herb	June– August
34	*Calamintha umbrosa (M.B) Bth. ex DC.*	Labiateae	Herb	Apr– June
35	*Calandula arvensis L.*	Asteraceae	Herb	April– June
36	*Caltha alba Camb.*	Ranunculaceae	Herb	April – July
37	*Cannabis sativa L.*	Cannabinaceae	Herb	April– July
38	*capsela bursa pistoris l.Medik*	Brassicaeae	Herb	June– July
39	*Cedrus deodara Roxb. ex Lamb.*	Pinaceae	Tree	September – October
40	*Celtis australis Linn.*	Ulmaceae	Tree	April – June
41	*Chenopdium ambrosiodes L*	Chenopodiaceae	Herb	March– May
42	*Chenopodium album L.*	Chenopodiaceae	Herb	March– May
43	*Cichorum intybus L.*	Asteraceae	Herb	April– June
44	*Clinopodium vulgare*	Lamiaceae	Herb	May– august
45	*Colchicum luteum Baker*	Colchicacea	Herb	Feb– March
46	*convulvulus arvensis L.*	Convulvulaceae	Herb	April – June

47	*Conyza canadensis L. Cronquist.*	Asteraceae	Herb	July – August
48	*Coronopus didymus (L) Sm*	Brassicaeae	Herb	March- April
49	*Cotoneaster multiflorus Bunge*	Rosaceae	shrub	April – May
50	*Crotolaria spp*	Fabaceae	Herb	June – August
51	*Cynodon dactylon (L.)Pers.*	Poaceae	Herb	February – March
52	*Cyperus spp.*	Cyperaceae	Herb	May – July
53	*Daphne papyracea Wall .ex Steud.*	Thymelaeaceae	shrub	April – June
54	*Desmodium elegans D. C.*	Papilionaceae	shrub	June – August
55	*Deutzia staminea R. Br .ex Wall.*	Philadelphaceae	shrub	April – June
56	*Dicliptra bupleorides Nees.*	Acanthaceae	Herb	April – June
57	*Digitaria nodosa Perl.*	Poaceae	Herb	May– August
58	*Diospyros lotus Linn.*	Ebenaceae	Tree	August – September
59	*Dodonaea viscosa (L.) Jacq.*	Sapindaceae	shrub	August – February
60	*Dryopteris stewartii Fress*	Pteridaceae	Herb	July– August
61	*Duchesnea indica (Andr.) Focke.*	Rosaceae	Herb	April – May
62	*Elymus spp*	Poaceae	Herb	June– August
63	*Erigeron multiradiatus Lindley*	Asteraceae	Herb	April – July
64	*Erigeron spp.*	Asteraceae	Herb	March – August
65	*Fagopyrum spp*	Polygonaceae	Herb	June – August
66	*Ficus carica Forsk.*	Moraceae	Tree	June – September
67	*Fragaria nubicola Lindl.*	Rosaceae	Herb	April – July
68	*Fumaria indica (Husskn.) H.N*	Fumaraceae	Herb	April – June
69	*Gallium aparine Linn.*	Rubiaceae	Herb	July – September
70	*Gentianodes pedicellata D.Don*	Gentianaceae	Herb	May – August
71	*Geranium rotundifolium Linn.*	Geraniaceae	Herb	May – September
72	*Geranium wallichinum D. Don ex Sweet.*	Geraniaceae	Herb	May – September
73	*Hedra nepalensis K. Koch.*	Araliaceae	Herb	August – October
74	*Heteropogon contortus Linn.*	Poaceae	Herb	August – October
75	*Hyoscyamus niger Linn.*	Solanaceae	Herb	May – August
76	*Hypericum perforatum Linn.*	Guttiferae	Herb	May – August
77	*Impatiens bicolor Royle*	Balsaminaceae	Herb	June – September
78	*Imprita cylindrica (L.) .P.Beaiev.*	Poaceae	Herb	May– August
79	*Inula coppa L*	Asteraceae	Herb	May – August
80	*Isodon rugosus Linn.*	Labiatae	shrub	March – April
81	*Jasminum humile Linn*	Oleaceae	shrub	April – June
82	*Juglans regia Linn.*	Juglandanceae	Tree	February – April
83	*Lactuca spp*	Asteraceae	Herb	April – June
84	*Lamium album Linn.*	Labiatae	Herb	April – August
85	*Lamium amplexicul L.*	Lamiaceae	Herb	March – May
86	*Leontopodium brachyoctis Gandoger*	Asteraceae	Herb	July – September
87	*Leonurus cordiaca*	Lamiaceae	Herb	June– July
88	*Lonicera spp*	Caprifoliaceae	shrub	March – June
89	*Malva neglecta Wallr.*	Malvaceae	Herb	April – June
90	*Malvastrum coromandelianum (L.)Garcke*	Malvaceae	Herb	April – June
91	*Medicago denticulata Willd.*	Papilionaceae	Herb	April – June
92	*Melia azedarach Linn.*	Meliaceae	Tree	March – June
93	*Micromeria biflora Buch.*	Labiatae	Herb	March – June
94	*Morus alba L.*	Moraceae	Tree	March – May
95	*Morus nigra L.*	Moraceae	Tree	March – May
96	*Myosotis arvensis (Linn.) Hill.*	Boraginaceae	Herb	May – October
97	*Myrsine africana Linn.*	Myrsinaceae	Shrub	March – April
98	*Nepeta cataria Linn.*	Labiatae	Herb	June – September
99	*Oenothera rosea Linn.*	Onagraceae	Herb	April – July
100	*Onychium japonicum (Kunze). Wall*	Pteridaceae	Herb	June– August
101	*Origanum vulgare Linn.*	Labiatae	Herb	June – September
102	*Oxalis corniculata L.*	Oxalidaceae	Herb	March – June
103	*Paeonia emodi Wall ex Hook. f.*	Paeoniaceae	Herb	April – June
104	*Parrotiopsis jacquemontiana Rehder.*	Hamamelidaceae	shrub	August– June
105	*Parthenium histoforous L*	Asteraceae	Herb	September-October
106	*Phlomis rotata Royle .ex Benth.*	Labiatae	Herb	June – August
107	*Picea smithiana (Wall.) Boiss.*	Pinaceae	Tree	April – May
108	*Pieris ovalifolia (Wall.) D. Don*	Ericaceae	Tree	March – May
109	*Pinus wallichiana L.*	Pinaceae	Tree	April – May
110	*Pinus roxburghii Surgent.*	Pinaceae	Tree	April– May
111	*Plantago lanceolata L.*	Plantaginaceae	Herb	April – August
112	*Plantago major L.*	Plantaginaceae	Herb	March – August
113	*Platanus orientalis L*	Platanaceae	Tree	May– June

114	*Poa anua L*	Poaceae	Herb	July – September
115	*Podophyllum emodi Wall .ex Royle*	Podophyllaceae	Herb	April – June
116	*Populus Ciliata Wall.ex Royle*	Salicacae	Tree	April – June
117	*Potentilla nepalensis Hook.f.*	Rosaceae	Herb	July – August
118	*Potentilla spp.*	Rosaceae	Herb	June – August
119	*Primula denticulata Sm.*	Primulaceae	Herb	May– July
120	*Primula denticulata Smith*	Primulaceae	Herb	April – June
121	*Prunella vulgaris L. Mi*	Rosaceae	Herb	May – August
122	*Prunus americana L.*	Rosaceae	Tree	February – March
123	*Prunus domestica L*	Rosaceae	Tree	February – March
124	*Prunus cornata*	Rosaceae	Tree	June– August
125	*pteridium spp*	Pteridaceae	Herb	September – December
126	*Pteris spp.*	Pteridaceae	Herb	September – December
127	*Pteris vitata L.*	Pteridaceae	Herb	June– August
128	*Pulicaria crispa (Forssk). Olive*	Asteraceae	Herb	November– March
129	*Pyrus pashia Ham.ex D. Don*	Rosaceae	Tree	February– March
130	*Quercus dilatata Lindle. Ex Royle*	Fagaceae	Tree	April– May
131	*Quercus incana Roxb.*	Fagaceae	Tree	April– May
132	*Ranunculus hirtellus Royle.*	Ranunculaceae	Herb	May – August
133	*Ranunculus muricatus L.*	Ranunculaceae	Herb	March– April
134	*Rhamnus virgata Roxb.*	Rhamnaceae	Tree	April– July
135	*Rhododendron arboreum Smith.*	Ericaceae	Tree	March – May
136	*Rosa moschata J. Herm.*	Rosaceae	shrub	April – June
137	*Rubus fructicosus Hook.f.*	Rosaceae	shrub	April – June
138	*Rumex hastatus D. Don.*	Polygonaceae	shrub	May – July
139	*Salvia lanata Roxb.*	Labiatae	Herb	April – June
140	*Sarcococca saligna (Don) Muell.*	Buxaceae	shrub	September– May
141	*Saromatum2venosum(Dryand.ex Aiton) Kun3h*	Areaseae	Herb	May– august
142	*Scutellaria c4amaedrifolia Hedge.*	Labiatae	Herb	May – July
143	*Senicio aureus L.*	Asteraceae	Herb	July – September
144	*silene conidea L.*	Caryophyllaceae	Herb	March– April
145	*Skimmia laureola D.C.*	Rutaceae	shrub	April – May
146	*Solanum surratense Burm.f.*	Solanaceae	Herb	April – May
147	*Solena amplexicaulis (Lam.) Gandhi*	Cucurbitaceae	Herb	July – September
148	*Solidago virgaurea Linn.*	Asteraceae	Herb	May– July
149	*Sonchus asper (L.) Hill.*	Asteraceae	Herb	April – July
150	*Sorbaria tomentosa Lindl.*	Rosaceae	shrub	June – August
151	*Spiraea vaccinifolia D. Don.*	Rosaceae	shrub	March – July
152	*Stellaria media (L.) Vill.*	Caryophyllaceae	Herb	March – April
153	*Swertia ciliate(G.Don)B.L.Burtt*	Gentianaceae	Herb	June – August
154	*Taraxacum officinale Weber.*	Asteraceae	Herb	March – April
155	*Taxus wallichiana Zuce.*	Taxaceae	Tree	March – May
156	*Themeda anathera (Nees.ex Steud) DC*	Poaceae	Herb	August – October
157	*Trifolium repens L.*	Paplionaceae	Herb	April– July
158	*Tussilago farfara Linn.*	Asteraceae	Herb	August– October
159	*Ulmus villosaBrandis ex. Gamble*	Ulmaceae	Tree	April – June
160	*Urtica dioica Linn.*	Urticaceae	Herb	May– July
161	*vaccaria spp.*	caryophyllaceae	Herb	April– May
162	*Valeriana jatamansi Jones.*	Valerianaceae	Herb	May – July
163	*Verbascum thapsus Linn.*	Scrophulariaceae	Herb	May – September
164	*Veronica persica Poir.*	Scrophulariaceae	Herb	June– August
165	*Viburnum grandiflorum Wall. ex DC Kuchh*	Caprifoliaceae	shrub	March– July
166	*Viola canescens Wall. Ex Roxb.*	Violaceae	Herb	July– September
167	*vitis lanata Roxb*	Vitaceae	shrub	May– June
168	*Woodfordia fruiticosus (L.) Kurz*	Lythraceae	shrub	September – December

Similarly Mehmood *et al.*, (2015) in their first exploration of Tor Ghar district (adjacent to study area) enlisted a total of 331 vascular plant species belonging to 246 genera and 101 families. Haq *et al.,* (2015) also documented 157 plant species of Nandiar Khuwar catchment area Western Himalaya. Shah and Khan (2006) reported 80 plant species of 49 families from Siran Valley Mansehra. Khalid (2009) investigated 80 plant species of 42 families from catchment areas of River Siran. Shah *et al.,* 2015 recorded 250 species of Tracheophytes from Basikhel tribal belt of district Tor Ghar.

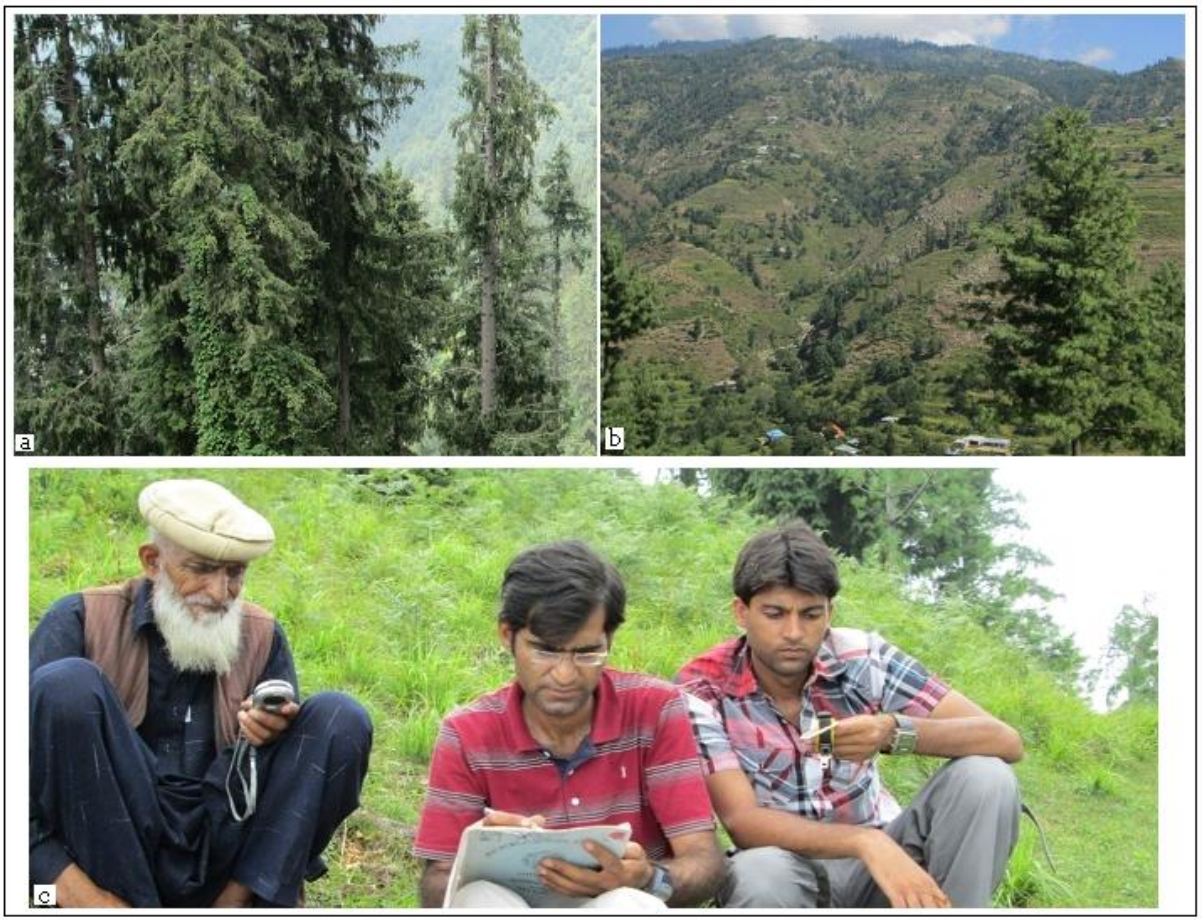

Fig. 2. Scenic view of the area; a) Reserved forest b) Guzara forest c) author while documenting data.

Study on plant biodiversity has also been conducted by Khan *et al.,* (2013) in Naran Valley. They reported 52 families, containing101 vascular plant species.

Our results showed that the dominant family was Asteraceae contributing 20 speciesto the total flora of the region followed by Rosaceae having 14 species, Poaceae 12 species, Primulaceae4 species and caryophyllaceae and Moraceae3 species each. According to Stewart (1972) the dominant family was Asteraceae followed by Rosaceae and Poaceaein Pakistan and Azad Jammu and Kashmir. Some other studies also showed that these families to be the major families in the flora of Pakistan (Ali, 1971 – 94; Ali and Qaisar, 1995 – 2004). While a number of other studies showing poaceae as a dominant family of certain areas of Pakistan.Musharaf *et al., (*2012) reported that Poaceae and Asteraceae weredominant families ofTehsil Takht– e– Nasrati, Pakistan. Qureshi and Bhatti (2010) reported that Poaceae was the largest family followed by Amaranthaceae.

The possible explanation of occurrence of Poaceae as a dominant family in these studies is due to habitat specificity, mostly these lie in dry sub– tropical zones having harsh and dry climatic condition favoring regeneration of grasses. Our area is mainly moist temperate harboring rich species diversity of family Asteraceae. Results of our studies depicting richness of Angiospermic flora (92.85%) followed by Gymnosperms (2.97%) and Pteridophytes (2.16%). Similar results were obtained in majority of explorations of Northern areas of Pakistan, by Mehmood *et al.,*(2015), Haq *et al.,*(2015),Fazal*et al.,*(2010), Qureshi and Bhatti, (2010), Saeed*et al.*,(2012), Waris*et al.,*(2013), Khan*et al.,*(2013), Ilyas*et al.,*(2013), Shaheen *et al.,* (2011), Tanvir *et al.,* (2014).The current study will be helpful to unearth the plant resources forvarious purposes.

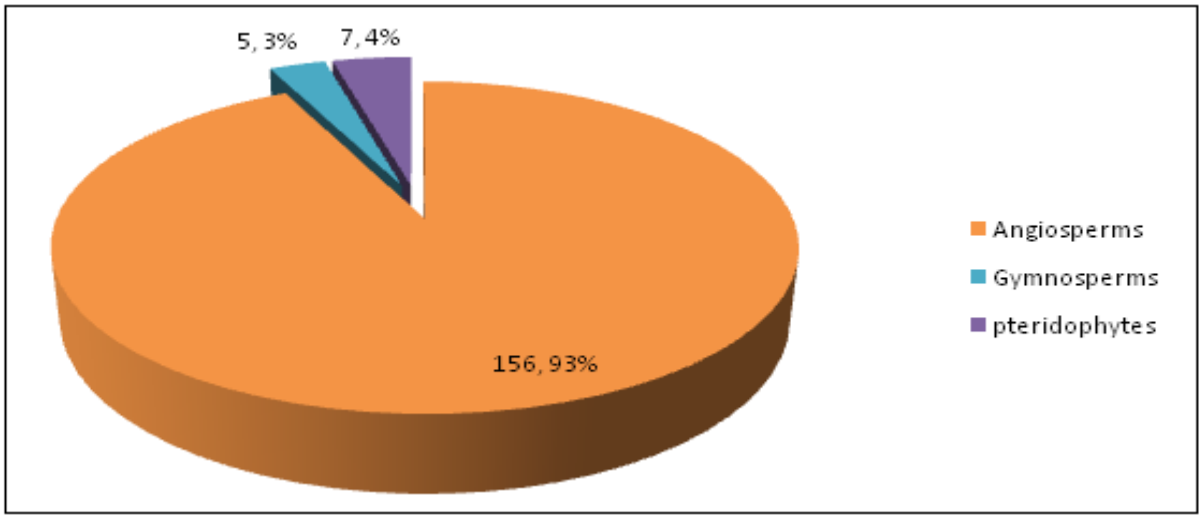

Fig. 2. Graphical representation of different groups of tracheophytes.

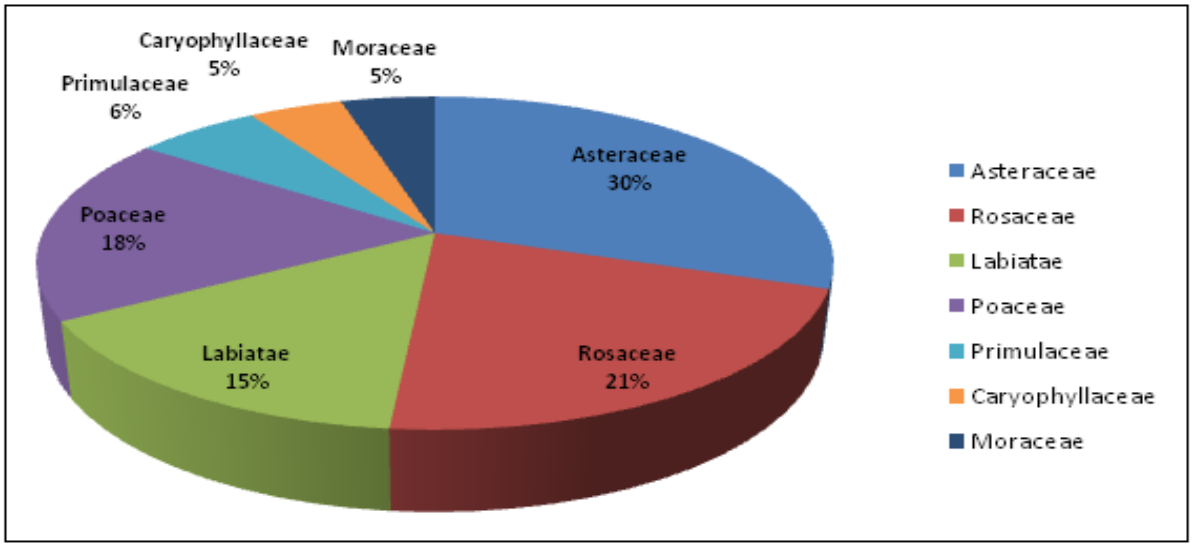

Fig. 3. Percentage of various families of vascular plants in Sathan Gali.

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