



FLORA OF VARIOUS “NALS” OF PHULWARI WILD LIFE SANCTUARY, UDAIPUR, RAJASTHAN

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ABSTRACT

441 species (Monocot = 126, Dicot = 315) belonging to 323 genera and 91 families (Monocot = 20, Dicot = 71) of angiosperms are reported in various *nals* of Phulwari Wildlife Sanctuary.

INTRODUCTION

Phulwari was declared as Wildlife Sanctuary during year 1983. This sanctuary comprises of 11 Forest Blocks spread in the area of 492.68 sq. km. It is an important sanctuary of Mewar region (Southern Rajasthan). The sanctuary is situated in Kotra and Jhadol Tehsils of Udaipur district along Rajasthan – Gujarat border between 73°7' and 73°20' E longitude and 24°0' and 24°30' N latitude.

High hills, presence of thick soil layer on the hill slopes and more availability of humus and litter, good rainfall, lack of frost, longer growing period (120-125 days) and better

perenniality of streams and presence of ‘nals’ of varying width are some important characteristics of this sanctuary.

The “nals”

A valley, specially a narrow one is called a ‘nal’ in the local dialect. The area present between two parallel mountain chains or a deep fold present in a chain itself is a ‘nal’. Essentially a ‘nallah’ or a stream or a river is present in the ‘nal’. Stream of the ‘nal’ may be perennial, semi-perennial, seasonal or ephemeral. Water regime in a ‘nal’ remains higher than the adjacent area. More water loving species are generally seen on the banks of the streams. A few important ‘nals’ of Phulwari sanctuary are as follows:

Table 1. A few important ‘nals’ of Phulwari Sanctuary

| S. No. | Name of ‘nal’ | Location | Nature of Valley | Nature of Stream |
|--------|------------------|---------------------------------|------------------------------|-----------------------------|
| 1. | Ada-Haldu-Ki-nal | Near Ada Haldu Village | Wide | Perennial |
| 2. | Amba-Ki-nal | Near Amba Village | Narrow | Perennial |
| 3. | Ambavi-Ki-nal | Near Ambavi Village | Narrow | Seasonal |
| 4. | Gamdi-Ki-nal | Near Gamdi Village | Narrow | Nearly perennial |
| 5. | Hukeri-Ki-nal | Near Bhildi Mata | Narrow | Perennial |
| 6. | Kanhal-Ki-nal | Near Manasi Village | Wide | Semi-Perennial |
| 7. | Katawali-Ki-nal | Near Ambavi Village | Natural narrow and deep fold | Perennial |
| 8. | Kawel-Ki-nal | Near Kawel Village | Narrow | Once perennial now seasonal |
| 9. | Kewdi-Ki-nal | Near Kewdi Village | Wide | Semi Perennial |
| 10. | Khanchan-Ki-nal | From Khanchan To Luhari Village | Narrow | Once perennial now seasonal |
| 11. | Kodar-Ki-nal | Near Ambasa Village | Wide | Perennial |
| 12. | Lathuni-Ki-nal | Near Lathuni Village | Narrow | Perennial |
| 13. | Manasi-Ki-nal | Near Manasi Village | Wide | Seasonal |
| 14. | Mandwa-Ki-nal | Near Mandwa Village | Wide | Semi Perennial |
| 15. | Phulwari-Ki-nal | Near Panarwa Village | Narrow | Perennial |
| 16. | Pipli-Ki-nal | Near Dungaria Village | Narrow | Seasonal |
| 17. | Sarli-Ki-nal | Near Sarli Village | Wide | Seasonal |
| 18. | Umaria-Ki-nal | Near Umaria Village | Wide | Seasonal |

The climate of this sanctuary is sub-tropical comprising of striped hyena etc. are important faunal species of the area. three distinct seasons viz., summer (March to June), rain (July to October) and winter (November to February). The average rainfall is around 730 mm. The hottest months are May and June and the coolest months are December and January. This sanctuary is free from frost as minimum temperature in winter is 8°C while the maximum mean temperature during summer is 42°C.

The forest in the sanctuary is quite dense and multi-storied (Bhatnagar et al. 2003) and mainly dry deciduous (Champion & Seth 1968). A few pockets possess dense riverine forest because of the presence of many perennial and semi-perennial streams. Wakal River is the biggest stream in the sanctuary, which bisects forest in two unequal parts. It is a westward flowing river.

Phulwari sanctuary seems a pro-runner of Mt Abu sanctuary. It is a transition zone of Kumbhalgarh and Mt Abu sanctuaries. It is the only sanctuary of the Aravallis in Rajasthan where *Anogeissus pendula* is totally absent. Absence of *A. pendula* indicates that something is special here, which makes this sanctuary different from other sanctuaries of the state. Phulwari sanctuary is rich in tuberous plants, climbers, lianas, orchids and many Western Ghats elements (Sharma, 1996, 1999, 2001, 2003, 2005; Shetty & Singh 1991-93, Tehsin 1980).

This sanctuary is also rich in faunal diversity. Once it was a famous tiger land of the state but now the tiger is not there. Today, leopard is at the apex of food pyramid. Sloth bear, wild boar, four-horned antelope, crocodile, common civet, small Indian civet, golden jackal, Bengal fox, jungle cat, ratel, rusty spotted cat, common mongoose, ruddy mongoose,

back, Green whip snake, Beaked blind snake etc. (Sharma 1995 a & b, 2005; Tehsin 1980, Bhatnagar et al. 2003). Floral diversity of nals in the Phulwari sanctuary has been reported in this communication.

METHODOLOGY

Phulwari Sanctuary had been under our observation for last 10 years and intensified study has been continued from June, 2014. The area was surveyed in three distinct season's viz., summer, rainy and winter. More emphasis was given during rainy season because growth of climbers, tuberous plants and ephemerals is commonly seen during this period. Help of local tribals was sought as they are good in escorting duty and also are familiar to all interior paths and trails of the area. Help of local forest officers was also taken while surveying in the forest area. Since Phulwari is a protected area hence specimens were not collected. However, photographs were taken for a record and further reference. The erstwhile Thikanedar Rana Manohar Singh Solanki (Thikana Panarwa), and Late Rana Himmat Singh Solanki (Thikana Mamer) were also contacted to get information of the area.

For authentication of a few species, help was sought from Foundation for Revitalization of Local Health Traditions (FRLHT), Bangalore.

RESULTS AND DISCUSSION

A systematic enumeration of Angiospermic flora, recorded from various 'nals' of Phulwari Sanctuary is presented in Table 2 and 3.

Table 2. Dicot flora of various 'nals' of Phulwari Wildlife Sanctuary

| S. No. | Family | Species recorded |
|--------|----------------|---|
| 1. | Annonaceae | <i>Milliusa tomentosa</i> (Roxb.) Sinclair |
| 2. | Menispermaceae | <i>Cissampelos pareira</i> L., <i>Stephania henandifolia</i> (Wild). Walp |
| 3. | Capparidaceae | <i>Capparis grandis</i> Linn., <i>C. sepiaria</i> L. |
| 4. | Flacourtiaceae | <i>Casearia elliptica</i> Willd., <i>Flacourtia indica</i> (Burm. f.) Merr. |
| 5. | Tamaricaceae | <i>Tamarix ericoides</i> Rottl. |
| 6. | Elatinaceae | <i>Bergia ammannioides</i> Roth. |
| 7. | Malvaceae | <i>Abutilon indicum</i> (L.) Sweet, <i>Thespisia lampas</i> (Cav.) Dalz. ex Gibbs, <i>Hibiscus caesius</i> Garcke, <i>Urena lobata</i> L., <i>Kydia calycina</i> Roxb, <i>Sida rhombifolia</i> L. |

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| 8. | Sterculiaceae | <i>Firmiana colorata</i> (Roxb.) R. Br., <i>Helicteris isora</i> L., <i>Melhania futteyporensis</i> Munro ex Mast., <i>Waltheria americana</i> L., <i>Eriolaena hookeriana</i> Wight & Arn., <i>Sterculia villosa</i> Roxb. ex DC. |
| 9. | Tiliaceae | <i>Corchorus aestuans</i> L., <i>C. olitorius</i> L., <i>C. trilocularis</i> L., <i>Grewia flavescens</i> A. Juss, <i>G. tenax</i> (Forsk) Fiori, <i>G. tellifolia</i> Vahl., <i>Triumfetta pentandra</i> A. Rich |
| 10. | Oxalidaceae | <i>Biophytum sensitivum</i> (L.) DC., <i>Oxalis corniculata</i> L. |
| 11. | Malpighiaceae | <i>Hiptage benghalensis</i> (L.) Kurz. |
| 12. | Balsaminaceae | <i>Impatiens balsamina</i> L. |
| 13. | Rutaceae | <i>Aegle marmelos</i> (L.) Correa, <i>Feronia limonia</i> (L.) Swingle |
| 14. | Burseraceae | <i>Garuga pinnata</i> Roxb. |
| 15. | Meliaceae | <i>Toona ciliata</i> Roem. |
| 16. | Celastraceae | <i>Celastrus paniculatus</i> Willd. |
| 17. | Rhamnaceae | <i>Ziziphus oenoplia</i> (L.) Miller |
| 18. | Leeaceae | <i>Leea macrophylla</i> Roxb. ex Hornem., <i>L. edgeworthii</i> Sant. |
| 19. | Vitaceae | <i>Ampelocissus latifolia</i> (Vahl.) Planch., <i>Cayratia trifolia</i> (L.) Domin., <i>C. auriculata</i> (Roxb.) Amble., <i>Cissus repanda</i> Vahl. |
| 20. | Sapindaceae | <i>Cardiospermum halicacabum</i> L., <i>Sapindus trifoliatus</i> L. |
| 21. | Anacardiaceae | <i>Mangifera indica</i> L. |
| 22. | Fabaceae | <i>Abrus precatorius</i> L., <i>Aeschynomene indica</i> L., <i>Alysicarpus bupleurifolius</i> (L.) DC., <i>Arachis hypogaea</i> L., <i>Butea monosperma</i> (Lamk.) Taub., <i>B. monosperma</i> (Lamk) Taub. Var. <i>lutea</i> (Wit.) Maheshwari, <i>Canavalia ensiformis</i> (L.) DC., <i>Clitoria annua</i> Graham, <i>C. ternatea</i> L., <i>Crotalaria medicaginea</i> Lamk., C. spectabilis Roth., <i>C. filipes</i> Benth, <i>C. ferruginea</i> Grah et. Benth., <i>Dalbergia lanceolata</i> L.f., <i>D. latifolia</i> Roxb., D. <i>paniculata</i> Roxb., <i>D. volubilis</i> Roxb., <i>Derris indica</i> (Lamk.) Bennet, <i>Desmodium gangeticum</i> (L.) DC., <i>D. velutinum</i> (Willd.) DC., <i>Dobichos nudiflorus</i> Lamk., <i>D. lablab</i> L., <i>Erythrina suberosa</i> Roxb., <i>Flemingia bracteata</i> (Roxb.) Wight, <i>Indigofera cordifolia</i> Heyne ex Roth, <i>I. linifolia</i> (L.f.) Retz., <i>I. linnaei</i> Ali, <i>Medicago polymorpha</i> L., <i>Mukuna pruriens</i> (L.) DC., <i>Psoralia corylifolia</i> L., <i>Pterocarpus marsupium</i> Roxb., <i>Pueraria tuberosa</i> (Roxb. Ex Willd.) DC., <i>P. lobata</i> (Willd.) Ohwi, <i>Rhynchosia minima</i> (Linn) DC., <i>R. rothii</i> Roxb. ex Aitchison, <i>Sesbania bispinosa</i> (Jacq.) Wight, <i>Tephrosia purpurea</i> (L.) Pers., <i>Vicia sativa</i> L., <i>Vigna trilobata</i> (L.) Verd., <i>Zornia gibbosa</i> Span |
| 23. | Caesalpiniaceae | <i>Bauhinia racemosa</i> Lamk., <i>B. variegata</i> L., <i>Caesalpinia bonduc</i> (L.) Roxb., <i>Cassia fistula</i> L., <i>C. occidentalis</i> L., <i>C. pumila</i> Lam., <i>C. mimosoides</i> L., <i>C. tora</i> L., <i>Tamarindus indica</i> L. |
| 24. | Mimosaceae | <i>Acacia ferruginea</i> DC., <i>A. leucophloea</i> (Roxb.) Willd., <i>A. pennata</i> (L.) Willd., <i>A. odoratissima</i> (L.f.) Benth., <i>Dichrostachys cinerea</i> (L.) Wight & Arn. |

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| 25. | Haloragaceae | <i>Myriophyllum spicatum</i> L. |
| 26. | Combretaceae | <i>Anogeissus latifolia</i> (Roxb. ex DC) Wall. ex Guill. & Pers., <i>A. sericea</i> var. <i>sericea</i> Brandis, <i>A. acuminata</i> (Roxb. ex. DC.) Guill & Pers., <i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn, <i>T. bellirica</i> (Gaertn.) Roxb, <i>T. crenulata</i> Roth. |
| 27. | Myrtaceae | <i>Syzygium cumini</i> (L.) Skeels, <i>S. heyneanum</i> (Duthie) Wall. ex Gamble |
| 28. | Lythraceae | <i>Ammannia auriculata</i> Willd., <i>A. baccifera</i> L., <i>A. multiflora</i> Roxb., <i>Woodfordia fruticosa</i> (L.) Kurz |
| 29. | Cucurbitaceae | <i>Coccinia grandis</i> (L.) J.O. Voigt, <i>Corallocarpus epigeus</i> (Rottl. & Willd.) Hook. f., <i>Cucumis mela</i> L. var <i>agrestis</i> Naud., <i>C. setosus</i> Cogn., <i>C. callosus</i> (Rottl.) Cogn., <i>C. prophetarum</i> L., <i>Diplocyclos palmatus</i> (L.) Jeffry, <i>Luffa acutangula</i> var. <i>amara</i> (Roxb) Clarke, <i>Momordica balsamina</i> L., <i>M. dioica</i> Roxb. ex Willd, <i>Mukia madraspatana</i> (L.) Roem., <i>Trichosanthes cucumerina</i> L., <i>T. dioica</i> Roxb., <i>T. bracteata</i> (Lam.) Voigt. |
| 30. | Molluginaceae | <i>Gilinus lotoides</i> L., <i>Mollugo cerviana</i> (L.) Ser. |
| 31. | Aizoaceae | <i>Trianthema portulacastrum</i> L., <i>Zaleya pentandra</i> (L.) Jeffrey |
| 32. | Apiaceae | <i>Centella asiatica</i> (L.) Urban, <i>Heracleum grande</i> (Dalz. & Gibbs), <i>Pimpinella heyneanum</i> Wall. ex Kuriz |
| 33. | Alangiaceae | <i>Alangium salvifolium</i> (L. f.) Wangerin |
| 34. | Rubiaceae | <i>Borreria articularis</i> (L.f.) F.N. Will., <i>Gardenia turgida</i> Roxb., <i>Haldina cordifolia</i> (Roxb.) Ridsdale, <i>Hymenodictyon orixense</i> (Roxb.) Mabberley, <i>Mitragyna parvifolia</i> (Roxb.) Korth., <i>Morinda pubescens</i> Roxb., <i>Xeromorphis spinosa</i> (Thunb.) Keay. |
| 35. | Asteraceae | <i>Acanthospermum hispidum</i> DC., <i>Artemisia nilagirica</i> (Clarke) Pamp., <i>A. parviflora</i> Buch - Ham ex. D. Don, <i>Ageratum conyzoides</i> L., <i>A. houstonianum</i> Mill., <i>Bidens biternata</i> (Lour.) Merr., <i>Centratherum anthelminticum</i> (L.) O. Kuntze, <i>C. phyllocaenum</i> (DC.) Benth ex Clarke, <i>Carthamus tinctorius</i> L., <i>Centipeda minima</i> (L.) A. Br. & Aschers, <i>Cyathocline purpurea</i> Ham ex Don O. Ktze, <i>Eclipta prostrata</i> (L.) Hassk., <i>Echinops echinatus</i> Roxb., <i>Grangea maderaspatana</i> (L.) Poir., <i>Launaea procumbens</i> (Roxb.) Ramayya & Rajagopal, <i>Lagascea mollis</i> Cav., <i>Parthenium hysterophorus</i> L., <i>Sphaeranthus indicus</i> L., <i>Tridax procumbens</i> L., <i>Vernonia cinerea</i> (L.) Less, <i>Xanthium strumarium</i> L., <i>Zinnia elegans</i> Jacq. |
| 36. | Campanulaceae | <i>Campanula wallichii</i> Babu |
| 37. | Plumbaginaceae | <i>Dyerophytum arabicum</i> (Boiss ex DC.) Almeida, <i>Plumbago zeylanica</i> L. |
| 38. | Primulaceae | <i>Anagallis arvensis</i> L. |

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| 39. | Sapotaceae | <i>Madhuca indica</i> J.F. Gmelin |
| 40. | Ebenaceae | <i>Diospyros melanoxylon</i> Roxb. |
| 41. | Oleaceae | <i>Jasminum grandiflorum</i> L., <i>J. sambac</i> (L.) Ait., <i>Nyctanthes arbortristis</i> L., <i>Schrebera swietenioides</i> Roxb. |
| 42. | Apocynaceae | <i>Carissa spinarum</i> L., <i>Catharanthus pusillus</i> (Murr.) G. Don, <i>Holarrhena antidysenterica</i> (L.) Wall. ex. A. DC., <i>Nerium oleander</i> L. Var. <i>roseolasimples</i> Voight, <i>Wrightia arborea</i> (Dennst.) Mabb., <i>W. tinctoria</i> (Roxb.) R. Br. |
| 43. | Periplocaceae | <i>Creptolepis dubia</i> (Burm. f.) Comb. nov., <i>Cryptostegia grandiflora</i> R.Br., <i>Hemidesmus indicus</i> (L.) Schultes |
| 44. | Asclepiadaceae | <i>Calotropis procera</i> (Ait.) Ait. f., <i>Holostemma adakodien</i> Schult., <i>Oxystelma secamone</i> acut non (L.) Karst., <i>Pergularia daemia</i> (Forsk.) Chiv., <i>Wattakaka volubilis</i> (L.f.) Stapf. |
| 45. | Menyanthaceae | <i>Nymphoides hydrophylla</i> (Lour.) Kuntze |
| 46. | Gentianaceae | <i>Enicostema verticillatum</i> (L.) Engl. |
| 47. | Boraginaceae | <i>Coldenia procumbens</i> L., <i>Heliotropium ovalifolium</i> Forsk., <i>Trichodesma amplexicaule</i> Roth |
| 48. | Epretiaceae | <i>Cordia crenata</i> Delile, <i>C. dichotoma</i> Forst f., <i>Ehretia laevis</i> Roxb. |
| 49. | Cuscutaceae | <i>Cuscuta reflexa</i> Roxb., <i>C. hyaline</i> Heyne ex Roth |
| 50. | Convolvulaceae | <i>Argyreio capitiformis</i> (Lamk.) Almeida, <i>A. nervosa</i> (Burm. f.) Boj; <i>Evolvulus alsinoides</i> (L.) L., <i>E. nummularius</i> (L.) L., <i>Ipomoea aquatica</i> Forsk., <i>I. carnea</i> ssp. <i>fistulosa</i> (Mart. ex Choisy) D Austin, <i>I. nil</i> (L.) Roth., <i>I. pes-tigridis</i> L., <i>Merremia gangetica</i> (L.) Cufod., <i>Porana paniculata</i> Roxb., <i>Rivea hypocrateriformis</i> (Desv.) Choisy |
| 51. | Solanaceae | <i>Solanum nigrum</i> L., <i>S. surattense</i> Burm f., <i>Withania somnifera</i> (L.) Dunal |
| 52. | Scrophulariaceae | <i>Bacopa monneri</i> (L.) Wettsl., <i>Kickxia ramosissima</i> (Wall.) Janchen, <i>Limnophila indica</i> (L.) Druce, <i>Lindenbergia muraria</i> (Roxb. ex D. Don Bruch, <i>Lindernia crustacea</i> (L.) f. Muell, <i>Striga gesnerioides</i> (Willd) Vatke var. <i>gesnerioides</i> Almeida, <i>S. gesnerioides</i> (Willd) Vatke var. <i>minor</i> Santapau, <i>Verbescum chinense</i> (L.) Sant |
| 53. | Lentibulariaceae | <i>Utricularia striatula</i> J.E. Smith, <i>U. stellaris</i> L. |
| 54. | Gesneriaceae | <i>Didymocarpus pygmaea</i> Clarke |
| 55. | Bignoniaceae | <i>Dolichandrone falcata</i> (Wall. ex DC.) Seem, <i>Oroxylum indicum</i> (L.) Vent., <i>Stereospermum personatum</i> (Harsk.) Chatterjee |
| 56. | Pedaliaceae | <i>Sesamum orientale</i> L. |
| 57. | Martyniaceae | <i>Martynia annua</i> L. |

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| 58. | Acanthaceae | <i>Andrographis paniculata</i> (Burm. f.) Wall. ex Nees, <i>Barleria cristata</i> L., <i>B. prionitis</i> L., <i>Blepharis maderaspatensis</i> (L.) Heyne ex Roth, <i>Carvia callosa</i> (Nees) Bremek, <i>Didiptera verticillata</i> (Forsk.) C. Christens, <i>Eranthemum roseum</i> (Vahl) R. Br., <i>Elytraria acaulis</i> (L.f.) Lindau, <i>Haplanthodes verticillatus</i> (Roxb.) Majumdar, <i>Hygrophila auriculata</i> (Schum) Heine, <i>H. serphyllum</i> (Nees) T. Anders., <i>Indoneesiella echiooides</i> (L.) Sreemadh, <i>Justicia procumbens</i> L., <i>J. belonica</i> L., <i>Lepidagathis trinervis</i> Wall. ex Nees, <i>Neurocanthus sphaerostachyus</i> (Nees) Dalz., <i>Peristrophe paniculata</i> (Forsk.) Brummitt, <i>Petalidium karlerioides</i> (Roth.) Nees., <i>Ruellia tuberosa</i> L. |
| 59. | Verbenaceae | <i>Lantana camara</i> L., <i>Tectona grandis</i> L.f., <i>Vitex negundo</i> L., <i>Gmelina arborea</i> Roxb., <i>Phyla nodiflora</i> (L.) E.E. Greene, <i>Verbena officinalis</i> L. |
| 60. | Lamiaceae | <i>Anisomalis indica</i> (L.) O. Kuntze., <i>A. heyneana</i> Benth., <i>Leonotis nepetifolia</i> (L.) R.Br., <i>Leucas aspera</i> (Willd.) Link, <i>L. urticaefolia</i> (Vah.) R.Br., <i>Ocimum canum</i> Suns, <i>O. gratissimum</i> L., <i>O. tenuiflorum</i> L., <i>Pogostemon pubescens</i> Benth, <i>Majorana hortensis</i> (Tourn) Rupp., <i>Mentha spicata</i> L., <i>Hyptis suaveolens</i> (L.) Poit. |
| 61. | Nyctaginaceae | <i>Boerhaavia diffusa</i> L., <i>B. erecta</i> L., <i>Commicarpus chinensis</i> (L.) Heimerl, <i>Mirabilis jalapa</i> L. |
| 62. | Amaranthaceae | <i>Achyranthes aspera</i> L., <i>Aerva lanata</i> (L.) Juss. ex Schult., <i>A. sanguinolenta</i> (L.) Blume, <i>Alternanthera sessilis</i> (L.) R.Br. ex DC., <i>Amaranthus hybridus</i> L. Mal, <i>A. spinosus</i> L., <i>Celosia argentea</i> L., <i>Digera muricata</i> (L.) Mart, <i>Pupalia lappacea</i> (L.) Juss. |
| 63. | Chenopodiaceae | <i>Chenopodium album</i> L., <i>C. ambrosioides</i> L., <i>C. murale</i> L. |
| 64. | Polygonaceae | <i>Polygonum plebeium</i> var. <i>diffusa</i> (Meissn) Hook. f., <i>P. barbatum</i> L., <i>Rumex dentatus</i> L. |
| 65. | Loranthaceae | <i>Dendrophthoe falcata</i> (L.f.) Etting, <i>Viscum articulatum</i> Burm f. |
| 66. | Euphorbiaceae | <i>Acalypha indica</i> L., <i>Baliospermum montanum</i> (Willd.) Muell. Arg., <i>Bridelia retusa</i> (L.) Spreng, <i>Chrozophora rotteieri</i> (Geis.) A. Juss. ex Spreng, <i>Croton berplandianum</i> Baill., <i>Putranjiva roxburghii</i> (Wall) Hurusawa, <i>Euphorbia fusiformis</i> Busch. Ham, <i>E. hirta</i> L., <i>E. thymifolia</i> L., <i>E. geniculata</i> Ort, <i>Jatropha gossypifolia</i> L., <i>Kirganelia reticulata</i> (Poir) Baill, <i>Mallotus philippensis</i> (Lam.) Muell. Arg., <i>Phyllanthus emblica</i> L., <i>P. fraternus</i> Webster, <i>P. virgatus</i> Forst. f., <i>Pedilanthus tithymaloides</i> (L.) Poir, <i>Ricinus communis</i> L., <i>Securinega leucopyrus</i> (Willd.) Muell. Arg., <i>S. virosa</i> (Roxb. ex Willd.) Baillon |
| 67. | Ulmaceae | <i>Holoptelea integrifolia</i> (Roxb.) Planch. |
| 68. | Cannabinaceae | <i>Cannabis sativa</i> L. |
| 69. | Moraceae | <i>Ficus amplissima</i> Smith, <i>F. arnottiana</i> Miq., <i>F. benghalensis</i> L., <i>F. hispida</i> L.f., <i>F. racemosa</i> L. |
| 70. | Urticaceae | <i>Girardinia zeylanica</i> Decne |
| 71. | Salicaceae | <i>Salix tetrasperma</i> Roxb. |

Table 3. Monocot Flora of various 'nals' of Phulwari Wildlife Sanctuary

| S. No. | Family | Species Recorded |
|--------|------------------|--|
| 1. | Hydrocharitaceae | <i>Hydrilla verticillata</i> (L.f.) Royle, <i>Nechamandra alternifolia</i> (Roxb.) Thwaites, <i>Ottelia alesmoides</i> (L.) Pers., <i>Valisneria spiralis</i> L. |
| 2. | Orchidaceae | <i>Aerides crispum</i> Lindl., <i>A. maculosum</i> Lindl., <i>Eulophia ochreata</i> Lindl., <i>Habenaria longicorniculata</i> Grah., <i>H. furcifera</i> Lindl., <i>H. planlaginea</i> Lindl., <i>Vanda tessellata</i> (Roxb.) Hook. ex G. Don, <i>Nervilia aragoona</i> Gaud. <i>Acampe praemorsa</i> (Roxb.) Blatt. & Mc.C., <i>Peristyles constrictus</i> (Lindl.) Lindl. |
| 3. | Zingiberaceae | <i>Curcuma indora</i> Blatt, <i>C. pseudomontana</i> Grah., <i>Zingiber officinale</i> Rosc., <i>Costus speciosus</i> Smith |
| 4. | Musaceæ | <i>Ensete superbum</i> (Roxb.) Cheesman |
| 5. | Amaryllidaceae | <i>Crinum latifolium</i> Linn. |
| 6. | Hypoxidaceae | <i>Curculigo orchoides</i> Gaerin |
| 7. | Taccaceae | <i>Tacca leontopetaloides</i> (L.) O. Ktze |
| 8. | Dioscoreaceae | <i>Dioscoreo bulbifera</i> L., <i>D. hispida</i> Dennstedt, <i>D. pentaphylla</i> L. |
| 9. | Liliaceae | <i>Aloe vera</i> (L.) Burm. f., <i>Asparagus racemosus</i> Willd. <i>Chlorophytum borivilliamum</i> Sant. ex. Fern., <i>C. tuberosum</i> (Roxb.) Baker, <i>Dipcadi serotinum</i> (L.) Medik, <i>Gloriosa superba</i> L. |
| 10. | Pantederiaceae | <i>Monochoria hastata</i> (L.) Solams |
| 11. | Commelinaceae | <i>Commelina benghalensis</i> L., <i>C. forsskalaei</i> Vahl., <i>Cyanotis cristata</i> (L.) D. Don, <i>C. fasciculata</i> (Heyne ex Roth) Schult, <i>Murdannia nudiflora</i> (L.) Brenan |
| 12. | Arecaceae | <i>Phoenix sylvestris</i> (L.) Roxb. |
| 13. | Typhaceae | <i>Typha angustata</i> Bory & Chaub |
| 14. | Araceae | <i>Arisaema tortuosum</i> (Wall) Schott, <i>Colocasia esculantus</i> (L.) Schott., <i>Sauromatum pedatum</i> (Willd.) Schott. |
| 15. | Lemnaceae | <i>Lemna minor</i> L., <i>Spirodela polyrhiza</i> (L.) Schleid., <i>Wolffia arrhiza</i> (L.) Horkel ex Wimmer |
| 16. | Aponogetonaceae | <i>Aponogeton natans</i> (L. Engle & Krause) |
| 17. | Potamogetonaceae | <i>Potamogeton pectinatus</i> L., <i>P. nodosus</i> Poir |
| 18. | Najadaceae | <i>Najas graminea</i> Del. |

| | | |
|-----|------------|---|
| 19. | Cyperaceae | <i>Cyperus alopecuroides</i> Rottb., <i>C. alutatus</i> Kern, <i>C. compressus</i> L., <i>C. corymbosus</i> Rottb., <i>C. difformis</i> L., <i>C. etaltatus</i> Retz., <i>C. unbricatus</i> Retz., <i>C. iria</i> L., <i>C. laevigatus</i> L., <i>C. pulchellus</i> R. Br., <i>C. pygmaeus</i> Rottb., <i>C. rotundus</i> L., <i>C. tuberosus</i> Rottb., <i>Eleocharis geniculata</i> (L.) Roem, <i>E. atropurpurea</i> Retz. Presl, <i>Eriophorum comosum</i> (Wall.) Wall ex Clarke, <i>Fimbristylis bisumbellata</i> (Forsk.) Bulani, <i>F. feruginea</i> (L.) Vahl, <i>F. miliacea</i> (L.) Vahl, <i>F. schoenoides</i> (Retz.) Vahl, <i>F. sieberiana</i> Kunth, <i>Kyllinga bulbosa</i> Beaur., <i>Marisus cyperoides</i> (Roxb.) A. dietr., <i>Pycneus pumilus</i> (L.) Nees ex Clarke <i>Schoenoplectus littoralis</i> (Schrad.) Palla |
| 20. | Poaceae | <i>Alloteropsis cimicina</i> (L.) Stapf, <i>Andropogon pumilus</i> Roxb., <i>Apluda mutica</i> L., <i>Aristida adscensionis</i> L., <i>A. hystrix</i> L.f., <i>Anthraxon hispidus</i> (Thunb.) Makina, <i>A. lanceolatus</i> (Roxb.) Hochst., <i>A. lancifolius</i> (Trin.) Hochst., <i>Bothriochloa blandhii</i> (Retz.) S.T. Blake, <i>Brachiaria deflexa</i> (Schumach) C. E. Hubbart ex Robyns, <i>B. eruciformis</i> (J. E. Smith) Griseb., <i>B. ramosa</i> (L.) Stapf, <i>Chloris dolichostachya</i> Lag., <i>C. virgata</i> Sw, <i>Chrysopogon fulvus</i> (Spreng.) Chiov, <i>Coix lacryma-jobi</i> L., <i>Cymbopogon martinii</i> (Roxb.) Watson, <i>Cynodon dactylon</i> (L.) Pers., <i>Dactyloctenium aegypticum</i> (L.) Willd., <i>Dendrocalamus strictus</i> (Roxb.) Nees, <i>Desmostachya bipinnata</i> (L.) Stapf, <i>Dichanthium annulatum</i> (Forsk.) Stapf., <i>D. foveolatum</i> (Del) Robertly, <i>D. huegellii</i> (Hack) Jain & Deshpande, <i>D. pertusum</i> (L.) Clayton, <i>Digitaria ciliaris</i> (Retz.) Koel, <i>D. stricta</i> Roth ex Roem, <i>Echinochloa colona</i> (L.) Link, <i>E. crus-galli</i> (L.) Beauv., <i>Eragrostis ciliaris</i> (L.) R. Br., <i>E. minor</i> Host, <i>E. tenella</i> (L.) P. Beauv., <i>Heteropogon contortus</i> (L.) P. Beauv., <i>Hygrorhiza aristata</i> (Retz.) Nees ex Wight of Arn., <i>Oryza sativa</i> L., <i>Oropetium thomaeum</i> (L.f.) Trin., <i>Melanocenchrис jacquemontii</i> Jaub. X Spach., <i>Panicum miliaceum</i> L., <i>P. paludosum</i> Roxb., <i>P. walense</i> Mez. <i>Paspalidium flavidum</i> (Retz.) A. Camus, <i>P. geminatum</i> (Forsk.) Stapf., <i>Paspalum paspaloides</i> (Michaux) Scribner, <i>P. vaginatum</i> Swartz., <i>Pennisetum hordeoides</i> (Lam.) Steud, <i>P. pedicellatum</i> Trin., <i>Phragmites karka</i> (Retz.) Trin. ex Steud., <i>Saccharum spontaneum</i> L. Mant, <i>Sehima nervosum</i> (Rottl.) Stapf., <i>Setaria geniculata</i> (Lam.) P. Beauv., <i>S. italica</i> (L.) P. Beauv., <i>S. intermedia</i> Roem & Schult, <i>S. pumila</i> (Poir) Roem, <i>Sorghum bicolor</i> (L.) Moench, <i>S. halepense</i> (L.) Pers, <i>Sporobolus diander</i> (Retz.) P. Beauv., <i>S. tenuissimus</i> |

Above Tables reveal that *nals* are rich in floral diversity. As many as 441 species were recorded from various *nals* (Table 4). The synoptical analysis of various taxa of *nals* is following:

Table 4. Synoptical analysis of the flora of various 'nals' of Phulwari Wildlife Sanctuary

| Taxa | Dicot | Monocot | Total |
|----------|-------|---------|-------|
| Families | 71 | 20 | 91 |
| Genera | 237 | 86 | 323 |
| Species | 315 | 126 | 441 |

Nals of Phulwari sanctuary support many interesting species. The vertical cliffs of waterfalls and springs support luxuriant growth of *Ensete superbum*, the wild plantain. This is a monocarpic species, which presents a picturesque scene during monsoon period. *Syzygium heyneanum* is a common tree of Phulwari ki nal sanctuary. This is an evergreen species which makes pure stand along the banks of the streams. *Nals* are rich in *Ficus spp.* also. *Ficus recemosa* is quite common in many *nals*. *Ficus hispida* can be seen in patches here and there along the moist banks of the streams. *Ficus arnottina* grows on cliffs of high hills, along the streams.

Water regime is not equal in all the *nals*. Some have seasonal streams, some semi-perennial while certain have perennials streams. *Nals* with good water regimes support growth of *Tamarix ericoides*, *Bergia ammannioides*, *Hiptage bengalensis*, *Toona ciliata*, *Dalbergia volubilis*, *Flemingia bracteata* and *Terminalia arjuna*.

REFERENCES

- Bhatnagar, R., K. S. Gupta and S. K. Sharma. 2003. Management Plan of Phulwari Wildlife Sanctuary (For year 2003-04 to 2012-13), pp. 1-206, Deptt. of Forest, Rajasthan.
- Champion, H. G. and S. K. Seth. 1968. A Revised Survey of the Forest Types of India. Govt. of India, Pp. 1-404.
- Sharma, S. K. 1995a. Presence of Common Green Whip Snake *Ahaetulla nasutus* at "Phulwari Ki Nal" Wildlife Sanctuary in Rajasthan. Journal of Bombay Natural History Society 92(1): 127.
- Sharma, S. K. 1995b. Amphibians of Phulwari-ki-Nal Wildlife Sanctuary. Journal of Bombay Natural History Society 92(2): 271-72.
- Sharma, S. K. 1996. Presence of Wild Plantain (*Ensete superbum*) in Rajasthan. Journal of Bombay Natural History Society 93(2): 322-23.
- Sharma, S. K. 1999. Tuberous plants of Sitamata, Phulwari and Sajjangarh Sanctuaries. Vijnana Parishad Anusandhan Patrika 42(4): 277-285.
- Sharma, S. K. 2001. New record of *Nervilia aragoana* in Rajasthan. Journal of Bombay Natural History Society 98(3): 493.
- Sharma, S. K. (2001). Distribution of Wild Plantain (*Ensete superbum*) in Rajasthan. Indian Journal of Environmental Science 5(1): 97-100.
- Sharma, S. K. 2003. Orchid flora of Phulwari Wildlife Sanctuary, Udaipur District, Rajasthan. Zoos' Print Journal 18(10): 1227-28.
- Sharma, S. K. 2005. Presence of Indian Palm Squirrel *Funambulus palmarum* L. in southern Aravallis. Zoos' Print Journal 20(6): 1908-9.
- Shetty, B. V. and V. Singh. 1987, 1991, 1993. Flora of Rajasthan, Vol. I, II & III Botanical Survey of India, pp. 1-1246.
- Tehsin, R. H. 1980. Occurrence of the Large Brown Flying Squirrel and Mouse Deer near Udaipur, Rajasthan. Journal of Bombay Natural History Society 77(3): 498.