

Results

RESULTS

The major objective of the study was to prepare a digital database of herbaceous community of Baroda and environs. The model of database prepared is illustrated in the concluding section of result. Sampling study was conducted in various regions of the study area based on the level of disturbances for three years (2001-2003). The results obtained from the sample study are described separately for each site. The periodic changes in the importance value index of the species documented in the sampling quadrates at each sites are presented in tabular form for all the three years of the study. Variations noted in the vegetation composition and growth pattern is presented in separate headings. Diversity richness and evenness of each community sampled is calculated by diversity indices & cluster analysis and the comparative values obtained are presented in a tabular format. Variation observed in phenotypic plasticity between the two regions is also portrayed. The results explain the overall comparison in the herbaceous community structure due to the levels of anthropogenic pressures amongst the region of Baroda and Savli. The metapopulation structure of the herbaceous plant community is represented from the values of frequency and average no of individuals per sub population of herbaceous community obtained from the sampled plots. Major associations of plants found growing in the study regions are represented with their distribution habitats. Comparison of current data with the previously documented data of the years 1967 and 1980 for Baroda region and for 1973 of Savli region highlights the shifts in density and reproductive duration of herbaceous vegetation.

The sampling sites at Baroda and Savli regions were selected based on the levels of disturbance pertaining to anthropogenic pressures, pollutions and land fragmentation.

Site 1 Nandesari

The area of Nandesari situated in the North-West of Baroda region is a ravine area surrounded by heavy chemical industry. The area is highly fragmented and faces high pressures of grazing and human interference activities. Moreover, the sampling area is fragmented into two parts (left and right) by the highway bridge and residential area of the local tribal. The sample study was initiated in the third week of July in the year 2001. The IVI values of the sampled plots for the year 2001 is given in (Table 3a). Sampled plots were laid on the left side of the region. The sampled plots were laid randomly taking into consideration the fragmentation levels of the area. During the first year of study, 38 herbaceous plant species were recorded from the sampled plots. The dominants amongst those were *Xanthium strumarium*, *Cassia tora*, *Tephrosia purpurea*, *Crotalaria medicaginea*, *Cynodon dactylon* and *Echinochloa colonum*. The plants with moderate density were *Indigofera cordifolia*, *Hedyotis corymbosa*, *Achyranthes aspera*, *Dactyloctenium aegyptium*, *Tridax procumbens*, *Cassia occidentalis*, *Commelina nudiflora*, *Croton bonplandianum*, *Indigofera linnaei*, etc. and the plants with low density were *Spermacoce articularis* and *Ocimum gratissimum*. During the initial stages, the density in seedling stages of plants namely *Xanthium strumarium*, *Cassia tora*, *Tephrosia purpurea*, *Crotalaria medicaginea*, *Hedyotis corymbosa*, *Commelina nudiflora*, *Croton bonplandianum*, was high which gradually got reduced (17-23%) and stabilized by the month of September. The density of plants namely *Crotalaria hebecarpa*, *Trichodesma indicum*, *Teramnus labialis*, *Polygala erioptera*, *Sida acuta*, *Ocimum gratissimum*, *Launaea procumbens*, *Pergularia daemia*, *Ipomoea pes-tigridis*, etc. was moderate during their seedling stage and did not show much fluctuation till their establishment. Reduction of (9-12%) in the density was observed until stabilization. By the second week of August, plants like *Justicia diffusa* and *Spermacoce articularis* emerged in their seedling stage. The density was quite high which gradually decreased (11-17%) and was stabilized in second week

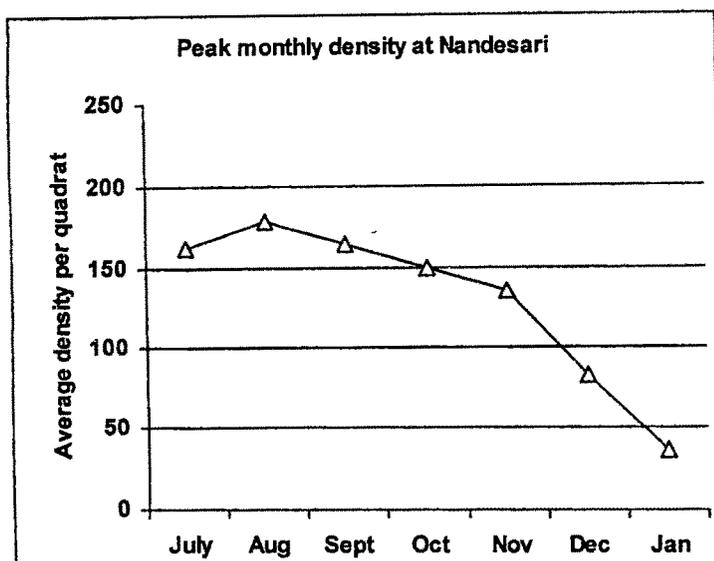
of September. The post monsoon herbs were *Blumea obliqua* and *Blumea lacera* documented in the sampled plots, which came up in the month of October. Flowering of early monsoon emergents was observed during the first week of August and flowering of late emergents was observed in the second week of September. The termination of life cycle of the annuals begun from the month of November and extended upto January where plants namely *Spermacoce articularis*, was first to leave the community by terminating the life cycle. Other plants slowly showed reduction in their densities from the month of November onwards and ended their life cycle by the month of January. Post monsoon herbs (*Blumea*) reached their reproductive stage by the month of January. Sampling study was terminated in the month of January.

During the first year of field survey, a variation in community structure and species diversity was noticed in the right side of the area. Hence, four quadrats were shifted to the right side of the area for the following of study years (2002 and 2003). The plots were kept as permanent for both the years 47 species were recorded in the sampled plots during the second and third year of study. By shifting the sampled plots to the right side of the area, an addition of species namely *Hyptis suaveolens*, *Pavonia zeylanica*, *Physalis minima*, *Sida cordifolia*, *Dalechampia scandens* var. *cordofana*, etc. was noted. The detailed IVI values of the species recorded in the year 2002 is given in (Table 3b).

Compared to the study of the first year, no significant variation was noted in the community structure. The phenological pattern of the species recorded in the second year of study showed similar pattern to that of first year. The newly recorded species showed low density. The sampling in the third year (2003) of the study tenure began by the third week of July. A variation was noted in the density of few species compared to that of first two years *Crotalaria medicaginea* showed a hike in the density status and a decline in the density of *Xanthium strumarium* and *Cassia tora* was noted. The details of IVI values is given in the (Table 3c). No variation was noted in the phenological cycle of the documented species compared to the records of first and second year of the study. Comparative IVI values for the three years of study is given in (Table 3d). The comparative values for all the three years is chosen from the stage when stabilization in the community was attained.

Fig (B) shows the peak monthly density. Similar pattern was noted for the three years of the study. The peak density was attained in the month of August.

Fig (B) - Peak monthly density at Nandesari



Site 2 IPCL

The herbaceous vegetation in the IPCL area was found growing underneath the canopy of the tree species namely *Acacia nilotica*, *Azadirachta indica*, *Ailanthus excelsa*, *Bauhinia racemose*, *Peltophorum pterocarpum*, *Pithecellobium dulce*, *Samanea saman*. The dominating tree species of the community was *Acacia nilotica*. The vegetation of the area was interfered by the industrial pollution and high grazing and human interference pressures.

Sampling study in the year 2001 was initiated from last week of July. The sampled plots were laid randomly and permanent marks were kept in the near by trees. During the first year of study, 28 herbaceous species were recorded in the sampled plots. The IVI values of the documented species is given in (Table 4a). Most dominant among those was *Elytraria acaulis*. Plants viz. *Echinochloa colonum*, *Cenchrus biflorus*, *Evolvulus nummularius*, *Crotalaria medicaginea*, etc. existed in higher densities. The plants with moderate density were *Commelina nudiflora*, *Hedyotis corymbosa*, *Lindernia ciliata*,

Cynodon dactylon, *Lindernia oppositifolia*, *Cassia tora*, *Acalypha indica*, etc and the plants with low density recorded were *Boerhavia diffusa*, *Desmodium triflorum*, *Triumfetta rhomboidea*, *Digera muricata*, *Sida rhombifolia*, etc. The density status in seedling stages of dominating plants were high, which gradually got reduced and stabilized by the month of mid August 18-22% decline in the densities of dominant species was noted until stabilization. The plants namely *Boerhavia diffusa*, *Digera muricata*, *Triumfetta rhomboidea*, *Desmodium triflorum*, *Boerhavia diffusa*, *Achyranthes aspera*, etc. did not show much fluctuation in their density status (7-10%) until their establishment. By the second week August, the late emergents like *Lindernia ciliata*, *Lindernia oppositifolia* emerged in their seedling stage. The stabilization was attained in the second week of September by showing 11-15% reduction in the density. The reproductive period of early arrivals initiated from August onwards and of late arrivals was initiated from the month of September onwards. The termination of life cycle of the annuals begun from the month of November to January where the plants namely, *Lindernia ciliata*, *Lindernia oppositifolia* were amongst the first to leave the community by terminating their life cycle. Other plants slowly showed gradual reduction in the density from November and ended the life cycle by January.

The study was repeated for the years 2002 and 2003 to look for the changes coming in the community structure. The marked quadrat area in the year 2001 was maintained for the years 2002-2003. The sampling study was begun in the last week of July. Similar pattern in the community structure was observed for the year 2002. IVI values for the year 2002 is given in (Table 4b). The phenological pattern also showed similarity as seen in the previous year of the study. A rise in the densities of *Cassia tora*, *Eragrostis pilosa*, *Oplismenus burmannii*, *Crotalaria medicaginea*, *Lindernia oppositifolia* and *Boerhavia diffusa* and a decline in the densities of *Echinochloa colonum*, *Cenchrus biflorus*, *Evolvulus nummularia*, *Teramnus labialis*, *Commelina nudiflora*, *Blepharis maderaspatensis* was noted in the year 2002.

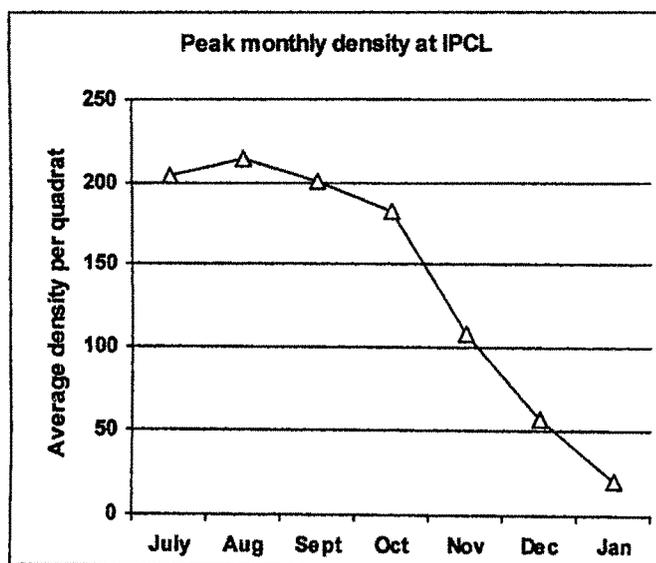
The third year (2003) sampling was initiated in late July. The sampling study was terminated in the month of September as high rainfall in the first week of September resulted in water logging throughout the area that lasted until second week of November after which, the entire area became barren except

for the presence of few Poaceae members and few members of *Elytraria acaulis*. The seedlings of *Acacia nilotica* started growing luxuriantly.

Comparative IVI values for the years 2001 and 2002 is given in (Table 4c).

Fig (C) shows the peak monthly density. Similar pattern was noted for the both the years of sample study. The peak density was attained in the month of August.

Fig (C) -Peak monthly density at IPCL



Site 3 Laxmi Vilas Palace (LVP)

The site of Laxmi Vilas Palace is situated in the heart of Baroda city. The area being personal property Gaekwad (formal ruling authority of Baroda), interference of human and grazing impact is at low scale. The area is fragmentation by a number of small constructions in form of temples, offices, small palaces, etc. at number of places. The major disturbance faced is of frequent clearing of vegetation by palace authority for security purpose.

The first year sample study was initiated from second week of July. IVI values for the year 2001 is given in the (Table 5a). The sampled plots were laid randomly taking into consideration the fragmentation levels of the area. During the first year of study, 43 herbaceous plant species were recorded in the sampled plots. The dominants among those were *Achyranthes aspera*, *Tephrosia purpurea*, *Cenchrus ciliaris*, *Echinochloa colonum*, *Commelina nudiflora*, *Indigofera cordifolia*, *Crotalaria medicaginea*, *Crotalaria hebecarpa*, *Sida acuta*, *Synedrella nodiflora*, *Parthenium hysterophorus*, *Euphorbia hirta*, *Cynadon dactylon*, *Alysicarpus monilifer*, *Commelina benghalensis*, *Indigofera linnaei*, and *Tridax procumbens*. The plants with moderate density were *Sida cordifolia*, *Dactyloctenium aegyptium*, *Hedyotis corymbosa*, *Corchorus aestuans*, *Boerhavia diffusa*, *Cymbopogon martini*, *Setaria verticillata*, *Rhynchosia minima*, *Phyllanthus amarus*, *Trianthema portulacastrum*, *Eragrostis ciliaris*, *Dipteracanthus prostratus*, *Cleome viscosa*, *Ipomoea pes-tigridis*, and *Acalypha indica* and the plants with low density were *Kyllinga tenuifolia*, *Alternanthera sessilis*, *Polygala erioptera*, *Sida rhombifolia*, *Elytraria acaulis*, *Triumfetta rotundifolia*, *Abutilon indicum*, *Trichosanthes cucumerina* and *Spermacoce articularis*. A gradual increase (7-9%) in the density of dominating plants was seen until their stabilization whereas a decline (9-12%) in density of plant with moderate density was observed until their stabilization. The seedlings of late monsoon emergent *Spermacoce articularis* were observed in the second week of August with low density. The post monsoon herbs were *Blumea mollis* and *Blumea lacera* documented in the sampled plots, which came up in the month of October. Flowering of early emergents was observed during August and flowering of late emergents was observed in the first week of September. The termination of life cycle of the annuals begun from December extended up to February where the late emergent namely



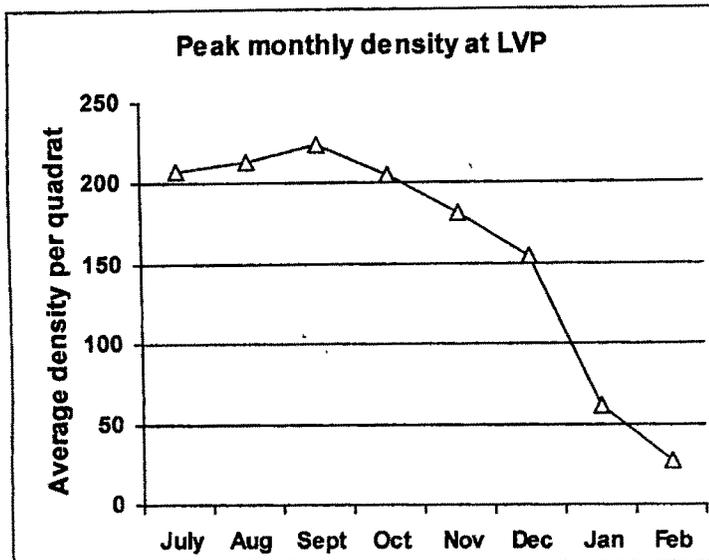
Spermacoce articulata, was first to leave the community by terminating the life cycle. Other plants slowly showed reduction in the density from November and ended the life cycle by the month of February except the post monsoon emergent which second week of December reached the reproductive stage. The sampling study was terminated by the February. Because of disturbances of vegetation clearing, few sampled plots were shifted during the mid way of the study. This has shown fluctuation in the density status of species namely *Synedrella nodiflora*, *Crotalaria hebecarpa*, *Indigofera cordifolia*, *Sida acuta*, etc. A restriction was enforced in the year 2001 (the study area is a private property) which resulted in minimizing the area of study.

The study was repeated for the year 2002 to look for the changes coming in the community structure. Care was taken to ensure easy accessibility of the study area. The area chosen was devoid of any kind of disturbance. Shifting of sampling plots resulted in the addition of species namely *Alysicarpus hamosus*, *Hibiscus lobatus*, *Indigofera astragalina*, *Rungia pectinata*, *Tephrosia strigosa*, *Cassia pumila*, *Sclerocarpus africanus*, *Bidens biternata*, *Lindernia oppositifolia*, *Lindernia ciliata*, *Clitoria biflora*, *Cassia absus*, *Blainvillea acmella*. Densities of these species were low with distribution. Species viz. *Triumfetta rotundifolia*, *Abutilon indicum*, *Trichosanthes cucumerina* that were located during the first year of study tenure were not present in the sampled plots because of shifting of quadrates to new localities. The detailed IVI values of the species recorded in the year 2002 is given in (Table 5b).

Compared to the study of the first year, no significant variation was noted in the community structure. The phenological pattern of the species recorded in the second year of study showed similar pattern to that of first year. The dominance of the species also showed same pattern to that of first year in the newly sampled localities with few fluctuations. Comparative IVI values for the years 2001 and 2002 is given in (Table 5c). In 2003, the sample area was converted into a Golf course. Hence sampling was not done.

Fig (D) shows the peak monthly density. Similar pattern was noted both the years of the sample study. The peak density was attained in the month of September.

Fig (D) - Peak monthly density at LVP



Site 4 Timbi

Interference by humans, grazing pressures, vehicular & industrial pollution is negligible at Timbi site. The area is irrigation pond surrounded by agricultural fields. Sampling at Timbi site was initiated in the second week of July in the year 2001. Ten quadrats were laid randomly on the bank. Quadrats were marked permanently. 57 species were noted in the sampled plots. Species viz. *Phyla nodiflora* Greene, *Heliotropium supinum*, *Coldenia procumbens*, *Merremia emarginata*, *Cynadon dactylon*, *Brachiaria ramosa* and *Cenchrus ciliaris* were seen growing in high density. Species viz. *Euphorbia microphylla*, *Enicostema axillare*, *Paspalidium flavidum*, *Evolvulus nummularis*, *Gomphrena celosioides*, *Ipomoea aquatica*, *Eclipta alba*, *Justicia diffusa* etc. were seen growing with moderate density. Plants namely *Phyllanthus simplex*, *Sarcostemma secamone*, *Alysicarpus longifolius*, *Euphorbia hypericifolia*, *Vigna trilobata*, *Grangea maderaspatana*, *Glinus oppositifolius*, *Cressa cretica*, *Verbascum chinensis*, *Cyperus difformis*, *Polygala arvensis*, *Bergia ammannioides*, etc. were seen growing with low density in the area. The IVI details for year 2001 are given in (Table 6a). The plant species namely

Heliotropium supinum, *Coldenia procumbens*, *Enicostema axillare*, *Gomphrena celosioides*, *Glinus oppositifolius*, *Cressa cretica*, *Verbascum chinensis*, *Glinus lotoides*, *Chrozophora prostrata*, *Dentella repens*, *Cleome chelidonii*, *Bergia ammannioides* were seen established in the area before the arrival of monsoon. The late emergent species were *Alysicarpus longifolius*, *Spermacoce articularis*, *Polygala arvensis*, *Spermacoce pusilla* which emerged in the first week of August. The reproductive phase of the early emergents started from July onwards.

A pattern of zonation was observed amongst the species growing in the pond area. The slope of the bank was 10-12 m wide. The bank of the pond can be divided into three portions: upper middle and lower. Species namely *Cleome chelidonii*, *Phyllanthus simplex*, *Dentella repens*, were seen occupied in the lower region of the slope area. Species namely *Polygala arvensis*, *Sarcostemma secamone*, *Desmodium triflorum*, *Glinus lotoides*, *Glinus oppositifolius*, *Vignatrilobus*, were seen occupied in the middle area of the bank slope. Whereas species viz. *Phyla nodiflora*, *Heliotropium supinum*, *Coldenia procumbens*, *Merremia emarginata*, *Cynadon dactylon*, *Brachiaria ramosa*, *Cenchrus ciliaris*, *Dinebra retroflexa* etc were seen spread in the entire area of the bank slope. Species like *Enicostema axillare*, *Alysicarpus longifolius*, *Gomphrena celosioides*, *Cressa cretica*, etc. were seen occupied in the upper portion of the bank slope. Species namely *Ipomoea aquatica*, *Portulaca oleracea*, were seen occupied in the middle and lower portion of the bank slope area. Species namely *Hedyotis corymbosa*, *Sida acuta*, *Justicia diffusa*, *Launaea procumbens*, *Parthenium hysterophorus*, *Commelina benghalensis*, *Alysicarpus hamosus*, *Alysicarpus monilifer*, *Tridax procumbens*, *Euphorbia hypericifolia*, etc. were seen occupied in the middle and upper zone of the bank slope.

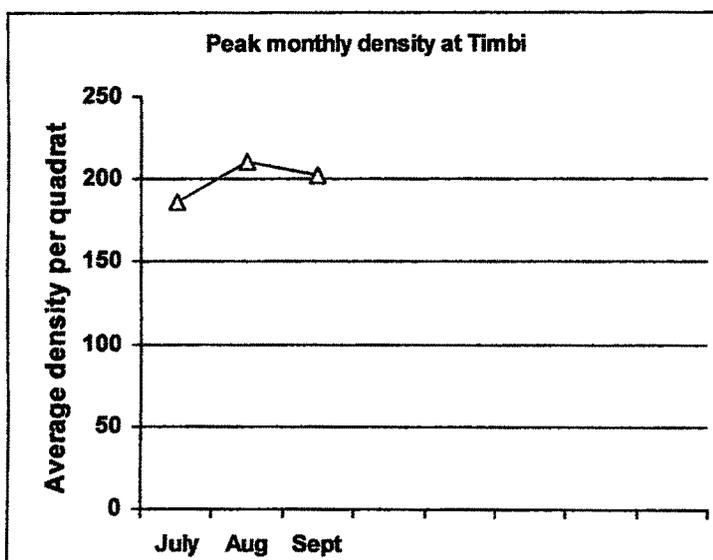
In the month of September the heavy rains resulted in drowning the major part (80%) of the sampled area. The area remained under water until November. Hence the quadrat study was terminated during this phase of the season.

The study was repeated for the years 2002 and 2003. Sampling area was the same for the years 2002 and 2003. No change in the community structure and zonation compared to the previous year of study was observed. Fluctuation in the density structure in few plant species was noticed in the area but which was

not very prominent. The sample study for the years 2002 and 2003 was also terminated in the month of September. Details of IVI value for the years 2002 and 2003 is given in (Table 6b & 6c). Comparative IVI values for years 2002-2003 is given in (Table 6d).

Fig (E) shows the peak monthly density. Similar pattern was noted for the three years of the study. The peak density was attained in the month of August.

Fig (E) -Peak monthly density at Timbi



Site 5 Mevli

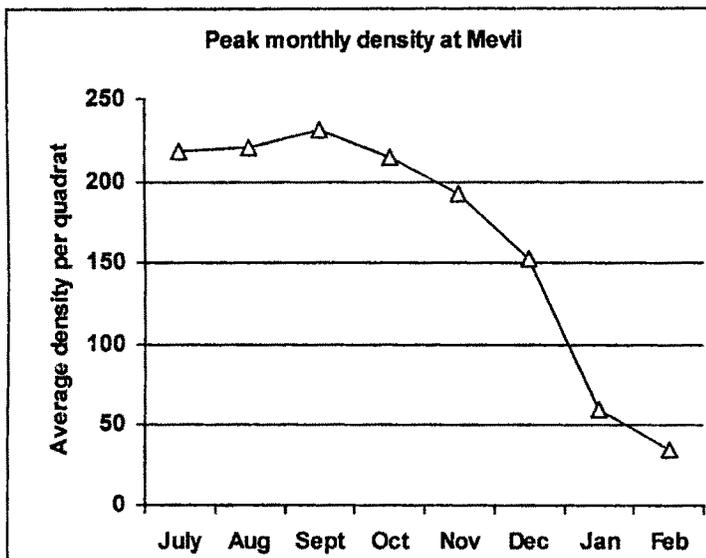
Site at Mevli is ravine area formed by river Kerad in the Savli region. The area is surrounded by agricultural fields with low interference of grazing pressures and a very minimum pressure of vehicular and industrial pollution. The sample study for year 2001 was initiated in the second week July. The IVI values of the sampled plots for the year 2001 is given in (Table 7a). During the first year of study, 60 herbaceous plant species were recorded in the sampled plots. The dominants amongst those were *Cassia tora*, *Tephrosia purpurea*, *Crotalaria medicaginea*, *Commelina nudiflora* and *Cynodon dactylon*. The plants with moderate density were *Lindernia oppositifolia*, *Eragrostis ciliaris*, *Convolvulus prostratus*, *Cassia occidentalis*, *Chloris barbata*, *Oplismenus burmanii*, *Commelina benghalensis*, *Hedyotis corymbosa*, etc. and the plants with low density were *Indigofera astragalina*, *Sida rhombifolia*, *Alysicarpus monilifer*, *Pupalia lappacea*, *Hibiscus ovalifolius*, *Ocimum gratissimum*, *Tephrosia villosa*, *Desmodium triflorum*, *Solanum indicum*, *Solanum nigrum*, *Abutilon indicum* etc. The density of dominant species did not show much fluctuation until their stabilization. An increase (4-6%) in the density of dominant species was observed until stabilization. Whereas the density of the species with moderate number of members showed gradual decline (9-16%) in their densities until their stability. In the second week of August, species viz. *Spermacoce pusilla*, *Cassia pumila*, *Elytraria acaulis*, *Spermacoce articularis*, arrived. By the month of September, the late monsoon emergent like *Justicia diffusa*, *Lindernia oppositifolia*, *Rungia pectinata*, *Lindernia ciliata*, *Blepharis maderaspatensis*, emerged in their seedling stage. The post monsoon herbs were *Sphaeranthus indicus*, and *Blumea lacera* documented in the sampled plots, which came up in the month of October. Flowering of early emergents was observed during first week of August and flowering of late emergent was observed in September month. The termination of life cycle of the annuals begun from the month of December onwards continued upto the end February. The sampling study was terminated by February.

The study was repeated for the years 2002 and 2003 to look for the changes coming in the community structure. Sampling area was the same for the years 2002 and 2003. IVI details for the years 2002 and 2003 are given in (Table 7b & 7c) respectively. The phenological pattern of the species recorded in the

second year (2002) of study showed similar pattern to that of first year. Rise in the density of species viz. *Evolvulus alsinoides*, *Hedyotis corymbosa* and *Sida acuta* and a decline in the density of species viz. *Lindernia oppositifolia*, *Elytraria acaulis*, and *Tephrosia strigosa* was noted compared to the first year's study. The sampling in the third year (2003) of the study tenure was initiated in the last week of July. A variation was noted in the density of few species compared to that of first two years. An increase in the density status of species viz. *Crotalaria medicaginea*, *Cynadon dactylon*, *Convolvulus prostratus*, *Eragrostis ciliaris*, and *Cassia occidentalis*, and a decline in the density of *Cassia tora*, *Tephrosia purpurea*, *Lindernia oppositifolia*, *Commelina nudiflora*, *Spermacoce pusilla*, and *Crotalaria hebecarpa* was noted. The comparative IVI values for the years 2001-2003 is given in (Table 7d). No variation was noted in the phenological cycle of the documented species compared to the records of first and second year of the study.

Fig (F) shows the peak monthly density. Similar pattern was noted for the three years of the study. The peak density was attained in the month of September.

Fig (F) - Peak monthly density at Mevii



Site 6 Goral

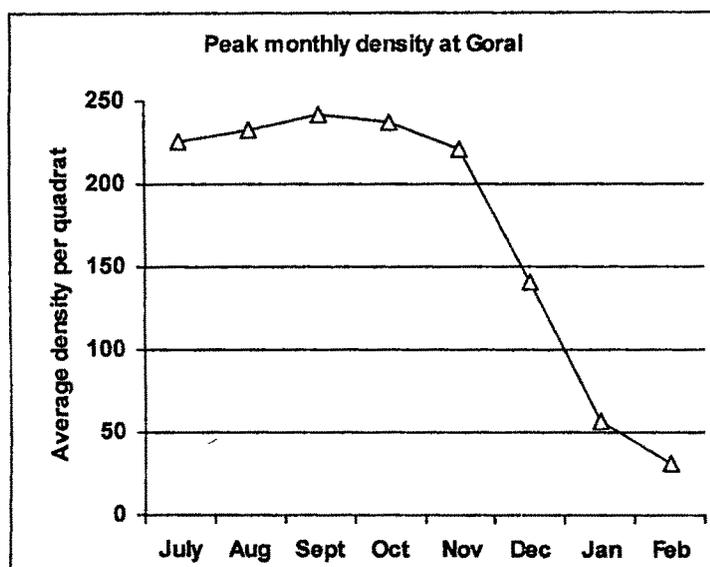
Site at Goral is open land with few undulations situated in the Savli region. There is absence of any major vehicular traffic activity or any small scale industry in the radius of approximately 7km from the area. Grazing and human interference is also very minimum scale. The area is surrounded by agricultural fields. Sampling in the year 2001 was initiated by July end. The IVI values of the sampled plots for the year 2001 is given in (Table 8a). During the first year of study, 67 herbaceous plant species were recorded in the sampled plots. The dominants amongst those were *Crotalaria medicaginea*, *Cassia tora*, *Tephrosia purpurea*, *Hedyotis corymbosa*, *Teramnus labialis*, *Lindernia ciliata*, *Cynodon dactylon*, *Commelina nodiflora*. The plants with moderate density were *Tridax procumbens*, *Cleome viscosa*, *Indigofera cordifolia*, *Cassia occidentalis*, *Lindernia oppositifolia*, *Oplismenus burmannii*, *Convolvulus prostratus*, *Indigofera linnaei*, etc. and the plants with low density were *Cleome gynandra*, *Hybanthus enneaspermus*, *Ocimum gratissimum*, *Polygala erioptera*, *Pedaliium murex*, *Sida alba*, *Hibiscus lobatus*, *Launaea procumbens*, *Aerva lanata*, etc. The dominant species showed 11-18% increase until stabilization. Whereas the density of the species with moderate number of members showed gradual decline (15-25%) until their stabilization. In the second week of August, species viz. *Spermacoce pusilla*, *Cassia pumila*, *Biophytum sensitivum*, *Spermacoce articularis*, arrived. In the first week of September, the late monsoon emergent like *Lindernia oppositifolia*, *Lindernia ciliata*, emerged in their seedling stage. The post monsoon herbs were *Sphaeranthus indicus*, *Blumea mollis* and *Blumea lacera* documented in the sampled plots, which came up in the month of October. Flowering of early emergents was observed during second week of August and flowering of late emergent was observed second week of September. The termination of life cycle of the annuals began from the month of December and extended upto February. The sampling study was terminated by the month of February.

The study was repeated for the years 2002 and 2003 to look for the changes coming in the community structure. Sampling area was the same for the years 2002 and 2003. IVI details for the years 2002 and 2003 are given in (Table 8b & 8c) respectively. The phenological pattern of the species recorded in the second year (2002) of study showed similar pattern to that of first year

Fluctuations in the density of species viz. *Crotalaria medicaginea*, *Cassia tora*, *Tephrosia purpurea*, *Teramnus labialis*, *Cleome viscosa*, *Lindernia ciliata*, *Crotalaria hebecarpa*, etc. was noted compared to first year's study. The sampling in the third year (2003) of the study tenure was initiated from July. A variation was noted in the density of few species compared to that of first two years. An increase in the density status of species viz. *Crotalaria medicaginea*, *Cynadon dactylon*, *Lindernia oppositifolia*, and a decline in the density of *Cassia tora*, *Tephrosia purpurea*, *Commelina nudiflora* was noted. The comparative IVI values for the years 2001-2003 is given in (Table 8d). No variation was noted in the phenological cycle of the documented species compared to the records of first and second year of the study.

Fig (G) shows the peak monthly density. Similar pattern was noted for the three years of the study. The peak density was attained in the month of September.

Fig (G) - Peak monthly density at Goral



VARIATIONS OBSERVED AMONGST SAMPLING SITES

By comparing the details of community composition of herbaceous vegetation estimated at each sampled sites of the study region, variation with respect to the number of species, number of dominant species & species with minimum distribution, variation in the period of peak density attained at each site, variation in the morphological features of common species amongst the site, variation in the period of initiation of reproductive period and phenological duration was observed for the common species amongst the sites.

a. Variation in number of species recorded at each site

A variation in the number of species recorded in the quadrat study was noted amongst each site sampled. The lowest number was recorded at IPCL and highest at Goral.

IPCL - 27 species

Nandesari ravines - 47 species

Laxmi Vilas Campus area - 51 species

Timbi - 57 species

Mevli - 60 species

Goral - 67 species

b. Variation in the species dominance and distribution

Variation was noted in the species which dominated the specific community. In the community at IPCL dominance of plant species viz. *Elytraria acaulis* was observed

The community at Nandesari ravine area was dominated by plant species viz. *Xanthium strumarium*, *Cassia tora*, *Tephrosia purpurea*, *Crotalaria medicaginea*, *Cynadon dactylon*, and *Echinochloa colonum*. The community at Laxmi Vilas Palace campus area was dominated by *Achyranthes aspera*, *Tephrosia purpurea*, *Cenchrus ciliaris*, *Echinochloa colonum*, *Commelina nudiflora*, *Indigofera cordifolia*, *Crotalaria medicaginea*, *Synedrella nodiflora*, *Cynadon dactylon* and *Alysicarpus monilifer*. The community at Timbi was dominated by *Phyla nodiflora*, *Heliotropium supinum* *Coldenia procumbens*, *Cynadon dactylon*, *Brachiaria ramose*, *Merremia emarginata* and *Cenchrus ciliaris*. The community at Mevli was dominated by *Cassia tora*, *Tephrosia*

purpurea, *Crotalaria medicaginea*, *Cynadon dactylon* and *Eragrostis ciliaris*. And the community at Goral was dominated by *Cassia tora*, *Crotalaria medicaginea*, *Tephrosia purpurea*, *Cynadon dactylon*, *Teramnus labialis*, and *Commelina nudiflora*.

The distribution of the species, which showed moderate and low density, also showed variation amongst the sites. The number of species with low density were high in the site Nandesari and IPCL vis-à-vis other sites. Despite of similarity in habitat observed amongst the regions at Nandesari, Mevli and Goral, site-specific distribution of species was noticed. Similarity in species composition existed between the sites of Mevli and Goral.

c. Variation in phenological period and attaining of peak density phase

A variation in phenological period was observed amongst the plants documented at Nandesari and IPCL of Baroda region and Mevli and Goral of Savli regions. The life cycle of plants viz. *Lindernia oppositifolia*, *Lindernia ciliata*, *Spermacoce articularis*, *Spermacoce pusilla*, etc. initiated early 12-18 days than observed at the regions of Savli. In addition, the reproductive phase started early compared to that noticed at Savli region. The duration of life cycle of these plants showed shrinkage of 15-20 days compared to regions of Savli. Majority of plants growing at Nandesari and IPCL areas showed variation in reproductive period compared to Savli region. The reproductive phase of the plants started 7-10 days early and attained early stabilization. The duration of life cycle also showed shrinkage compared to that noticed in the plants growing in the Savli region. Life cycle duration of the plants growing at Laxmi Vilas Palace compound showed similarity with that of the sites at Savli. A variation was also observed in the specific period for attaining peak density. Peak density at sites IPCL, Nandesari and Timbi was attained in the month of August whereas peak density at sites Laxmi Vilas Palace, Mevli and Goral were seen attaining in the month of September.

d. Variation in morphological characters

Variation in morphological features of few common plant species with respect to size and texture of leaf and height of the plants was noted between the regions of IPCL, Nandesari and Mevli, Goral. The details are mentioned in (Table A). The size of leaf and leaflet and height of the plants at IPCL and Nandesari were smaller compared to those occurred at Mevli and Goral.

Table (A) - Variation in leaf & leaflet size and plant height amongst the sites of Nandesari & IPCL and Mevli & Goral

Plant Name	Leaf size (cm)		Plant height (cm)	
	(*) Leaflet size (cm)		Nandesari and IPCL	Savli Region
	Nandesari and IPCL	Savli Region		
<i>Acalypha indica</i>	3.40 – 3.75	4.32 – 4.75	33.00 – 45.25	52.00 – 62.00
<i>Achyranthes aspera</i>	5.14 – 7.58	6.25 – 8.57	50.00 – 75.59	80.33 – 112.25
<i>Blepharis maderaspatensis</i>	3.5 – 7.25	5.74 – 9.28	-	-
<i>Boerhavia diffusa</i>	2.83 – 4.45	4.21 – 5.30	-	-
<i>Spermacoce articularis</i>	1.50 – 2.53	2.88 – 3.52	-	-
<i>Cassia occidentalis</i>	*7.50 – 8.76	*9.25 – 10.37	87.00 – 90.00	120.00 – 144.00
<i>Cassia tora</i>	*3.24 – 4.18	*4.55 – 5.29	55.50 – 62.00	67.55 – 100.25
<i>Cassia pumila</i>	2.80 – 5.42	4.28 – 6.52	-	-
<i>Commelina benghalensis</i>	5.55 – 6.81	8.53 – 9.44	-	-
<i>Commelina nudiflora</i>	5.34 – 7.85	6.85 – 8.72	-	-
<i>Crotalaria medicaginea</i>	*2.34 – 2.55	*2.85 – 3.73	45.00 – 62.54	52.55 – 78.47
<i>Dalechampia scandens</i> var <i>cordofana</i>	5.25 – 7.24	6.78 – 8.59	-	-
<i>Digera muricata</i>	4.25 – 5.62	6.37 – 7.85	30.15 – 48.37	45.29 – 57.32
<i>Dipteracanthus prostratus</i>	2.85 – 4.27	3.95 – 7.21	-	-
<i>Evolvulus alsinoides</i>	0.8 – 1.25	1.31 – 2.22	-	-
<i>Indigofera cordifolia</i>	0.83 – 1.32	1.14 – 1.85	-	-
<i>Lindernia ciliata</i>	1.35 – 2.87	2.24 – 3.54	10.55 – 12.43	12.45 – 15.28
<i>Lindernia oppositifolia</i>	1.48 – 2.87	2.51 – 3.42	11.47 – 13.28	14.32 – 16.41
<i>Polygala enoptera</i>	1.87 – 2.28	1.95 – 2.59	15.44 – 18.53	20.28 – 25.65
<i>Sida acuta</i>	4.86 – 6.72	5.21 – 8.68	25.37 – 30.47	35.44 – 45.00
<i>Sida rhombifolia</i>	4.31 – 5.91	5.31 – 8.03	24.25 – 28.27	32.24 – 38.55
<i>Tephrosia purpurea</i>	*4.55 – 5.32	*5.28 – 6.41	45.00 – 53.25	49.47 – 73.28
<i>Teramnus labialis</i>	*3.28 – 5.42	*6.89 – 9.57	-	-
<i>Vernonia cinerea</i>	3.47 – 3.98	4.18 – 5.21	37.28 – 59.44	57.57 – 71.29

The foliage of vegetation growing at Nandesari region showed thick texture. In addition, vegetation at Nandesari showed symptoms of chlorosis. The foliage of *Xanthium strumarium*, *Achyranthes aspera*, *Cassia occidentalis*, *Trichodesma indicum*, *Digera muricata*, *Spermacoce articularis*, *Leucas aspera* and *Physalis minima* showed browning in young leaves. Such symptoms were not noted in the plants growing in other regions. Reduction in secondary branches was also noted for the species occurring at Nandesari and IPCL sites.

e. Variation in flower color

Variation in the color intensity of flower was noted in the region of Nandesari and IPCL compared to the regions of Laxmi Vilas Palace, Mevli and Goral. The flowers of herbaceous plants at Nandesari and IPCL appeared to be paler. This was noted for the plants viz. *Blepharis maderaspatensis*, *Teramnus labialis*, *Sida acuta*, *Tephrosia purpurea*, *Justicia diffusa*, *Indigofera linnaei*, *Indigofera cordifolia*, *Vernonia cinerea*, *Lindernia oppositifolia*, *Trichodesma indicum*, *Boerhavia diffusa*, *Digera muricata*, *Spermacoce articularis*, *Pavonia zeylanica*, *Dalechampia scandens* var. *cordofana*, *Physalis minima*, and *Sida cordifolia*.

RESULTS OF DIVERSITY INDICES

Species accumulation curve-

The plot of cumulative number of species, collected against a measure of the sampling effort is termed the species accumulation curve. By this method, the sampling effort can be measured. As the number of sampling plot increases in an area, more number of species will be calculated in the plots until occasional species remain unrecorded. When this occurs, increase effort will not increase the recorded species number. The species accumulation curve will reach an asymptote. This proves the sampling effort is sufficient for that particular community.

Shannon Wiener indices-

The indices measure the amount of order contained in a system, i.e. the number of species, number of individuals in each species and the places occupied by individuals of each species. The diversity indices measure amount of uncertainty in the community i.e. to predict correctly the species of next individual picked up in the community. The higher value of Shannon Wiener, greater is the uncertainty and this implies higher diversity and evenness of the community. For biological community the value of the indices dose not exceed 5

Simpson indices-

Simpson diversity index implies that diversity is inversely related to the probability that two individuals picked up at random belongs to same species. The Simpson formulation ranges from 1 to ∞ . For different community comparison, the lower the value of indices, higher is the species diversity of the community.

Equitability analysis-

Most of the communities of plants contain a few dominant species and many species that are relatively uncommon. Equitability refers to the pattern of distribution of number of individuals between the species. The higher the value of the indices, greater is the diversity and evenness of the sampled community

Mcintosh diversity indices-

This diversity indices measure the evenness of the distribution of the species. Greater the value obtained, better the evenness in the distribution of the species in the community.

Fisher's α Diversity-

It is a parametric index of diversity that assumes that the abundance of species follows a log series distribution. The higher the value implies the greater diversity of the community.

 β diversity-

β diversity measures the increase in species diversity along transect. It measures two attributes, the number of distinct habitats within the region and the replacement of species by another between disjoint parts of same habitat. If the value obtained for diversity is in close proximity to 1, the greater is richness of species in the community

Fig H (1-3) -Species accumulation curve for Nandesari (2001-2003)

Fig (H1) - Species accumulation curve for Nandesari 2001

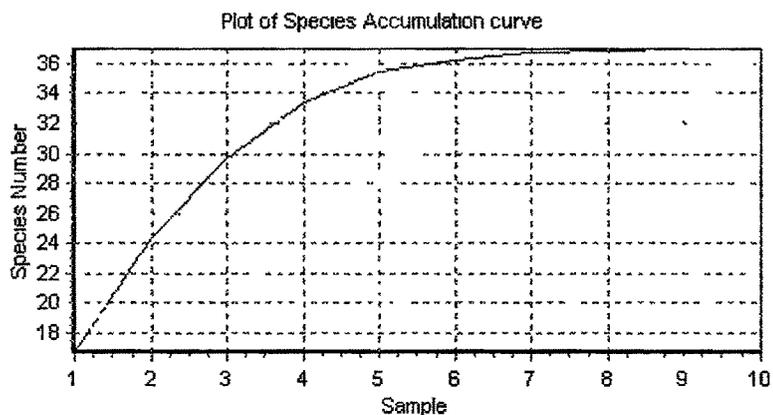


Fig (H2) - Species accumulation curve for Nandesari 2002

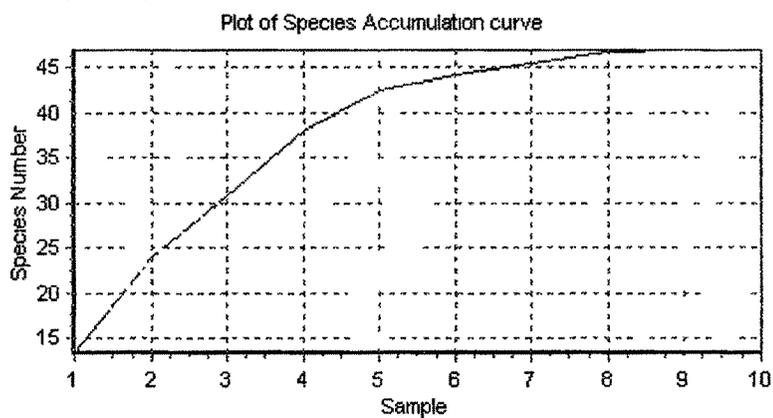


Fig (H3) - Species accumulation curve for Nandesari 2003

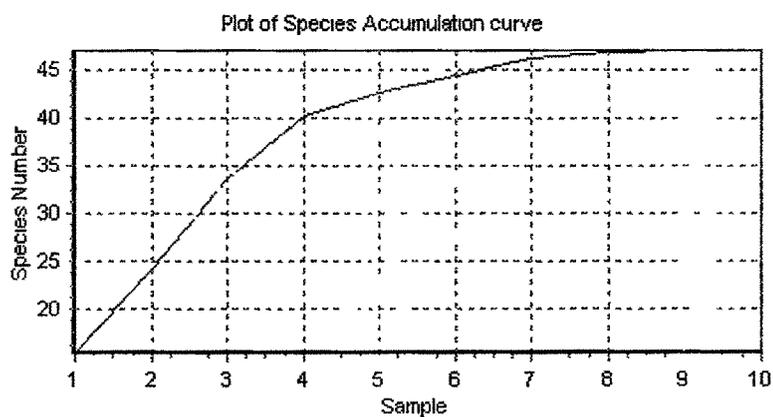


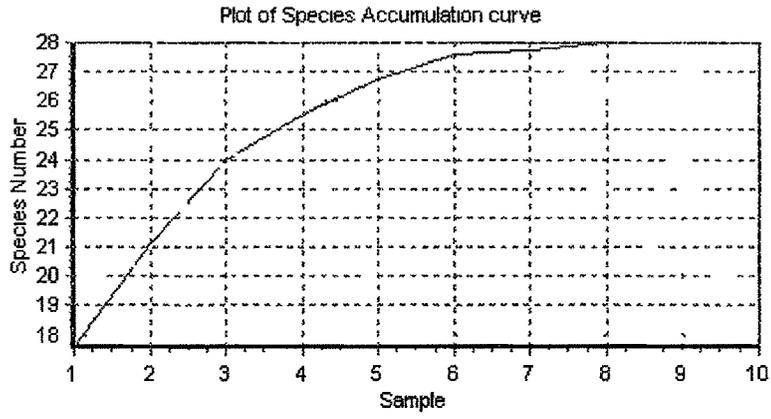
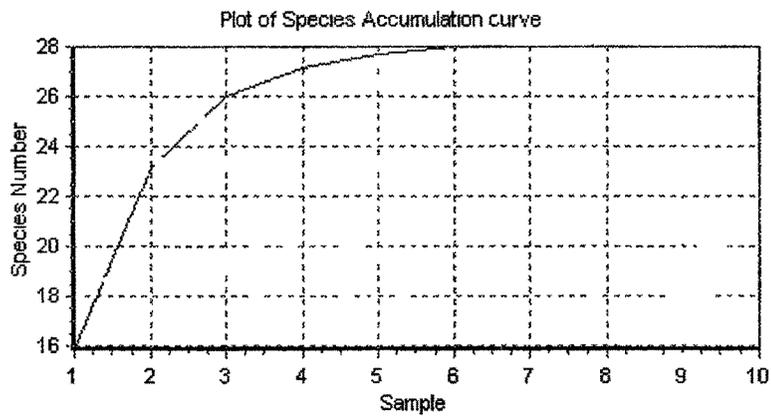
Fig 1 (1-3) -Species accumulation curve for IPCL (2001-2002)**Fig (I1) -Species accumulation curve for IPCL 2001****Fig (I2) - Species accumulation curve for IPCL 2002**

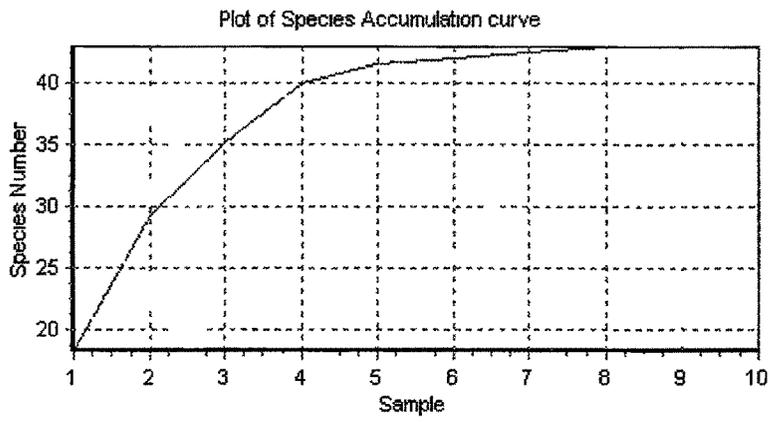
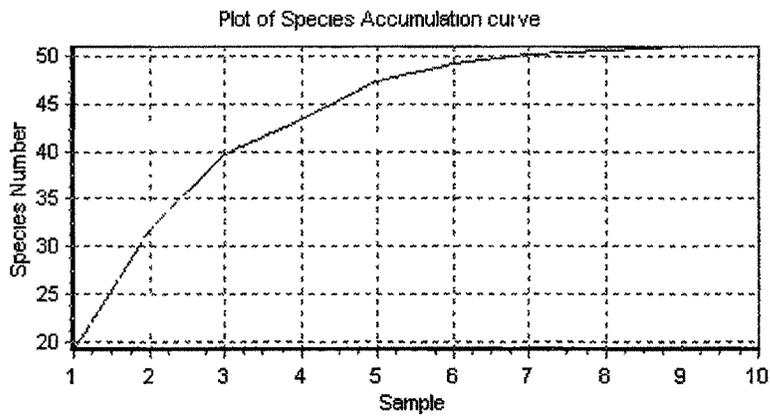
Fig J (1-3) -Species accumulation curve for LVP (2001-2002)**Fig (J1) -Species accumulation curve for LVP 2001****Fig (J2) - Species accumulation curve for LVP 2002**

Fig K (1-3) -Species accumulation curve for Timbi (2001-2003)

Fig (K1) - Species accumulation curve for Timbi 2001

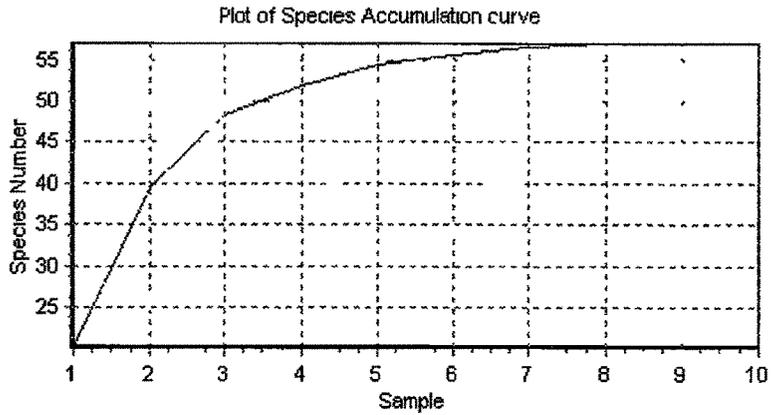


Fig (K2) - Species accumulation curve for Timbi 2002

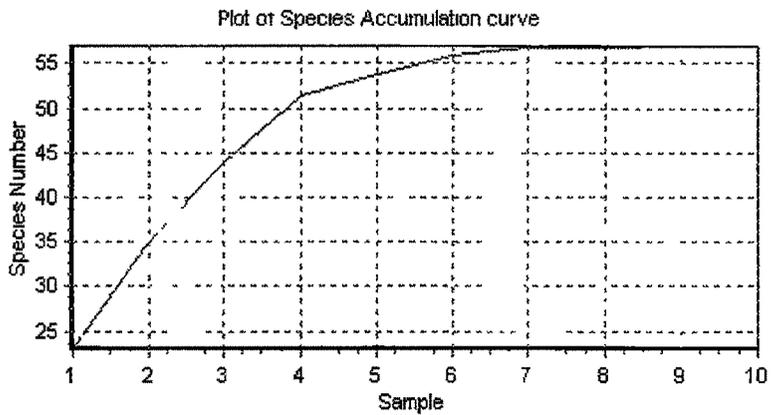


Fig (K3) - Species accumulation curve for Timbi 2003

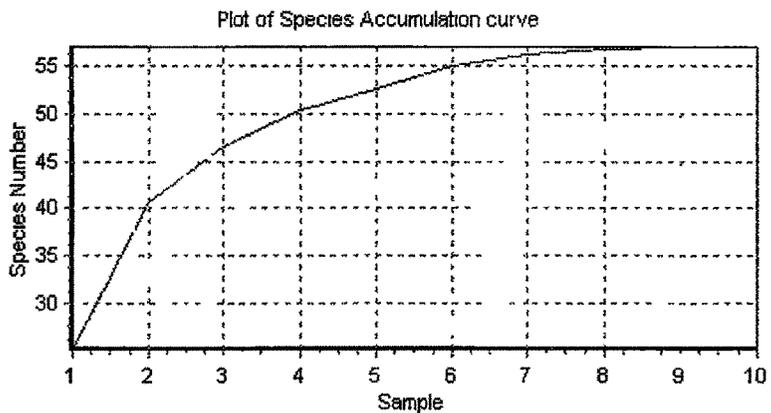


Fig L (1-3) -Species accumulation curve for Mevli (2001-2003)

Fig (L1) - Species accumulation curve for Mevli 2001

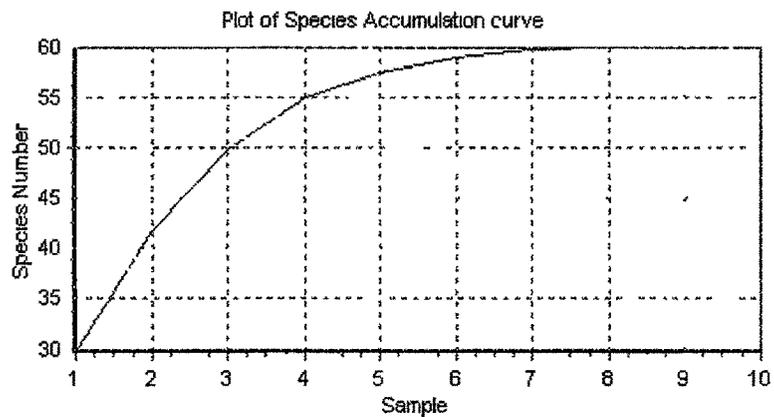


Fig (L2) - Species accumulation curve for Mevli 2002

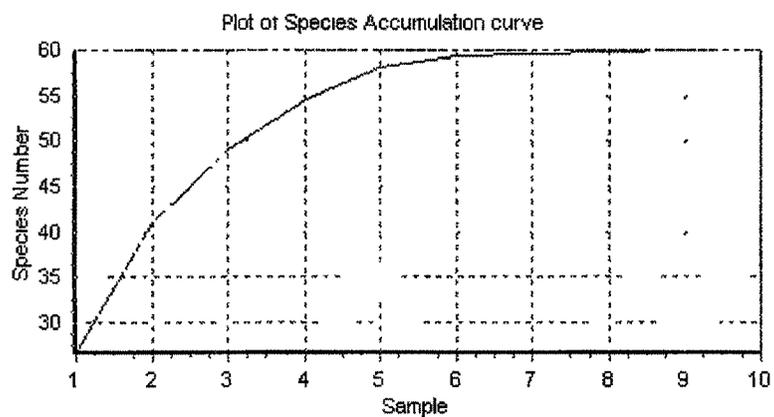


Fig (L3) - Species accumulation curve for Mevli 2003

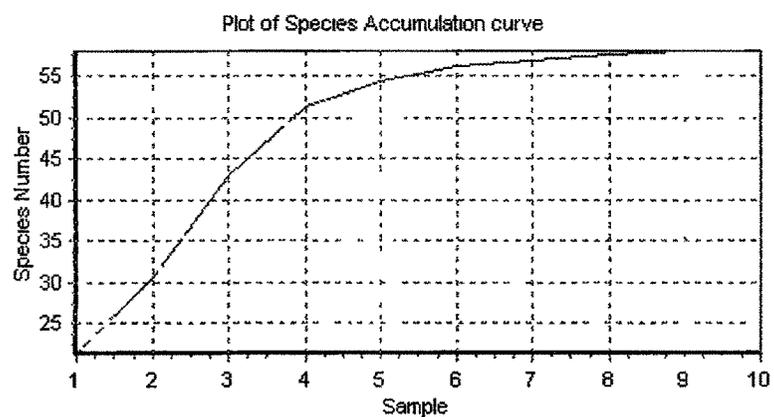


Fig M (1-3) -Species accumulation curve for Goral (2001-2003)

Fig (M1) - Species accumulation curve for Goral 2001

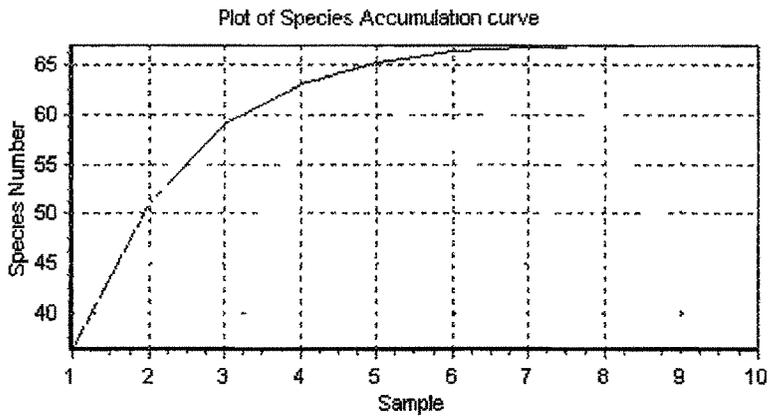


Fig (M2) - Species accumulation curve for Goral 2002

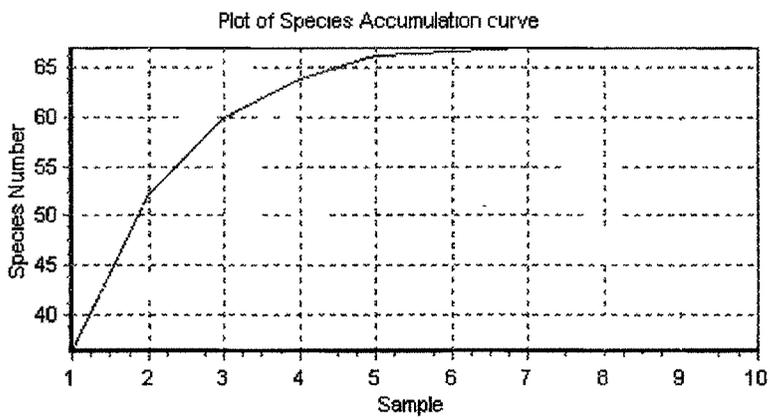


Fig (M3) - Species accumulation curve for Goral 2003

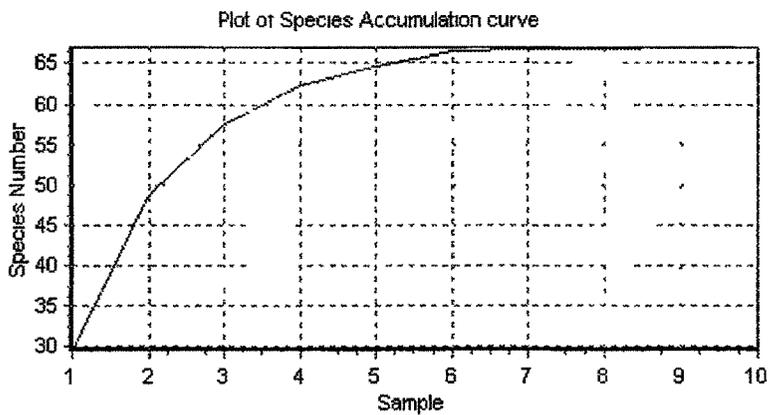


Table B(1-3) - Results of diversity indices of the sampled sites for the years 2001-03

Table (B1) -Results of diversity indices of the sampled sites for the year 2001

Indices	IPCL	Nandesari	LVP	Timbi	Mevli	Goral
Shannon Wiener indices	2.02	1.8	3.09	3.32	3.26	3.53
Simpson diversity indices	13.88	19.14	8.88	12.56	11.24	11.20
Equitability analysis	0.51	0.58	0.8	0.82	0.77	0.81
McIntosh diversity measure	0.51	0.66	0.82	0.84	0.84	0.85
Fisher's α diversity	2.62	1.98	4.53	8.89	10.41	13.41
β diversity	0.66	1.40	1.28	1.28	1.18	0.98

Table (B2) -Results of diversity indices of the sampled sites for the year 2002

Indices	IPCL	Nandesari	LVP	Timbi	Mevli	Goral
Shannon Wiener indices	2.42	1.50	2.80	3.37	3.34	3.44
Simpson diversity indices	14.73	18.14	11.68	9.41	10.84	11.28
Equitability analysis	0.52	0.58	0.70	0.83	0.81	0.81
McIntosh diversity measure	0.52	0.61	0.79	0.82	0.83	0.86
Fisher's α diversity	2.84	1.50	4.21	10.15	13.30	13.67
β diversity	0.67	2.19	1.80	1.39	1.27	0.89

Table (B3) -Results of diversity indices of the sampled sites for the year 2003

Indices	IPCL	Nandesari	LVP	Timbi	Mevli	Goral
Shannon Wiener indices	-	1.93	-	3.31	3.14	3.45
Simpson diversity indices	-	16.56	-	10.39	9.30	11.13
Equitability analysis	-	0.59	-	0.82	0.77	0.82
McIntosh diversity measure	-	0.57	-	0.83	0.84	0.86
Fisher's α diversity	-	1.53	-	10.09	10.55	14.79
β diversity	-	2.28	-	1.34	1.54	1.04

Species accumulation curve-

The species accumulation curves obtained for all the sampled sites of the study area (Fig H - M) for the years 2001-2003 appears an asymptote. This proves the sampling effort is sufficient for sampled communities.

Shannon Wiener indices – By comparing the values obtained for all sampled sites, higher values of the indices are obtained for the sites Goral, Mevli, Timbi, and Laxmi Vilas Palace and low values are obtained for the sites IPCL and Nandesari. Higher value of diversity indicates greater uncertainty for the prediction of next individual in the community. Similar pattern is observed for the three years (2001-2003) of sampling period. Hence, substantiates presence of higher species diversity at the sites Goral, Mevli, Timbi and Laxmi Vilas Palace and comparatively low species diversity at sites IPCL and Nandesari.

Simpson diversity indices – By comparing the values obtained for all sampled sites, higher values of the indices are obtained for the sites Nandesari and IPCL compared to other 4 sites, which implies higher probability that two individuals picked up at random belongs to same species. Hence, confirms lower species diversity at sites Nandesari and IPCL compared to other 4 sites. Similar pattern is followed for all the three years (2001-2003) of the sample study

Equitability analysis – By comparing the values obtained for all sampled sites, higher values of equitability are obtained for the sites Goral, Mevli, Timbi and Laxmi Vilas Palace compared to Nandesari and IPCL. This implies presence of greater diversity and evenness at the sites with higher value. Similar pattern is followed for all the three years (2001-2003) of the sample study.

McIntosh Diversity Measure – By comparing the values obtained for all sampled sites, higher values of diversity are obtained for the sites Goral, Mevli, Timbi and Laxmi Vilas Palace compared to Nandesari and IPCL. This implies better evenness in the distribution of species in the community. Similar pattern is followed for all the three years (2001-2003) of the sample study

Fisher's α Diversity – By comparing the values obtained for all sampled sites, higher values of diversity are obtained for the sites Goral, Mevli and Timbi compared to Laxmi Vilas Palace, Nandesari and IPCL. This implies greater diversity in the community with higher values. Similar pattern is followed for all the three study years (2001-2003)

Beta Diversity – By comparing the values obtained for the sampled sites, values of sites Goral, Mevli and Timbi are found closer to 1 compared to the sites Nandesari, IPCL and Laxmi Vilas Palace. This implies greater richness of the species at the community at Goral, Mevli and Timbi. Similar pattern is seen followed for all the three years of the study tenure (2001-2003).

Cluster analysis

The cluster analysis measures the similarity between samples from the sampled community. The samples with similar species are kept close together, and dissimilar species are far apart. The analysis summarizes a community data to a single cluster that summarizes the patterns in the data.

The values of the cluster analysis and the corresponding tree diagram for the sampled sites for years (2001-2003) are given in Table (9-14)

Nandesari

The sampling was done for the years 2001-2003. The quadrats were marked permanent for the years 2002 & 2003

2001-

The samples were arranged in 3 groups based on their similarity. First group with similar members included samples 1,2. Second group with similar members were samples 3, 6, 8 & 9, 10 and the third group with similar members were 4, 7, 5.

2002-

The samples were arranged in 3 groups based on their similarity. First group with similar members included samples 1,2 & 7,9. Second group with similar members were samples 4,6 and the third group with similar members were 3 & 8 and 5,10.

2003-

The samples were arranged in 3 groups based on their similarity. First group with similar members included samples 1,2 & 10. Second group with similar members were samples 3,8 & 5 and the third group with similar members were 4,6 & 7,9.

IPCL

The sampling was carried out for the years 2001 and 2002. The quadrats were marked permanent.

2001-

The cluster shows that 3 groups of similarity pattern is observed for the sampled site. Similarity is observed amongst the samples 1,2 & 5 (first group),

second group includes the samples 9,3 & 4 and third group includes samples 6,8 & 7,10.

2002-

The cluster shows that 3 groups of similarity pattern is observed for the sampled site. Similarity is observed amongst the samples 1,5 & 4 (first group), second group includes the samples 2,3 & 6,8 and third group includes samples 7 & 9,10

Laxmi Vilas Palace

The sampling was carried out for the years 2001 and 2002. The quadrats were not marked permanent.

2001-

Three groups of similarity were observed. First groups included samples 1,2 & 6,7,5, second group included samples 9,10 and third group included samples 3 & 4,8

2002-

Three groups of similarity were observed. First groups included samples 1,2, 3 & 6,7 second group included samples 8, 9,10 and third group included samples 4,5.

Timbi

Sampling was done for the years 2001-2003 and the quadrats were marked permanent.

2001-

Two group of similarity in quadrats were seen. First group of similarity included quadrats (1,2), (3,4) & (5,6) and second group included quadrats (7,8) & (9,10).

2002-

Three group of similarity in quadrats were seen. First group of similarity included quadrats 1,2 &3, second group included quadrats 4,5 and 6,7,8 and third group included quadrats 9,10.

2003-

Three group of similarity in quadrats were seen. First group of similarity included quadrats 1,2 &3, second group included quadrats 4,6 and 5,7,8 and third group included quadrats 9,10.

Mevli

Sampling was done for the years 2001-2003 and the quadrats were marked permanent.

2001-

Three groups of similarity in quadrats were seen. First group of similarity included quadrats 1,9 & 6, second group included quadrats 2,3 & 7 and the third group included quadrats 4,5 & 8,10.

2002-

Three group of similarity in quadrats were seen. First group of similarity included quadrats 1,10 & 9, second group included quadrats 3,4 & 8 and third group included quadrats 2,5 & 6,7.

2003-

Three group of similarity in quadrats were seen. First group of similarity included quadrats 1,9 and 10,8 second group included quadrats 2,5 and 3,4 and third group included quadrats 6,7.

Goral

Sampling was done for the years 2001-2003 and the quadrats were marked permanent.

2001-

Two groups of similarity in quadrats were seen First group of similarity included quadrats 1,2 & 8,7, 10 second group included quadrats 3,4 & 5,9,6.

2002-

Three group of similarity in quadrats were seen. First group of similarity included quadrats 1,2 & 8, second group included quadrats 3,4 & 9 and 6,7 and third group included quadrats 5,10.

2003-

Four group of similarity in quadrats were seen. First group of similarity included quadrats 1,2 & 7,8 second group included quadrats 3,9 and 4,5 , third group included quadrat 6 and fourth group included quadrat 10.

From the cluster analysis, it is observed that greater variation in subgrouping and similarity pattern for the sampled quadrats is observed at the sites Timbi, Mevli and Goral compared to Nandesari, IPCL and Laxmi Vilas Palace sites

This implies better dispersal of the plants because of habitat connectivity within the patches of the community at Timbi, Mevli and Goral. Whereas the moderate amount of difference in the yearly similarity pattern for the sites Nandesari, IPCL and Laxmi Vilas Palace implies a hindrance in the movement (dispersion) of plant species within the community because of habitat fragmentation and higher disturbance levels.

VARIATION IN PHENOTYPIC PLASTICITY

Different areas and habitats falling in the study region (Baroda and Savli) were visited periodically for documentation of existing vegetation and its pattern of distribution. Various anthropogenic activities and disturbances prevailing in the area have also been noted. Disturbances have reflected directly with their impact on composition of the vegetation which has shown remarkable differences in the phenotypic plasticity. Phenotypic plasticity is the response by an organism to an environmental stimulus. It refers to the ability of individuals to alter its physiology, morphology and /or behavior in response to a change in the environmental conditions and the potential for an organism to produce a range of different, relatively fit phenotypes in multiple environments

The vegetation pattern in terms of species composition amongst the region of Baroda and Savli showed high percentage of similarity. A range of differences in terms of the density status, growth pattern, phenology, etc. were seen. The reproductive phase of many plants of Baroda region started early by 1-2 weeks compared to that of Savli. The longevity of reproductive phase and life cycle duration of the herbaceous vegetation was high in the plants growing in Savli region. Gradation was seen in the recorded variations. Some of the areas in Savli showed similarity with the vegetation of Baroda. These areas were closer to Baroda region.

For example *Gloriosa superba*, a member of family Liliaceae, was noticed growing on the hedges at Manjusar region (Savli region) along the road side agricultural fields on the highway connecting the of Baroda and Savli. Flowering in the plant was observed in last week of August or first week of September. Whereas the plants which were growing in the northern part of Savli region showed flowering in the second week of September. Plants of Baroda region showed flowering in the last week of August. Similar variation in flowering initiation episode were also made for the plants like *Malachra capitata*, *Urena lobata*, *Abelmoschus manihot*, *Corchorus capsularis*, *Corchorus olitorius*, *Triumfetta rhomboidea*, *Tribulus terrestris*, *Cardiospermum halicacabum*, *Crotalaria retusa*, *Melilotus alba*, *Melilotus indica*, *Cullen corylifolia*, *Aeschynomene indica*, *Ageratum conyzoides*, *Eclipta prostrata*, *Blainvillea acmella*, *Sonchus oleraceus*, *Anagallis arvensis*, etc.

Variation was also noted in the morphological characters and branching pattern in the plants of both regions. The plants documented in the Savli region showed an increase of 10-28% in foliage length, an increase of 5-45% in plant height compared to the plants collected from the urban areas of Baroda region. The plants from Savli region had profuse secondary branches that eventually resulted in higher amount of reproductive out put compared to the plants of Baroda region. An increase of 7-18% of secondary branches was noted for the plants of Savli region and an increase of 10-45% of increase in reproductive output was noted from the plants collected from Savli region compared to those collected from urban areas of Baroda region.

Considering the height difference as a preferential factor, the variation observed falls in three ranges, 30-40%, 20-29% and 5-19%. The corresponding reproductive difference observed amongst the plants of both the region falls in the ranges of 35-45%, 20-38% and 8-28% respectively. Specifically leaf and leaflet size variation noted amongst the climbers and prostrate trailers amongst the two regions was in the range between 5-25%. The details of the variations are mentioned in the Tables C(1-4)

Table (C1) -Variations observed in the height (range difference 40-30%), leaf (leaflet) size and reproductive out put amongst the plants growing in Baroda and Savli region

NAME	Height of plant (cm)		Leaf (*leaflet) size (cm)		Reproductive output fruit / plant	
	Baroda	Savli	Baroda	Savli	Baroda	Savli
<i>Anagallis arvensis</i>	10-15	14-25	1 2-1 9	1 2-2 3	25-30	45-50
<i>Biophytum sensitivum</i>	6-10	9-15	5 2-7 3	6 5-8 3	65-75	95-110
<i>Cleome simplicifolia</i>	15-20	20-30	1 7-3 2	2 0-3 5	9-12	15-18
<i>Exacum pedunculatum</i>	9-11	10-16	2 5-2 8	2 5-3 2	8-10	12-15
<i>Pedaliun murex</i>	13-17	15-25	3 4-4 5	4 5-6 0	10-12	15-18
<i>Polygala arvensis</i>	10-12	11-20	1 5-2 5	2 0-3 0	22-27	28-42
<i>Polygala enoptera</i>	18-25	24-35	1 5-2 2	2 0-3 5	85-90	105-140
<i>Stemodia viscosa</i>	13-20	15-28	2 2-4 5	2 2-4 5	85-90	110-150
<i>Striga angustifolia</i>	15-18	28-35	2 5-3 6	2 9-4 2	45-80	108-128
<i>Zornia gibbosa</i>	15-22	15-30	*1 2-2 5	*1 8-3 10	45-50	75-80

Table (C2) -Variations observed in the height (range difference 29-20%), leaf (leaflet) size and reproductive out put amongst the plants growing in Baroda and Savli region

NAME	Height of plant (cm)		Leaf (*leaflet) size (cm)		Reproductive output fruit / plant	
	Baroda	Savli	Baroda	Savli	Baroda	Savli
<i>Acalypha indica</i>	33- 45	52- 62	3 40-3 75	4 32-4 75	-	-
<i>Achyranthes aspera</i>	50- 75	80- 105	5 14-7 58	6 25-8 57	-	-
<i>Apluda mutica</i>	65-110	75-140	-	-	-	-
<i>Asphodelus tenuifolius</i>	35-40	35-55	12-14	12-15	240-290	390-420
<i>Basilicum polystachyon</i>	38-50	40-65	2 7-5 6	3 0-6 0	-	-
<i>Bergia odorata</i>	25-35	30-45	1 5-3 1	2 2-3 7	150-162	190-220
<i>Blainvillea acmella</i>	38-45	42-57	5 5-7 5	5 5-7 8	18-20 (heads)	22-30 (heads)
<i>Spermacoce articularis</i>	25-31	32-47	2 4-3 7	2 6-5 2	65-70	85-90
<i>Spermacoce pusilla</i>	15-22	15-28	2 2-3 7	2 3-4 5	62-65	78-92
<i>Cassia absus</i>	40-50	45-60	*1 4-2 8	1 8-3 5	15-20	35-40
<i>Cassia occidentalis</i>	87-90	120-125	*7 50-8 76	*9 25- 10 37	30-40	52-60
<i>Cassia tora</i>	55-62	67-90	*3 24-4 18	*4 55-5 29	35-45	55-70
<i>Catharanthus pusillus</i>	7-12	11-16	2 7-4 6	3 2-5 6	8-12	15-18
<i>Celosia argentea</i>	65-110	65-140	4 4-8 5	4 4-9 2	260-280	390-400
<i>Cenchrus cilians</i>	40-50	40-65	10-18	10-23	-	-
<i>Cleome viscosa</i>	65-75	60-95	*2 5-4 3	*3 5-5 5	45-55	57-66
<i>Commelina benghalensis</i>	25-34	28-48	5 55- 6 81	8 53-9 44	15-18	15-25
<i>Commelina nudiflora</i>	18-22	21-30	5 34-7 85	6 85-8 72	25-30	25-45
<i>Crotalaria linifolia</i>	55-60	50-75	3 2-3 8	3 5-4 2	75-80	110-120
<i>Crotalaria medicaginea</i>	45- 62	52 - 78	*2 34-2 85	*2 85-3 73	110-120	150-170
<i>Dinebra retroflexa</i>	35-60	35-75	10-18	13-22	-	-
<i>Emilia sonchifolia</i>	30-35	35-45	6 2-9 3	7 3-11 6	12-15 (heads)	15-22 (heads)
<i>Hybanthus enneaspermus</i>	13-16	18-20	2 0-2 8	2 5-3 6	25-29	28-37
<i>Ischaemum rugosum</i>	30-40	30-55	-	-	-	-
<i>Lagascea mollis</i>	30-45	45-60	3 5-5 6	3 5-5 9	22-25 (heads)	32-40 (heads)
<i>Malvastrum coromandelianum</i>	40-50	45-70	3 8-4 6	4 5-5 6	28-32	40-45
<i>Melanocenchns jacquemontii</i>	8-11	8-15	3 0-4 5	3 0-5 2	-	-
<i>Melilotus alba</i>	35-40	35-55	*1 0-2 5	1 5-2 5	15-20	22-30
<i>Perotis indica</i>	18-24	20-30	-	-	-	-
<i>Phyllanthus maderaspatensis</i>	30-45	30-57	1 2-2 5	1 5-2 5	450-480	500-550
<i>Physalis longifolia</i>	62-85	70-110	4 5-9 8	4 5-10 0	25-28	35-45
<i>Physalis minima</i>	35-52	40-68	4 5-8 2	4 5-10 5	22-27	30-35
<i>Setana tomentosa</i>	55-65	55-85	-	-	-	-
<i>Sida acuta</i>	32-40	35-50	2 5-4 2	3 7-5 8	65-85	95-120
<i>Sida alba</i>	38-45	45-60	2 5-3 9	3 0-4 7	24-35	44-56
<i>Tephrosia purpurea</i>	45-53	49-73	3 55-4 32	4 28- 6 41	67-90	115-135
<i>Tragus roxburghii</i>	10-15	10-20	1 5-2 3	1 5-3 0	-	-
<i>Urena lobata</i>	65-80	65-105	5 7-7 5	6 9-9 5	35-40	39-50

Table (C3) -Variations observed in the height (range difference 19-5%), leaf (leaflet) size and reproductive out put amongst the plants growing in Baroda and Savli region

NAME	Height of plant (cm)		Leaf (*leaflet) size (cm)		Reproductive output fruit / plant	
	Baroda	Savli	Baroda	Savli	Baroda	Savli
<i>Acanthospermum hispidum</i>	45-57	45-65	4 5-5 2	4 5-6 7	18-25	20-30
<i>Aeschynomene indica</i>	45-58	50-67	6 2-7 6	6 5-8 5	35-40	45-55
<i>Ageratum conyzoides</i>	25-45	35-50	3 5-6 5	4 2-7 2	-	-
<i>Argemone mexicana</i>	50-75	60-90	-	-	-	-
<i>Chrysopogon fulvus</i>	40-65	45-75	-	-	-	-
<i>Cleome chelidoni</i>	40-55	45-65	*2 5-4 7	*3 0-5 3	12-15	15-20
<i>Cleome gynandra</i>	60-80	75-90	*3 2-5 5	*4 0-6 5	65-70	67-85
<i>Corchorus aestuans</i>	45-60	50-68	3 5-6 2	4 2-6 8	25-31	38-42
<i>Corchorus capsularis</i>	85-110	100-135	6 7-8 5	8 0-10 8	75-80	95-110
<i>Crotalaria retusa</i>	55-70	60-80	4 2-6 0	4 5-6 5	12-18	22-25
<i>Croton bonplandianum</i>	35-50	35-60	3 2-6 7	3 2-6 7	145-160	152-190
<i>Cyperus compressus</i>	15-35	20-40	10-15	10-17	-	-
<i>Cyperus difformis</i>	25-38	25-45	15-25	15-30	-	-
<i>Kyllinga tenuifolia</i>	10-15	10-18	4 5-7 5	4 5-7 5	-	-
<i>Digera muncata</i>	30-50	45-57	4 2-6 6	6 3-7 8	480-500	510-550
<i>Euphorbia heterophylla</i>	35-45	35-54	4 5-6 2	4 5-6 1	-	-
<i>Fimbristylis miliacea</i>	20-35	20-40	18-28	20-30	-	-
<i>Indigofera astragalina</i>	55-70	55-85	*2 5-3 5	*2 5-4 2	285-300	320-380
<i>Indigofera glandulosa</i>	25-35	30-40	2 5-3 5	2 5-3 8	340-350	450-460
<i>Lindernia ciliata</i>	8-16	10-16	1 5-1 8	1 5-2 3	58-75	90-103
<i>Lindernia oppositifolia</i>	10-19	10-22	1 5-2 3	1 5-2 5	72-80	95-110
<i>Malachra capitata</i>	55-70	55-85	6 9-10 5	7 5-14 5	85-90	85-140
<i>Melochia corchorifolia</i>	55-68	62-85	3 5-5 7	4 7-6 8	180-190	180-225
<i>Nothosaerva brachiata</i>	25-35	25-38	1 2-3 8	1 2-4 0	-	-
<i>Pavonia zeylanica</i>	75-110	75-130	1 5-2 3	2 0-3 0	285-300	400-450
<i>Penstrophe bicalyculata</i>	75-110	75-120	3 8-5 7	4 1-6 1	380-400	380-440
<i>Cullen corylifolia</i>	55-69	60-75	3 7-5 6	4 2-6 7	180-200	220-275
<i>Saccharum spontaneum</i>	95-140	110-165	35-53	35-60	-	-
<i>Sclerocarpus africanus</i>	55-75	62-83	4 5-9 2	4 5-9 5	15-21	19-28
<i>Setaria verticillata</i>	55-65	55-80	-	-	-	-
<i>Sida cordifolia</i>	58-65	60-80	4 3-5 7	4 5-6 6	27-35	25-35
<i>Sida rhombifolia</i>	42-50	45-60	2 8-3 7	3 5-4 4	140-150	175-195
<i>Solanum nigrum</i>	45-62	45-69	5 6-7 8	5 6-8 2	-	-
<i>Synedrella nodiflora</i>	38-45	42-55	4 7-7 5	5 7-9 8	75-80 (heads)	78-110 (heads)
<i>Tephrosia villosa</i>	38-56	44-65	*4 00-5 6	*4 28-6 41	55-80	85-110
<i>Vernonia cinerea</i>	48-67	52-75	2 5-5 7	3 2-6 2	-	-
<i>Waltheria americana</i>	65-75	70-90	2 8-4 5	3 5-5 5	180-210	220-275

Table (C4) -Variations observed in leaf (leaflet) size amongst the climbers and prostrate trailers growing in Baroda and Savli region

NAME	Leaf (*leaflet) size (cm)	
	Baroda	Savli
<i>Blastania cerasiformis</i>	2 5-4 3	2 8-4 5
<i>Blepharis maderaspatensis</i>	2 5-5 7	3 7-6 2
<i>Blepharis repens</i>	1 2-1 8	1 5-2 2
<i>Cardiospermum halicacabum</i>	*3 5-5 3	*4 8-6 9
<i>Cassia pumila</i>	3 8-5 7	4 5-6 7
<i>Convolvulus prostratus</i>	1 2-2 1	1 5-2 8
<i>Diplocyclos palmatus</i>	3 8-6 7	3 8-7 4
<i>Dipteracanthus prostratus</i>	3 4-4 5	3 5-5 8
<i>Eclipta alba</i>	2 5-5 6	3 2-6 9
<i>Evolvulus alsinoides</i>	1 5-2 2	1 5-2 6
<i>Glinus oppositifolius</i>	1 4-2 0	1 5-2 5
<i>Indigofera cordifolia</i>	0 83-1 32	1 14-1 85
<i>Ipomoea obscura</i>	2 3-3 9	2 5-4 2
<i>Ipomoea sepiana</i>	2 8-5 1	3 2-5 5
<i>Melothria maderaspatana</i>	2 8-5 7	3 4-6 8
<i>Rhynchosia minima</i>	*1 2-2 5	*1 6-3 0
<i>Teramnus labialis</i>	*3 28-5 42	* 4 89-6 57

VARIATION AMONGST ANTHROPOGENIC ACTIVITIES AND ITS IMPACT ON PLANT DIVERSITY

Savli region has lesser anthropogenic activities. Chief activity of the region is agriculture. Baroda region is an industrialized urban system with diverse anthropogenic activities. This has altered land use/land cover pattern resulting in the deeper fragmentation of the habitat. Area available for natural vegetation has been reduced. Road widening in various areas of Baroda has resulted in leveling up the road side ditches where good number of wet land communities were seen growing during monsoon. In Savli region, such activities are observed at a minimum scale.

An example for this sort of activity was experienced In the year 2001 and 2002, a small ditch was observed adjacent to the busy road in the area of Vaghodia (Baroda region) An aquatic plant species *Monochoria vaginalis*, a plant of rare occurrence of the Baroda region was found occupied in the ditch A large water body of Kamlanagar pond was present half a km away from this point with diverse hydrophytes *Monochoria vaginalis* was not noted in that particular pond In the process of road widening in the year 2003, the ditch was covered and plant disappeared from the area

Hence, the wild land and various habitats like wetlands, agricultural fields, ravines, etc. available in the Savli region are four to five folds higher than what was observed for Baroda region. Ultimately, this directly reflected in the density of habitat specific plants such as *Nymphaea stellata*, *Nymphaea pubescens*, *Nelumbo nucifera*, *Cleome chelidonii*, *Polygala arvensis*, *Bergia ammannioides*, *Urena lobata*, *Pavonia zeylanica*, *Hibiscus ovalifolius*, *Abelmoschus moschatus*, *Melochia corchorifolia*, *Corchorus capsularis*, *Corchorus olitorius*, *Tribulus terrestris*, *Cardiospermum halicacabum*, *Crotalaria burhia*, *Indigofera glandulosa*, *Zornia gibbosa*, *Aeschynomene indica*, *Alysicarpus longifolius*, *Cassia pumila*, *Neptunia triquetra*, *Blastania cerasiformis*, *Diplocyclos palmatus*, *Glinus lotoides*, *Bidens biternata*, *Blainvillea acmella*, *Sphaeranthus indicus*, *Emilia sonchifolia*, *Gnaphalium polycaulon*, *Anagallis arvensis*, *Sarcostemma secamone*, *Physalis longifolia*, *Limnophila indica*, *Bacopa monnieri*, *Sopubia delphinifolia*, *Striga angustifolia*, *Stemodia viscosa*, *Orobanche cernua*, *Indonessiella echioides*, *Phyla nodiflora*, *Basilicum polystachyon*, *Nothosaerva brachiata*, *Tragia cannibina*, *Vallisneria*

spiralis, *Limnophyton obtusifolium*, etc. and a number of Cyperaceae & Poaceae members which showed four to five folds higher densities in the Savli region compared to that available in Baroda region. The anthropogenic and urbanization activities were relatively at a lower scale observed in the region of Savli. Activities like grazing, fuel wood collection were noted at a number of localities. As these are spread over smaller areas, their overall impact was insignificant.

Land use variation in Baroda and Savli region

Land use data was acquired from Town Planning and Valuation Department, Narmada Bhavan, Baroda. Total area of Baroda and Savli taluka comprises of 650 sq km and 792 sq km respectively. Urban area in Baroda region comprises of 108.22 sq km and for Savli area is 19.33 sq km. Other area is rural area for both Baroda and Savli Taluka. In Savli taluka, 78.93% of total land is utilized for agricultural activities and remaining 21.07% of land is distributed for residential, industrial, commercial, transport, etc. purposes. In Baroda taluka, out of total land, 35.38% of land is utilized for agricultural activities and other 64.62% of land is being utilized for residential, industrial, commercial, transport, etc. purposes. Correspondingly, the daily vehicular traffic faced by both the regions varies with a high degree of difference. The details about the land use pattern of urban areas of Baroda and Savli regions is given in the Table (D).

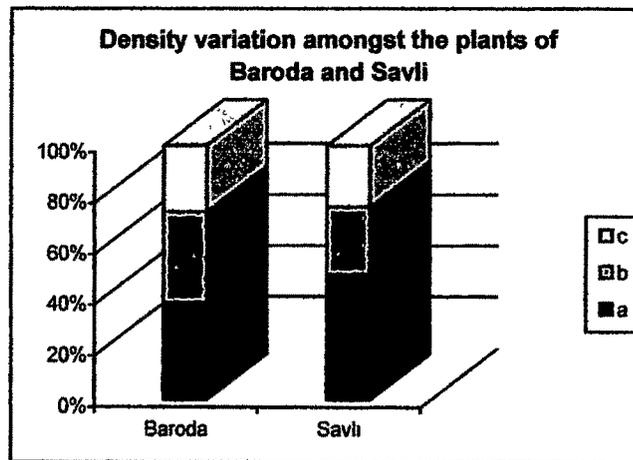
Table (D) -Comparative account of population size and land use pattern for Baroda and Savli urban areas (population data is for Baroda and Savli taluka)

	BARODA	SAVLI
Population (of taluka)	17,05,617	2,36,115
Residential area	41.03 sq km	3.24 sq km
Industrial and commercial area	11.09 sq km	0.15 sq km
Agriculture land	5.80 sq km	12.98 sq km
Road and railway	15.30 sq km	1.22 sq km
Other (restricted area, parks, gardens, etc)	37.71 sq km	2.34 sq km

The variation observed in the population size and land use pattern is directly reflected on the composition of wild vegetation growing amongst both the regions. An overall variation is noted amongst the densities of wild vegetation. The study resulted in the documentation 458 and 465 plant species from

Baroda and Savli regions respectively. 98% of similarity was noted amongst the plant species diversity between the regions. However, a variation was noted in the density of these species. Major proportion of species occurred with high density in Savli region compared to Baroda region. Whereas in Baroda region the proportion of plants with moderate and low density was high compared to that observed in Savli region. The density variation observed between the regions is illustrated in fig (N).

Fig (N) -Density variation amongst the plants of Baroda and Savli region



- a. Plants with high density
- b. Plants with moderate density
- c. Plants with low density

The list of the plants with their density status from both the regions is being detailed in the Tables (15 (a,b,c) & 16 (a,b,c)).

METAPOPULATION STRUCTURE

A detailed survey was undertaken across the study regions (Baroda and Savli) exploring diverse habitats in various seasons to look for the status of existing vegetation and metapopulation structure. The vegetation sampling at the selected sites (selection of the sites done on the basis of disturbance levels and habitat variations) in the study region resulted in recording the density distribution of plants whose subpopulations occupied a wider range of habitats. The frequency and average number of individuals per patch in the subpopulation varied across the region. Based on these values, the population size of plants can be divided into three ranges viz. broad, moderate and narrow. The plants with broad range had wide range of metapopulation size which were found growing or distributed in diverse habitats like fallow fields, agricultural and road side hedges, ravine area, as weeds in agricultural fields, occupying wet banks of rivers and ponds, etc. Broad range includes occupancy of plant species in 4-6 sampled localities with 30-90% of frequency distribution. The probability of these plants to continue through generations is high as, if one of the habitat is fragmented or disturbed or destroyed, then the continuity of those plant can persevere through the other range of habitats

Table (E1) -Plant species with broad range of metapopulation. Value in bracket indicates frequency and the decimal figure indicates average no. of individuals per population patch. Broad range includes occupancy of plant species in 4-6 sampled localities with 30-90% of frequency distribution.

Name of the species	Nandesari	IPCL	LVP	Timbi	Mevli	Goral
<i>Alysicarpus monilifer</i>			15 67 (6)	17 8 (5)	11 3 (3)	15 25 (4)
<i>Blephans maderaspatensis</i>	11 50 (4)	12 25 (4)			14 2 (3)	14 5 (4)
<i>Boerhavia diffusa</i>	8 0 (3)	4 45 (3)	7 0 (5)			4 25 (6)
<i>Blumea lacera</i>	5 0 (5)		3 5 (4)		4 33 (3)	3 67 (3)
<i>Spermacoe articulans</i>	7 (4)		5 67 (4)	6 0 (4)	11 0 (5)	17 55 (4)
<i>Cassia tora</i>	21 5 (6)	7 0 (6)		3 25 (4)	13 5 (6)	21 0 (7)
<i>Cassia occidentalis</i>	12 67 (4)			2 5 (2)	19 75 (4)	6 71 (6)
<i>Cenchrus ciliars</i>	14 0 (4)		21 6 (5)	16 14 (7)		22 71 (5)
<i>Commelina benghalensis</i>		14 20 (5)	10 5 (4)	7 33 (3)	21 33 (6)	13 8 (5)
<i>Commelina nudiflora</i>	9 50 (4)	19 33 (4)	17 67 (4)		19 88 (5)	15 0 (6)
<i>Crotalana medicaginea</i>	22 0 (6)	14 1 (6)	14 6 (5)		17 78 (7)	18 34 (6)
<i>Cynadon dactylon</i>	30 48 (5)	44 87 (7)	59 34 (5)	42 68 (8)	57 46 (6)	33 69(7)
<i>Desmodium triflorum</i>		3 0 (5)		16 25 (4)	17 3 (3)	6 2 (5)
<i>Digera muncata</i>	7 0 (3)	4 33 (3)		3 5 (2)		6 0 (5)
<i>Elytrana acaulis</i>		27 70 (9)	5 67 (3)		6 5 (3)	6 7 (4)
<i>Eragrostis ciliars</i>	45 78 (3)		32 11 (4)		58 67 (4)	72 25 (3)
<i>Evolvulus alsinoides</i>	12 0 (4)		8 68 (3)	10 25 (4)	9 67 (6)	5 67 (5)
<i>Euphorbia hirta</i>	17 0 (3)		22 0(4)	13 2 (5)	19 17 (4)	18 71 (4)

<i>Crotalaria hebecarpa</i>	15 33 (3)		15 0 (4)	8 75 (4)	18 0 (3)	14 2 (4)
<i>Indigofera cordifolia</i>	11 67 (3)		18 0 (3)		6 25 (4)	11 2 (5)
<i>Indigofera linnaei</i>	11 23 (3)		17 0 (3)		6 25 (4)	8 8 (5)
<i>Justicia diffusa</i>	12 0 (5)			9 3 (3)	12 0 (3)	9 2 (5)
<i>Launaea procumbens</i>	6 0 (3)			7 5 (4)	9 8 (4)	9 75 (4)
<i>Lindernia ciliata</i>		12 0 (6)	12 33 (3)		9 25 (4)	12 0 (3)
<i>Lindernia oppositifolia</i>	12 5 (3)	17 41 (6)	18 33 (3)		12 25 (4)	21 25 (6)
<i>Hedyotis corymbosa</i>	33 46 (4)		49 24 (4)	28 25 (4)	34 64 (4)	53 57 (5)
<i>Paspalidium flavidum</i>		12 79 (3)		23 24 (4)	22 31 (6)	19 5 (4)
<i>Phyllanthus amarus</i>	16 43 (5)	12 (4)	11 5 (4)	8 4 (4)	18 33 (5)	19 17 (3)
<i>Sida acuta</i>	11 0 (3)	6 72 (5)	6 5 (6)	3 33 (3)	7 5 (4)	5 32 (5)
<i>Sida rhombifolia</i>	6 0 (4)	2 8 (3)	7 0 (3)		3 67 (3)	
<i>Tephrosia purpurea</i>	26 29 (7)		11 4 (5)		18 8 (7)	19 43 (7)
<i>Trianthema portulacastrum</i>	5 0 (3)	9 25 (4)	11 0 (3)	5 5 (3)		
<i>Tridax procumbens</i>	10 67 (3)		6 33 (3)	7 33 (3)	9 28 (4)	7 25 (6)
<i>Teramnus labialis</i>	8 0 (3)	11 83 (5)		5 0 (4)		6 63 (5)

Besides the plants picked up from sample plots, other plants growing in the vicinity with similar pattern of distribution have also been recorded. The plants are, *Cissampelos pareira*, *Cocculus villosus*, *Argemone mexicana*, *Sida cordata*, *Abelmoschus manihot*, *Alysicarpus vaginalis*, *Triumfetta rhomboidea*, *Triumfetta rotundifolia*, *Cayratia trifolia*, *Clitoria ternatea*, *Melothria maderaspatana*, *Coccinia grandis*, *Cuscuta reflexa*, *Lindenbergia indica*, *Peristrophe bicalyculata*, *Chenopodium album*, *Phyllanthus maderaspatensis*, *Cyperus rotundus*, *Cyperus esculentus*, *Cyperus exaltatus*, *Apluda mutica*, *Themeda triandra*, *Elusine indica*, *Sporobolus marginatus*, etc.

Specific plants were distinguished, occurring in moderate range of metapopulation structure. Moderate range includes occupancy of plant species in 1-3 sampled localities with 20-70% of frequency distribution. These plants were distributed in specific habitats across the area but their status in that specific habitat was very high or in other words, the plants were dominating in that particular habitat. These are the plants, which prefer to grow (habitat specific) in aquatic/marshy ecosystem, or as a weed in agricultural fields along with a specific crop. The metapopulation size of this group of plants was found in higher range at the Savli region compared to Baroda region as the Savli region had wide range of habitat configuration compared to Baroda region. In addition few plants were distinguished which occupied distinct habitats but their frequency and number of individuals per population patch were low compared to the plants with broad range of metapopulation structure. The probability of these plants to continue is secured in a particular region until the specific habitats are not altered. The disturbance or destruction of habitat might result in

lowering down the population of these particular plants. The plants falling in this range are:

Table (E2) -Plant species with moderate range of metapopulation. Value in bracket indicates frequency and the decimal figure indicates average no. of individuals per population patch. Moderate range includes occupancy of plant species in 1-3 sampled localities with 20-70% of frequency distribution.

Name of the species	Nandesari	IPCL	LVP	Timbi	Mevli	Goral
<i>Coldenia procumbens</i>				16 71 (7)		
<i>Cressa cretica</i>				18 0 (3)		
<i>Cyperus difformis</i>				6 5 (3)		
<i>Dinebra retroflexa</i>				44 25 (5)		
<i>Enicostema axillare</i>				19 0 (4)		
<i>Glinus lotoides</i>				24 33 (4)		
<i>Glinus oppositifolius</i>				15 0 (3)		
<i>Heliotropium supinum</i>				13 88 (7)		
<i>Merremia emarginata</i>				16 83 (6)		
<i>Phyla nodiflora</i>				15 33 (7)		
<i>Ipomoea aquatica</i>				8 0 (4)		
<i>Phyllanthus simplex</i>				12 0 (4)		
<i>Abutilon indicum</i>			1 5 (2)		2 0 (2)	2 33 (3)
<i>Alternanthera sessilis</i>			12 5 (2)	8 25 (4)		
<i>Alysicarpus hamosus</i>			16 0 (3)	9 5 (4)		
<i>Spermacoce pusilla</i>				14 0 (3)	19 33 (3)	14 4 (5)
<i>Cassia pumila</i>			9 0 (2)		7 84 (3)	4 2 (5)
<i>Chlons barbata</i>					19 42 (5)	21 42 (4)
<i>Cymbopogon martinii</i>			59(2)		48 64 (4)	39 59 (3)
<i>Kyllinga tenuifolia</i>			5 33 (3)		7 0 (4)	4 6 (4)
<i>Eclipta prostrata</i>				8 9 (6)	4 4 (3)	4 6 (5)
<i>Eragrostis pilosa</i>		34 56 (4)				
<i>Euphorbia microphylla</i>				6 17 (6)		6 33 (3)
<i>Evolvulus nummularius</i>		26 86 (7)		12 33 (4)		
<i>Gomphrena celosioides</i>				17 6 (5)		14 72 (3)
<i>Hybanthus enneaspermus</i>					3 0 (3)	4 5 (4)
<i>Ipomoea pes-tigndis</i>	6 0 (3)		4 75 (4)	3 0 (2)		
<i>Ocimum gratissimum</i>					6 67 (3)	8 (3)
<i>Polygala eroptera</i>			2 5 (2)		12 0 (4)	9 67 (4)
<i>Rhynchosia minima</i>			5 0 (4)	6 67 (3)		5 5 (6)
<i>Rungia pectinata</i>			11 74 (4)		15 0 (3)	8 25 (5)
<i>Sclerocarpus africanus</i>			2 5 (2)		4 33 (3)	
<i>Sida cordifolia</i>	3 5 (2)		3 0 (3)			
<i>Sphaeranthus indicus</i>					5 67 (5)	4 8 (3)
<i>Tephrosia strigosa</i>			9 0 (3)		8 67 (3)	10 75 (4)
<i>Tephrosia villosa</i>					5 0 (4)	6 0 (3)
<i>Zornia gibbosa</i>					14 68 (4)	19 0 (3)

Plants having higher densities in specific habitats are.

Nymphaea stellata, *Nymphaea nouchali*, *Nelumbo nucifera*, *Polycarpha corymbosa*, *Melochia corchorifolia*, *Crotalaria retusa*, *Melilotus indica*, *Melilotus alba*, *Neptunia prostrata*, *Ammannia baccifera*, *Jussiaea perennis*, *Caesulia axillaries*, *Anagallis arvensis*, *Nymphoides hydrophylla*, *Nymphoides indicum*, *Convolvulus arvensis*, *Bacopa monnieri*, *Orobanche cernua*, *Utricularia stellaris*, *Hygrophila auriculata*, *Polygonum plebeium*, *Ceratophyllum demersum*, *Hydrilla verticillata*, *Vallisneria spiralis*, *Tonningia axillaries*, *Lemna polyrhiza*, *Lemna gibba*, *Limnophyton obtusifolium*, *Cyperus difformis*, *Cyperus iria*, *Fimbristylis dichotoma*, *Fimbristylis littoralis*, *Scheonoplectus articulatus*, *Hygroryza aristata*, etc.

The plant species *Orobanche cernua*, a member of family Orobanchaceae is found associated specifically with the plant *Nicotiana tabacum* and grows as a parasite along with the crop. In 2001, the plant was noted growing in two agricultural fields in Sama area (Baroda region). Crop rotation practice in the year 2002 and 2003 in those particular fields showed disappearance of that plant at least for two years from that particular piece of land.

A good number of plants were noticed to have a very narrow range of metapopulation size. Narrow range includes occupancy of plant species in 1-2 sampled localities with 10-30% of frequency distribution. These were plants which were seen growing in a specific habitat or were distributed in the narrow pocket of a particular region only. The frequency and number of individuals per population was also at very low range. The disturbance, fragmentation or clearance of that particular habitat might result in disappearance of these plants from the region.

This was noticed for the plants viz. *Clitoria biflora*, *Cassia absus*, *Indigofera astragalina*, *Peperomia pellusida*, *Lagascea mollis*, etc. In Baroda region, these plants were seen occupying only few regions of Laxmi Vilas Place campus area. The conversion of the wild habitat to golf ground has resulted in total removal of the plants from the region.

Table (E3) -Plant species with narrow range of metapopulation. Value in bracket indicates frequency and the decimal figure indicates average no. of individuals per population patch. Narrow range includes occupancy of plant species in 1-2 sampled localities with 10-30% of frequency distribution.

Name of the species	Nandesari	IPCL	LVP	Timbi	Mevli	Goral
<i>Bergia ammannioides</i>				3 0 (2)		
<i>Bidens biternata</i>			3 0 (2)			
<i>Biophytum sensitivum</i>						3 7 (2)
<i>Blainvillea acmella</i>			2 5 (2)			
<i>Cassia absus</i>			2 0 (2)			2 6 (3)
<i>Cleome chelidonii</i>				2 5 (2)		
<i>Crotalaria burhia</i>					3 33 (3)	
<i>Dalechampia scandens</i> <i>var cordofana</i>	2 5 (2)					2 00 (2)
<i>Grangea maderaspatana</i>				3 0 (2)		
<i>Hyptis suaveolens</i>	2 0 (2)					
<i>Pedaliium murex</i>						1 1 (3)
<i>Sida alba</i>						2 5 (3)
<i>Solanum indicum</i>					1 5 (2)	
<i>Catharanthus pusillus</i>						3 0 (3)
<i>Clitoria biflora</i>			2 5 (2)			
<i>Hibiscus lobatus</i>			2 0 (2)			2 67 (3)
<i>Indigofera astragalina</i>			1 0 (2)		2 0 (1)	
<i>Sarcostemma secamone</i>				4 0 (2)		
<i>Polygala arvensis</i>				3 0 (4)		

Other plants although not reported in the sample study but falling in this range are *Lepidum sativum*, *Cleome simplicifolia*, *Abutilon glaucum*, *Hibiscus panduraeformis*, *Hibiscus caesius*, *Crotalaria mysorensis*, *Trigonella occulata*, *Cullen corylifolia*, *Tephrosia senticosa*, *Alysicarpus bupleurifolius*, *Desmodium neomexicanum*, *Neptunia triquetra*, *Rotala indica*, *Lagascea mollis*, *Monochoria vaginalis*, *Coix lacryma jobi*, *Oryza rufipogon*, etc.

MAJOR ASSOCIATES

Sample study done at the sites of Baroda and Savli region, resulted in identifying few herbaceous plant species which were growing in association with each other and presence of one indicates occurrence of the other associate. In addition, association amongst other plant species which did not fall in the sampling plots, which were found inhabiting other variety of habitats like road side hedges, weed of agricultural fields, hydrophytic plants, etc. were also documented. The association noted was consistent across the study region.

a) Association of plant species observed in the sampled plots

1. *Crotalaria medicaginea* and *Cassia tora*. The plants belong to family Papilionaceae and Caesalpiniaceae respectively. This association is also noted in the lands of many habitats
2. *Crotalaria medicaginea* and *Tephrosia purpurea*. The plants belong to family Papilionaceae. This association is also noted in the lands of many habitats
3. *Cassia tora* and *Cassia occidentalis*. The plants belong to family Caesalpiniaceae. This association is noted in the wild and open lands at a variety of habitats.
4. *Sida acuta*, *Tephrosia purpurea*, *Crotalaria medicaginea*, *Cassia tora*. The plants are the members of family Malvaceae, Papilionaceae and Caesalpiniaceae. This association is noted in the wild and open lands at a variety of habitats.
5. *Euphorbia hirta* and *Phyllanthus amarus*. Plants are the members of family Euphorbiaceae. This association is noted in the wild and open lands at a variety of habitats.
6. *Xanthium strumarium*, *Tephrosia purpurea*, *Crotalaria medicaginea*, Plants are the members of family Compositae and Papilionaceae. This association is noted in the wild and open lands at a variety of habitats.
7. *Croton bonplandianum* and *Tephrosia purpurea*. The plants are the members of family Euphorbiaceae and Papilionaceae respectively. This type of association is noted growing in the open lands and also fallow fields.

8. *Alysicarpus hamosus*, *Tephrosia strigosa*, and *Cynadon dactylon*. The plants *Alysicarpus hamosus* and *Tephrosia strigosa* are the members of family Papilionaceae and *Cynadon dactylon* belongs to family Poaceae. This type of association is also noted at various habitats like banks of ponds and rivers and many wild open areas.
9. *Lindernia ciliata* and *Lindernia oppositifolia*. The plants are the members of family Acanthaceae. This type of association is noted at various open places in the wild.
10. *Setaria glauca* and *Setaria verticillata*. The plants are the members of family Poaceae. This type of association is also noted growing on the path ways of Agricultural fields.
11. *Indigofera cordifolia* and *Indigofera linnaei*. The plants are the members of family Papilionaceae This type of association is also noted growing at various habitats like ravine area, banks of ponds and rivers, etc
12. *Zornia gibbosa* and *Tephrosia strigosa*. The plants belong to family Papilionaceae This type of association is also found growing in cool shady places amongst grasses growing near the river beds.
13. *Cressa cretica* and *Enicostema axillare*. The plants belong to family Convolvulaceae and Gentianaceae respectively. This type of association is noted on the slopes of ponds.
14. *Biophytum sensitivum* and *Catharanthus pusillus*. The plants belong to family Oxalidaceae and Apocynaceae respectively The association is also noted underneath the moist and shady places of agricultural hedge bushes.
15. *Dalechampia scandens* var *cordofana* and *Teramnus labialis*. The plants belong to family Euphorbiaceae and Papilionaceae. This is one way association (true for *Dalechampia scandens* var. *cordofana*) noted climbing on the support of bushy shrubs in the Ravine areas.

b) Association of plant species observed in other variety of habitats

1. *Ipomoea obscura* and *Ipomoea sepiaria*. The plants belong to family Convolvulaceae. This is a major type of association noted in various road side hedges and agricultural hedges.
2. *Cocculus villosus* and *Pergularia daemia*. The plants *Cocculus villosus* belong to family Menispermaceae and *Pergularia daemia* belong to family Asclepiadaceae. All the three plants are climbers. This is a major type of association noted in various hedges at agricultural and roadside localities and at ravine region. Even noted on the banks of ponds and rivers growing with the support of bushy shrubs like *Prosopis juliflora*.
3. *Cocculus villosus* and *Cissampelos pareira*. The plants belong to family Menispermaceae. This type of associations is normally found on the garden hedges, road side hedges, ravine area, etc.
4. *Coccinia grandis* and *Diplocyclos palmatus*. The plants are members of family Cucurbitaceae. This type of association is found growing on the agricultural and road side hedges.
5. *Melothria maderaspatana* and *Blastaria cerasiformis*. The plants are members of family Cucurbitaceae. This type of association is noted growing on the agricultural hedges, road side hedges and ravine areas.
6. *Merremia aegyptia* and *Pergularia daemia*. The plants are the members of family Convolvulaceae and Asclepiadaceae respectively. This type of association is noted growing on the bushes of *Prosopis juliflora* at road side and at the hedges of agricultural fields.
7. *Commicarpus verticillatus* and *Diplocyclos palmatus*. The plants are the members of family Nyctaginaceae and Cucurbitaceae respectively. This type of association is noted growing over the bushy shrubs growing along the agricultural hedges.
8. *Ipomoea nil* and *Ipomoea pes-tigridis*. The plants belong to family Convolvulaceae. This type of association is noted growing in the ravine area and in the hedges of agricultural fields.

9. *Bergia odorata* and *Sphaeranthus indicus*. The plants belong to family Elatinaceae and Compositae respectively. This type of major association is noted during the month of October onwards until March/April in the open lands and fallow fields.
10. *Malachra capitata* and *Malvastrum coromandelianum*. The plants belong to family Malvaceae. This type of association is noted at the road sided open places especially the major highways.
11. *Triumfetta rhomboidea* and *Triumfetta rotundifolia*. Plants are the members of family Tiliaceae. This association is noted mainly at the edges of agricultural fields growing as weed.
12. *Cleome gynandra* and *Parthenium hysterophorus*. The plants are the members of family Cleomaceae and Compositae respectively. This type of association is noted growing in the open lands, road side and fallow fields.
13. *Physalis longifolia* and *Physalis minima*. The plants are the members of family Solanaceae. This is one sided association noted growing along the hedges of agricultural fields. The association is true for *Physalis longifolia*.
14. *Nothosaerva brachiata* and *Basilicum polystachyon*. The plants belong to family Amaranthaceae and Labiatae respectively. This type of association is noted under cool and shady places beneath the trees or shrubs at various habitats.
15. *Synedrella nodiflora* and *Ageratum conyzoides*. The plants are the members of family Compositae. This type of association is noted in the cool shady places at many habitats.
16. *Ageratum conyzoides* and *Vernonia cinerea*. The plants are the members of family Compositae. This type of association is noted in the cool shady places at many habitats.
17. *Datura metel* and *Withania somnifera*. The plants are the members of the family Solanaceae. This type of association is noted growing on the open lands near the road side.
18. *Cleome gynandra* and *Parthenium hysterophorus*. The plants belong to family Cleomaceae and Compositae respectively. This

type of association is found occupying the open places of fallow fields or fallow lands and growing along the road side as weed

19. *Argemone mexicana* and *Solanum xanthocarpum*. The plants are the members of family Papaveraceae and Solanaceae respectively. The plants are found growing in association especially in the road side dried temporary ditches
20. *Kyllinga tenuifolia* and *Striga angustifolia*. The plants belong to family Cyperaceae and Scrophulariaceae respectively. This type of association is noted amongst the grasses in the pathways of agricultural fields mostly in the shaded places
21. *Scoparia dulcis* and *Vernonia cinerea*. The plants belong to family Scrophulariaceae and Compositae. This is one way association true for *Scoparia dulcis* found growing in the shady and cool places at few localities.
22. *Parthenium hysterophorus* and *Argemone mexicana*. The plants belong to family Compositae and Papaveraceae respectively. This type of association is noted amongst the waste open places near road side, fallow lands and fallow fields.
23. *Tonningia axillaris* and *Phyllanthus maderaspatensis*. The plants belong to family Commelinaceae and Euphorbiaceae. This is a weed association found growing amongst agricultural crops.
24. *Chenopodium album* and *Anagallis arvensis*. The plants belong to family Chenopodiaceae and Primulaceae respectively. This is a weed association found growing amongst agricultural crops.
25. *Melilotus indica* and *Melilotus alba*. The plants belong to family Papilionaceae. This is a weed association found growing amongst agricultural crops.
26. *Melilotus indica* and *Anagallis arvensis*. The plants belong to family Papilionaceae and Primulaceae respectively. This is a weed association found growing amongst agricultural crops.
27. *Digera muricata* and *Phyllanthus maderaspatensis*. The plants belong to family Amaranthaceae and Euphorbiaceae respectively. This is a weed association found growing amongst agricultural crops

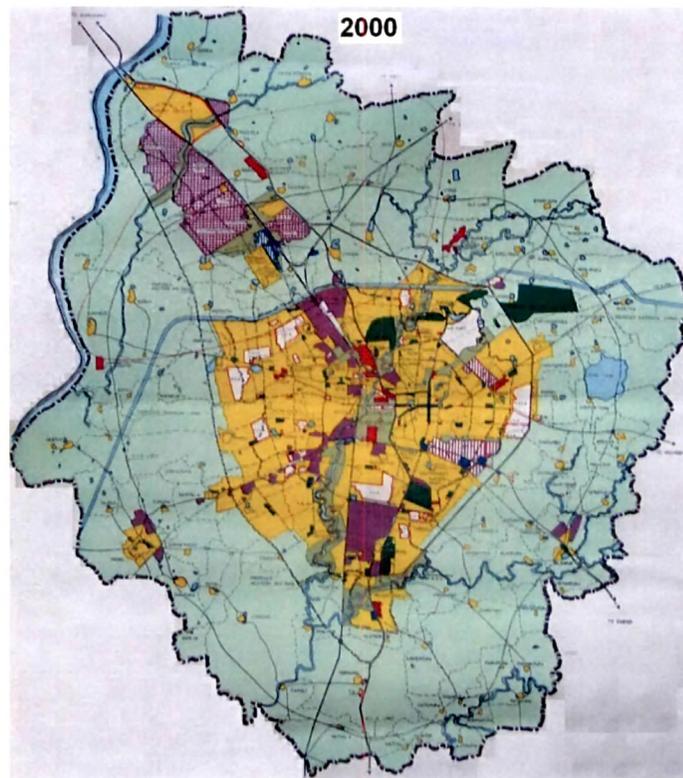
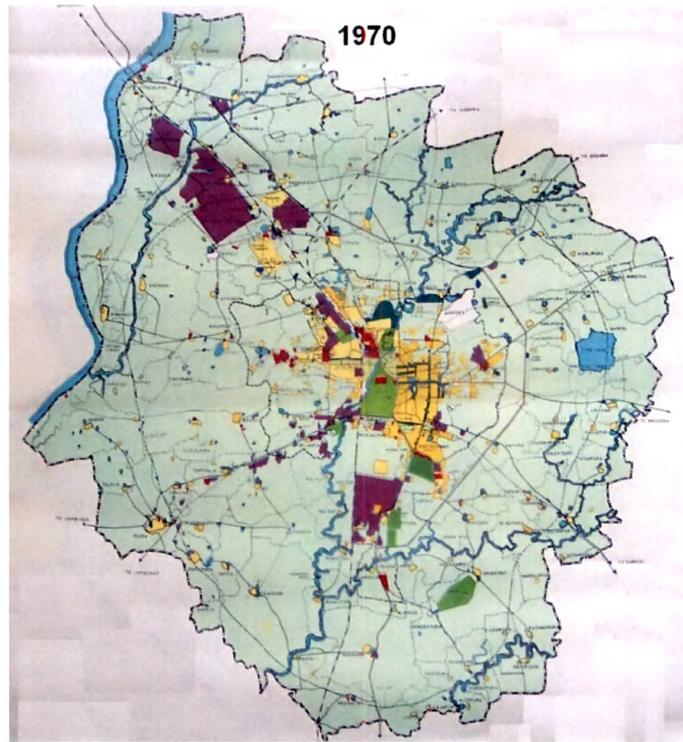
28. *Digera muricata* and *Leucas aspera*. The plants belong to family Amaranthaceae and Labiatae respectively. This is a weed association found growing amongst agricultural crops.
29. *Trianthema portulacastrum* and *Portulaca oleracea*. The plants belong to family Aizoaceae and Portulacaceae respectively. This is a weed association found growing amongst agricultural crops.
30. *Dipteracanthus prostratus* and *Blepharis maderaspatensis*. The plants belong to family Acanthaceae. This type of association is found growing in several habitats specifically underneath the shady area of bushy shrubs
31. *Stemodia viscosa* and *Tricholepis glaberrima* The plants belong to family Scrophulariaceae and Compositae respectively. This is an association noted especially in the fallow fields growing in large number
32. *Abelmoschus manihot* and *Abelmoschus moschatus*. The plants belong to family Malvaceae. This association is noted growing on the hedges of agricultural fields.
33. *Nymphaea stellata*, *Nymphaea nouchali*, *Nymphoides hydrophylla*, *Ipomoea aquatica*. The plants are the members of family Nymphaeaceae and Convolvulaceae. This is hydrophytic plant association found occupying perennial and temporary ponds and road side ditches
34. *Limnophyton obtusifolium* and *Ipomoea aquatica*. This is hydrophytic plant association found occupying perennial and temporary ponds and road side ditches
35. *Hydrilla verticillata* and *Vallisneria spiralis*. The plants are the members of family Hydrocharitaceae. This type of association is noted growing submerged in the waters of temporary and perennial ponds
36. *Hydrilla verticillata* and *Potamogeton nodosus*. The plants are the members of family Hydrocharitaceae and Potamogetonaceae. This type of association is noted growing submerged in the waters of temporary and perennial ponds.

37. *Potamogeton nodosus* and *Aponogeton natans*. The plants are the members of family Potamogetonaceae and Aponogetonaceae respectively. This type of association is noted growing submerged in the waters of temporary and perennial ponds
38. *Hygrophila auriculata* and *Caesulia axillaris*. The plants belong to family Acanthaceae and Compositae respectively. This type of association is noted growing in the temporary ditches and ponds of the area.
39. *Trigonella occulta* and *Heliotropium supinum*. The plants belong to family Papilionaceae and Boraginaceae respectively. This is one way type of association true for *Trigonella occulta* and is found growing on the dry beds of ponds specifically in the depression areas of dry beds.
40. *Bacopa monnieri* and *Phyla nodiflora*. The plants belong to family Scrophulariaceae and Verbenaceae respectively. This type of association is noted growing on the wet banks of river Mahisagar in the Savli area forming large carpets.

COMPARISION WITH PAST DATA

Preceding floristic work for Baroda and environs were conducted during the years 1967 & 1980 and for the Savli region in the year 1973. The three thesis were studied in detail and from the listed plant diversity of the regions, herbaceous plant species were sorted out along with the specifications of the density and reproductive period mentioned in the respective records. The grouping of the plants were done according to the density status mentioned (common, not-common and rare) and on the whole, percentage of plants falling in each category were determined for Baroda and Savli regions. The data collected for herbaceous vegetation of the years 2001-2003 from Baroda and Savli regions were also arranged in the similar pattern as followed by the previous workers to facilitate relevant comparison. Data on the land use pattern for Baroda and Savli regions is also given consideration, which has reflected its direct impact on the available vegetal cover in the respective years of the study (land use data collected from Town planning and Valuation Dept., Baroda). The changes in the land use pattern for Baroda region since last three decades is given in the comparative map (4) (maps procured from Vadodara Urban Developmental Authority (VUDA))

Map 4- Maps of Baroda showing variation in land use pattern in the years 1970 & 2000



-  Residential area
-  Agricultural land

Table (F) -Variation in land use pattern for Baroda region (values represented in sq km)

Year	1970	2000
Residential area	23 20	41 03
Industrial and commercial area	8 02	11 09
Agricultural area	30 42	5 8
Transport	13 07	15 3
Extra (restricted area, parks, garden, etc.)	23 48	37 17

In 1970, out of the total area of Baroda taluka (650 sq km), 62.25 % of land was utilized for agricultural activities which got reduced to 35.38% in 2000. There was a broadening in the urban boundary and good proportion of agricultural and wild open land were rehabilitated to residential, industrial and commercial sector.

Table (G) -Variation in land use pattern for Savli region (values represented in sq km)

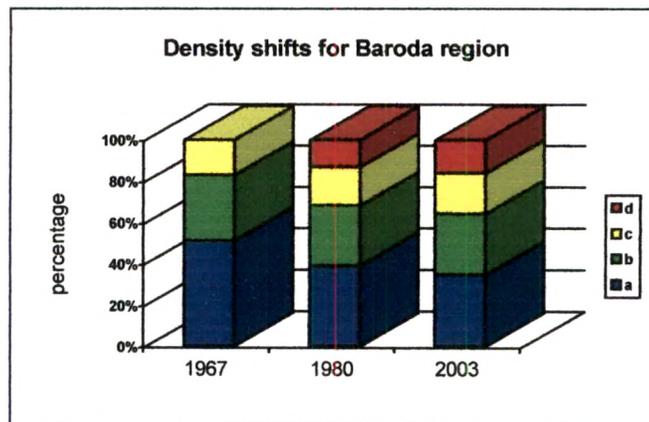
Year	1970	2000
Residential area	0 68	3 24
Industrial and commercial area	0 06	0 14
Agricultural area	13 92	12 98
Transport	0 90	1 22
Extra (restricted area, parks, garden, etc.)	0 31	2 34

More than 70% of the land at Savli taluka (792 sq km) is utilized for agricultural activities. Major increase in the urban boundary is also at moderate scale within last 3 decades.

a) Baroda Region

The floristic work of Baroda and environs done in the year 1967 resulted in documentation of 481 wild herbaceous plant species amongst which 246 (51.55%) of plants were documented as occurring with high density in the region, 153 (31.80%) of plant species with moderate density and 82 (17.05%) of plants occurring with low density. A similarly study on the floristic and ecology on urban residual system of Baroda in the year 1980 resulted in documentation of 490 (417 species similar to 1967's record and 73 plants newly documented). Out of 417 list, 188 (39.08%) of plants were reported to occur with high density, 140 (31.80%) plants reported to occur with moderate density, 89 (18.50%) plants with low density and 64 (13.30%) of plants which were documented in 1973 were reported to get locally extinct. The present study 2001-2003, compared to the records of 1967, 167 (34.71%) plants are documented with high density, 142 (29.52%) plants with moderate density, 94 (19.54%) with low density and 78 (16.21%) of plants are reported to get locally extinct.

Fig (O) - A comparative graph of density shifts of herbaceous vegetation in Baroda region



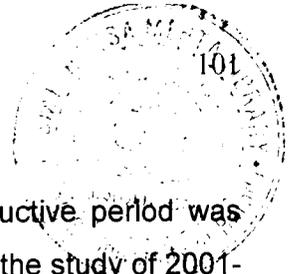
values given are in percentage

a-plants with high density

b-plants with moderate density

c-plants with low density

d-plants locally extinct



Compared to the past years records, a shift in the reproductive period was noted for a good number of plant which were documented in the study of 2001-2003.

Table (H) -Shows observation of changes in reproductive period of herbaceous plants noted for various years of study

Name of the plant	1967	1980	2001-03
<i>Abelmoschus manihot</i>	Oct to March	Sept to Feb	Sept to Jan
<i>Acanthospermum hispidum</i>	Aug to Feb	Aug to Feb	Aug to Jan
<i>Aerva persica</i>	Dec to March	Dec to March	Dec to Feb
<i>Ageratum conyzoides</i>	July to April	July to Nov	Aug to March
<i>Alysicarpus longifolius</i>	Sept to Nov	July to Oct	Aug to Nov
<i>Alysicarpus hamosus</i>	Sept to Dec	Aug to Nov	Aug to Nov
<i>Alysicarpus vaginalis</i>	Sept to Nov	Aug to Oct	Aug to Oct
<i>Anisomeles indica</i>	Sept to Dec	Aug to Nov	July to Dec
<i>Apluda mutica</i>	Sept to Nov	Dec to March	Oct to Feb
<i>Asphodelus tenuifolius</i>	Jan to April	Jan to April	Dec to Feb
<i>Bacopa monnieri</i>	Aug to March	Aug to March	July to Dec
<i>Basilicum polystachyon</i>	Sept to Dec	Sept to Dec	Oct to Jan
<i>Bidens biternata</i>	Sept to Nov	Sept to Dec	Aug to Oct
<i>Biophytum sensitivum</i>	Sept to Oct	Aug to Oct	Aug to Oct
<i>Blainvillea acmella</i>	Aug to Nov	Aug to Nov	Aug to Oct
<i>Blastania cerasiformis</i>	Sept to Nov	Sept to Nov	Aug to Oct
<i>Blepharis repens</i>	Sept to Jan	Sept to Jan	Sept to Dec
<i>Commicarpus chinensis</i>	Sept to Jan	Sept to Jan	Aug to Jan
<i>Spermacoce articularis</i>	Sept to Feb	Sept to March	Aug to Jan
<i>Spermacoce pusilla</i>	Sept to Oct	Aug to Oct	Aug to Oct
<i>Bothriochloa pertusa</i>	Sept to Oct	Aug to Oct	Aug to Oct
<i>Caesulia axillaris</i>	Sept to April	Sept to Jan	Sept to Jan
<i>Cardiospermum halicacabum</i>	Sept to Feb	Aug to Oct	Aug to Nov
<i>Cassia absus</i>	Oct	Aug to Nov	Aug to Oct
<i>Cassia pumila</i>	Sept to Nov	Aug to Oct	Aug to Oct
<i>Catharanthus pusillus</i>	Aug to Oct	Aug to Sept	Aug to Sept
<i>Celosia argentea</i>	Nov to Jan	Oct to Feb	Sept to Dec
<i>Chrysopogon fulvus</i>	Aug to Oct	-	Sept to Dec
<i>Cleome simplicifolia</i>	-	July - Sept	Aug - Oct
<i>Clitoria biflora</i>	Sept to Nov	Sept to Nov	Sept to Oct
<i>Coix lacryma - jobi</i>	Sept to Oct	Sept to Oct	Sept to Dec
<i>Commelina benghalensis</i>	Sept to Nov	Aug to Oct	Aug to Oct
<i>Commicarpus verticillatus</i>	Sept to Oct	Sept to Dec	Aug to Dec
<i>Convolvulus arvensis</i>	Oct to April	Jan to Feb	Dec to Feb
<i>Corchorus capsularis</i>	Sept to Nov	Sept to Nov	Aug to Oct
<i>Corchorus fascicularis</i>	Sept to Dec	Sept to Nov	Sept to Nov
<i>Crotalaria burhia</i>	Dec to March	Oct to April	Aug to Dec
<i>Crotalaria linifolia</i>	Sept to Oct	Aug to Oct	Sept to Oct
<i>Crotalaria retusa</i>	Sept to Dec	Oct to Nov	Aug to Nov
<i>Croton bonplandianum</i>	Sept to Oct	Sept to March	July to March
<i>Cullen corylifolia</i>	Oct to Jan	Oct to Jan	Nov to Jan
<i>Cyperus pangorei</i>	July to Jan	Oct to Feb	Aug to Jan
<i>Desmodium gangeticum</i>	Sept to Nov	Aug to Nov	Aug to Oct
<i>Desmodium triflorum</i>	Sept to Dec	Sept to Nov	Aug to Nov
<i>Echinochloa colonum</i>	Sept to Feb	Sept to Feb	Aug to Feb
<i>Evolvulus nummularius</i>	Sept to Oct	Aug to Oct	Aug to March
<i>Exacum pedunculatum</i>	-	Sept to Oct	Aug to Oct
<i>Fimbristylis miliacea</i>	July to Jan	July to Oct	Aug to Nov
<i>Laportea interrupta</i>	Sept to Oct	Aug to Oct	Aug to Oct
<i>Gloriosa superba</i>	Sept to Nov	Sept to Nov	Aug to Oct
<i>Gnaphalium polycaulon</i>	Nov to April	Nov to April	Dec to March
<i>Hibiscus lobatus</i>	Sept to Jan	Aug to Oct	Aug to Oct

<i>Hoppea dichotoma</i>	Oct	Sept to Oct	Aug to Sept
<i>Hybanthus enneaspermus</i>	July to Feb	July to Sept	July to Jan
<i>Hydnlla verticillata</i>	Oct to April	Oct to April	Sept to Feb
<i>Hyptis suaveolens</i>	Sept to Feb	Sept to Feb	Aug to Jan
<i>Indigofera astragalina</i>	Aug to Nov	Aug to Nov	Aug to Oct
<i>Indigofera cordifolia</i>	Sept to Nov	Aug to Nov	Aug to Nov
<i>Indigofera linifolia</i>	Sept to March	Aug to Nov	Aug to Nov
<i>Indonessiella echioides</i>	Sept to Dec	Sept to Dec	Aug to Oct
<i>Ipomoea nil</i>	Aug to Nov	Aug to Nov	Aug to Jan
<i>Ipomoea sinensis</i>	Aug to Nov	Aug to Nov	Aug to Jan
<i>Jussiaea perennis</i>	Sept to Nov	Sept to Oct	Aug to Oct
<i>Kyllinga tenuifolia</i>	July to Jan	July to Jan	Aug to Dec
<i>Lagascea mollis</i>	May to Nov	July to Oct	Aug to Jan
<i>Leonotis nepetaefolia</i>	Oct to March	Oct to March	Sept to Jan
<i>Limnophila indica</i>	Sept to Feb	Sept to Feb	Aug to Dec
<i>Malachra capitata</i>	Oct to Dec	-	Aug to Nov
<i>Malvastrum coromandelianum</i>	Aug to Feb	Aug to Dec	Aug to Dec
<i>Martynia annua</i>	Sept to Nov	Sept to Nov	Aug to Oct
<i>Melanocenchns jacquemontii</i>	Aug to Sept	-	July to Sept
<i>Melilotus alba</i>	Jan to May	Jan to April	Dec to March
<i>Melochia corchorifolia</i>	Sept to Dec	Sept to Jan	Aug to Nov
<i>Merremia dentata</i>	Sept to Dec	Sept to Dec	Sept to Nov
<i>Neptunia triquetra</i>	Aug to Oct	Aug to Oct	July to Sept
<i>Nicotianan plumbaginifolia</i>	Oct to April	Oct to April	Dec to Feb
<i>Nothosaerva brachiata</i>	Oct to Dec	Oct to Feb	Oct to Feb
<i>Ocimum canum</i>	Sept to March	July to Oct	Aug to Dec
<i>Ocimum gratissimum</i>	Sept to March	Aug to Oct	Aug to Dec
<i>Orobanche cernua</i>	Dec to March	Jan to March	Jan to March
<i>Oryza rufipogon</i>	Sept to Jan	Aug to Oct	Aug to Nov
<i>Pavonia zeylanica</i>	Aug to May	Aug to Nov	Aug to Dec
<i>Pedaliium murex</i>	Aug to Oct	Aug to Oct	Aug to Sept
<i>Peristrophe bicalyculata</i>	Sept to May	Sept to Jan	Aug to Jan
<i>Perotis indica</i>	Aug to Nov	Aug to Nov	Aug to Dec
<i>Vigna trilobata</i>	Sept to Oct	Sept to Oct	Aug to Oct
<i>Physalis minima</i>	Aug to Feb	Aug to Dec	July to Dec
<i>Polygala erioptera</i>	July to Feb	July to Oct	Aug to Feb
<i>Polygonum plebeium</i>	Nov to June	Dec to April	Jan to April
<i>Rotala indica</i>	Oct to Nov	Oct to Nov	Nov to Jan
<i>Sclerocarpus africanus</i>	Aug to Oct	Aug to Oct	July to Oct
<i>Scheonoplectus articulatus</i>	Aug to April	Aug to Feb	Sept to March
<i>Setaria pallide-fusca</i>	August	Aug to Oct	Sept to Oct
<i>Setaria tomentosa</i>	Sept to April	Sep to April	Aug to Feb
<i>Setaria verticillata</i>	Sept to April	Sep to April	Sept to March
<i>Sida alba</i>	Aug to March	Aug to Dec	Aug to Nov
<i>Sonchus oleraceus</i>	Oct to Feb	Dec to March	Jan to March
<i>Sopubia delphinifolia</i>	Sept to Nov	Aug to Oct	Aug to Oct
<i>Sutera dissecta</i>	Oct to Dec	Nov to Jan	Dec to Feb
<i>Synedrella nodiflora</i>	-	Aug to Nov	Aug to Feb
<i>Tephrosia senticosa</i>	Aug to Nov	Aug to Nov	Aug to Oct
<i>Teramnus labialis</i>	Sept to Jan	Sept to Dec	Aug to Dec
<i>Tragus roxburghii</i>	-	Aug to Oct	July to Sept
<i>Tnumfetta rhomboidea</i>	Sept to Dec	Aug to Nov	Aug to Dec
<i>Urena lobata</i>	Aug to March	Aug to Dec	Sept to Jan
<i>Utricularia stellans</i>	Sept to March	Nov to Feb	Aug to Jan
<i>Waltheria americana</i>	Sept to Dec	Sept to Dec	Aug to Nov
<i>Xanthium strumarium</i>	Sept to May	Aug to March	Aug to Feb

There are two major changes with reference to the reproductive period. One is a change in the timing and the second one an alteration in the duration of reproductive period. By and large, the duration was curtailed.

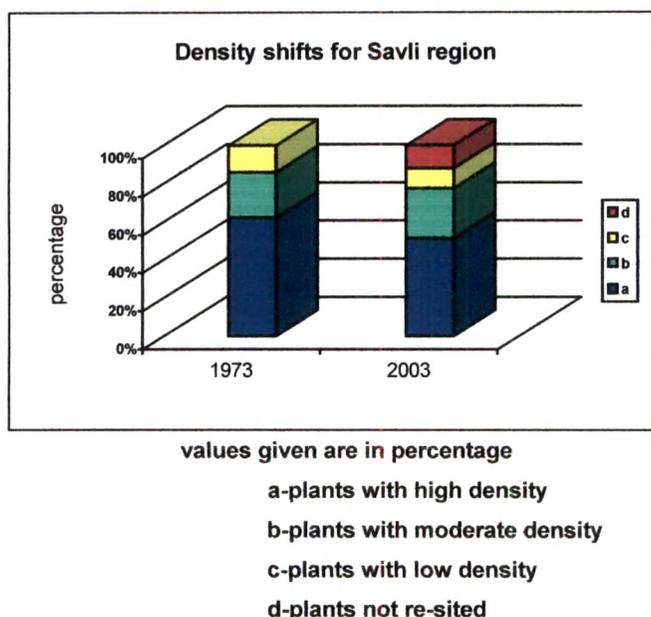
The list of plant species enlisted in the early records but not documented in 2001-2003 is given in Table (17).

b) Savli region

The floristic work of Savli region done in the year 1973 resulted in documentation of 441 wild herbaceous plant species amongst which 273 (61.90%) of plants were documented as occurring with high density in the region, 106 (24.04%) of plant species with moderate density and 62 (14.06%) of plants occurring with low density. The present study 2001-2003, compared to the records of 1973, 225 (51.02%) plants are documented with high density, 115 (26.08%) plants with moderate density, 45 (10.22%) with low density and 56 (12.70%) of plants were not re-sited.

A comparative graph of density shifts of herbaceous vegetation is given below.

Fig (P) -A comparative graph of density shifts of herbaceous vegetation in Savli region



The comparison of the reproductive phase and period mentioned in the year 1973 did not show any significant shift to that noted for year 2001-03.

The list of plant species enlisted in the early records but not documented in 2001-2003 is given in Table (18)

New records from Baroda and Environs

The study resulted in a report of 4 plant species which were new record for Baroda and environs. Of these, *Aeschynomene villosa* is a new record from India. Identity of the plant was confirmed from A revised handbook to the flora of Ceylon (Dassanayake & Fosberg, 1981). The list is given below in the Table (I). The details regarding the description, phenology, etc. is provided in the database

Table (I) -List of plant species reported as a new record for Baroda and environs

Papilionaceae	
1	<i>Aeschynomene villosa</i> Poir
Cucurbitaceae	
2	<i>Corallocarpus conocarpus</i> (D & G) Cl
3	<i>Cucumis prophetarum</i> L
Compositae	
4	<i>Centratherum phyllolaenum</i> (DC) Bth ex Cl

Herbarium comparison

Comparative study was initiated after the collection of first and second year's data of the study tenure. The selection criterion was based on focusing the plants that has shown remarkable decline in their densities as compared to earlier records (1967 & 1980). Phenological and morphological details of the selected plant species (2001-2003) were gathered. The plants were collected at their matured stage and preserved in the form of herbarium. These herbariums were then compared with the available herbariums of the past years (1960's and 1980's) of similar localities of Baroda region. The comparative photographs are taken at the same scale. A limitation was faced for the comparison with the data of Savli region due to unavailability of herbarium documentation for Savli region from the preserved collection. Even for the Baroda region, a constraint was faced in availability of entire collection of herbarium records of the past data.

Merremia tridentata

Merremia tridentata is a prostrate trailer. The plant is seen in occupying the habitat of wild land, agricultural hedges, ravines, etc. By comparing the past details with the present collection, variations were noted in flower number (Plate 1). Earlier records and herbarium specimens showed flowers either solitary or in a group of two growing at alternate nodes or at an interval of 2 – 3 nodes. Present ones had flowers growing at an interval of 5 to 6 nodes, mostly solitary. Correspondingly, there was a decline in the fruit number also. Comparison of flower size and floral parts dimensions did not show any significant variation. Similarly no change was noted in the size of fruit and seed size and texture of the seed of past and present year's plant.

Reproductive period got reduced by approximately 15-20 days.

Hibiscus lobatus

Hibiscus lobatus is an erect herb. The plant occupies wild and open land and at times noted in agriculture fields growing at the borders of crop fields. A decline in overall population was observed. Variations in the seed texture were observed (Plate 2). No variation was seen in the number of seeds per fruit. By comparing the seed number, size and texture of present herbarium specimen

with prior collected specimens, it was noted that in current specimens, of the total seeds observed per fruit, 34-43% of seeds showed shriveled texture and reduction in size. The size of all the seeds in the earlier herbarium was 2.3 mm in length and 1.5mm in width. Seeds of the specimens observed in (2000 – 03) got reduced by 1.88 mm in length and 1.22 mm in width. Shriveled seeds were much smaller (0.88 mm in length and 0.72 mm in width). No variation was observed in the size and number of flower and fruits. Dimensions of floral organs were also similar.

Asphodelus tenuifolius

Asphodelus tenuifolius is reported to be a dominant weed of the winter crops like wheat growing with close associates namely *Melilotus alba*, *Melilotus indica* and *Anagallis arvensis*. The life cycle of plants starts along with the winter crops getting germinated with the aid of irrigation water provided to the fields. Comparison of specimens showed variation in flower & fruit size and seed number of the plant (Plate 3a, 3b). The flower of earlier documented plant measured 6.0 – 7.0 mm in length whereas the dimension of recently documented plants was found to be 4.0 – 5.0 mm. Reduction in fruit size (diameter) was from 8.0 – 7.5 mm to 6.5 – 6.0 mm. Mature fruits of the former documented plant were noted bearing 6 seeds measuring 4.0 – 5.0 mm in length and 2.0 – 2.5 mm in width. Plants of (2001 – 03) had 3-5 seeds per fruit measuring about 2.8 – 3.6 mm length and 1.22 – 1.56 mm width. The reproductive period was noted getting preponed by 7 to 15 days. Reduction in reproductive period was observed.

Hoppea dichotoma

The plant belongs to family Gentianaceae. The status of the plant was mentioned as rare in Baroda region but found growing in good numbers at muddy banks at Timbi pond area. The recent exploration in the area concluded a reduction in density. By comparison with previous specimens, it was noted that the plants collected during 60's measured upto 15.0 – 14.5 cm in length and flowers were produced in lax dichotomous cymes in high number (Plate 4). The recently collected specimen showed a high decline in the flower number

and plant length. The plant length of currently collected plants was found within a range of 5.0 – 8.0 cm. The plants were collected in their matured state.

Exacum pedunculatum

Exacum pedunculatum belongs to family Gentianaceae. The plant was reported to be rare in the Baroda region (1980) but found growing in good numbers at Timbi pond area. The recent exploration in the area concluded a reduction in density. By comparing the herbarium specimens of early records of the same region it was noted that the current ones showed stunted growth and a high reduction in the branching pattern (Plate 5). The height of the plant of previous records was noted as 20.0 – 23.0 cm. The current ones measured 12.0 – 15.0 cm in length. The floral characteristics of the previous specimens depicted that the flowers were found growing in terminal, much-branched cymes. A reduction in flower number was noted in the current specimens. Hence, a reduction in fruit number was also noticed. Even the size of the flower has shown reduction compared to earlier records. Flowers of previous records measured upto 1.5 – 1.8 cm in length. The flower of current plants measured 0.82 – 1.11 cm in length.

Sutera dissecta

The plant belongs to family Scrophulariaceae. The plant was recorded rare in the area but found in moderate number at wet banks of rivers and ponds. Comparison of specimens current collection to the earlier records showed reduction in flower number (38 - 41%) and reduction in height and branching pattern (42 - 45%) of the plant (Plate 6). No variation was noted in the size of flower, fruit and seed number.

Biophytum sensitivium

The plant belongs to family Oxalidaceae. Plant was reported to be locally abundant in wet localities during monsoon. The recent exploration in the area concluded a reduction in density. By comparing the past details with the presently collected plants from the herbarium specimens, variations were noted in the overall appearance of plant and a decline in flower number and fruit number was prominently noted. The specimen of 1967 showed very healthy

appearance with 10-15 inflorescence crowded at the top of the plant (Plate 7). The plant measured 15.0 – 20.0 cm in length. The current specimens measured within the range of 10.0 – 14.0 cm (25-30% reduction) and showed a reduction in the inflorescence number per plant. The number of inflorescence got reduced to 5-7 per plant (40-45% reduction). No variation was noted in number of flower per inflorescence and the size of flower and fruit.

Tephrosia strigosa

The plant belongs to family Papilionaceae. The plant was reported (1967) to be common usually growing amongst the grasses during the monsoon. The recent exploration in the area concluded a reduction in density. By comparing the past details with the presently collected plants from the herbarium specimens, decline in fruit number (30 – 34%) was noted (Plate 8). Hence a decline in fruit number was noted. No variation was noted in flower size, fruit size and seed number compared to the past details.

Indonessiella echioides

The plant belongs to family Acanthaceae. Records of 1967 reported the plant to occur in not common status. The recent exploration in the area concluded a reduction in density. By comparing the past details with the current collection, a reduction (23 – 31%) was noted in the number of flowers per spike (Plate 9). The spike length of previously collected specimens measured 6.0-9.0 cm. The spike length in the present collection measures up to 4.0-5.5 cm. Flower size and fruit size did not show any significant variation.

Sopubia delphinifolia

The plant belongs to family Scrophulariaceae. Earlier records depict the plant to occur common on the grassy banks of ponds and in roadside marshes and on lawns. The recent exploration in the area concluded a reduction in density. By comparing the past details with the presently collected plants from the herbarium specimens, a decline was noted in the flower number and overall size of the plant (Plate 10). Plants of earlier record were seen to bear at least 15-25 axillary flowers per branch. The recent records has shown reduction in flower number. The flower number was reduced to 8-12 flowers per branch.

Even branch numbers has shown reduction (25-40%). Variation is not being noted in the flower, fruit size and seed number.

Cleome simplicifolia

The plant belongs to family Cleomaceae. The plant was reported to be rare in the Baroda region but found growing in good numbers at Harni and Timbi pond area. The recent exploration in the area concluded a reduction in density. By comparing the herbarium specimens of earlier records of the same region it was noted that the present collection showed stunted growth and a high reduction in the branching pattern was found. The height of the plant of earlier records was noted 22.0 – 25.0 cm (Plate 11) Current specimens measured 11.0 – 15.0 cm in length. A reduction in flower number was noted in the recently collected specimens compared to early records.

Clitoria biflora

Clitoria biflora belongs to family Papilionaceae. The plant was reported to grow abundantly in Laxmi Vilas Palace Compound area in 1967. The recent exploration in the area concluded a reduction in density. By comparing the past details with the presently collected plants from the herbarium specimens, variations was noted in the flower number (Plate 12). The herbarium specimen of past record showed flowers present at every axil of leaf. A reduction in flower number is observed in the collected in 2001-2002. The flower growth is observed at alternate or at an interval of 2-3 leaf axils. The flower size and fruit size did not show significant variation.

Sida alba

The plant belongs to family Malvaceae The status of the plant in 1967 was mentioned to be common in the area in close association with *Sida acuta*. The recent exploration in the area concluded a reduction in density. Comparison of specimens showed a decline in the flower number of the plant (Plate 13). Flowers in early specimens are found axillary and crowded at the end of branches in number of 5-8 per branch. Flowers of specimens collected in 2001-2003 are found to be axillary, solitary or in pairs. Even branching pattern showed reduction. This has resulted in overall reduction of flower number and

hence fruit number has shown reduction. No variation was noticed in the flower and fruit size.

Desmodium gangeticum

Desmodium gangeticum is an erect sturdy annual belonging to family Papilionaceae. The plant is distinguished in occupying the habitat of wild land, agricultural hedges, ravines, etc. By comparing the past details with the presently collected plants from the herbarium specimens, variations were noted in seed number of pod (Plate 14). Earlier records and herbarium specimens show pods with 6-8 seeds of healthy nature. Pods of the plants observed (2000-03) had some of the seeds which show shriveled nature. Comparison of flower size and floral parts dimension did not show any significant variation.

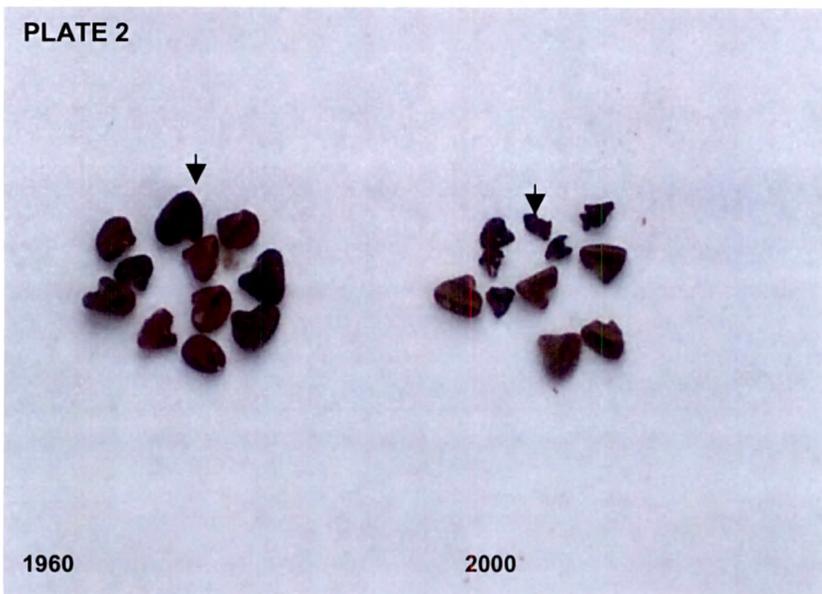


Plate 1-Herbarium specimens of *Merremia tridentata* showing variation in flower number of years 1960 & 2000

Plate 2-Seed size variation in *Hibiscus lobatus* of years 1960 & 2000

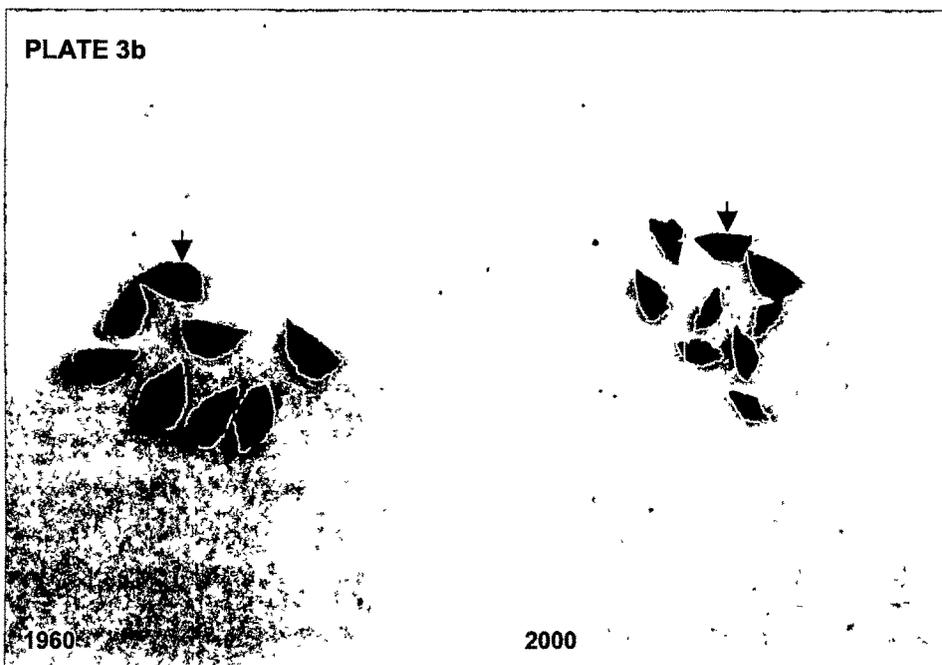
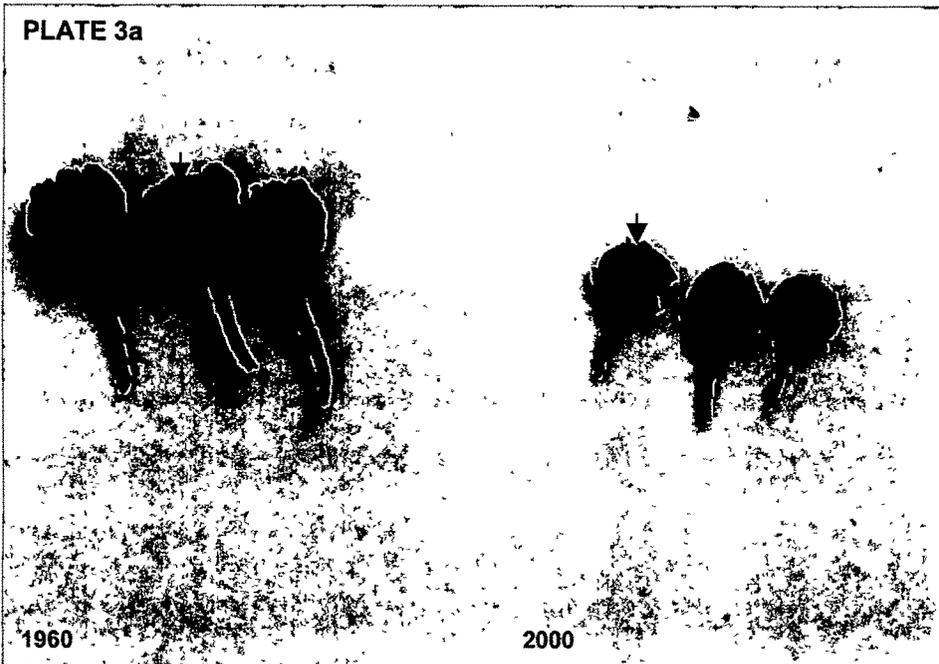


Plate 3a-Fruit size variation in *Asphodelus tenuifolius* of years 1960 & 2000

Plate 3b-Seed size variation in *Asphodelus tenuifolius* of years 1960 & 2000

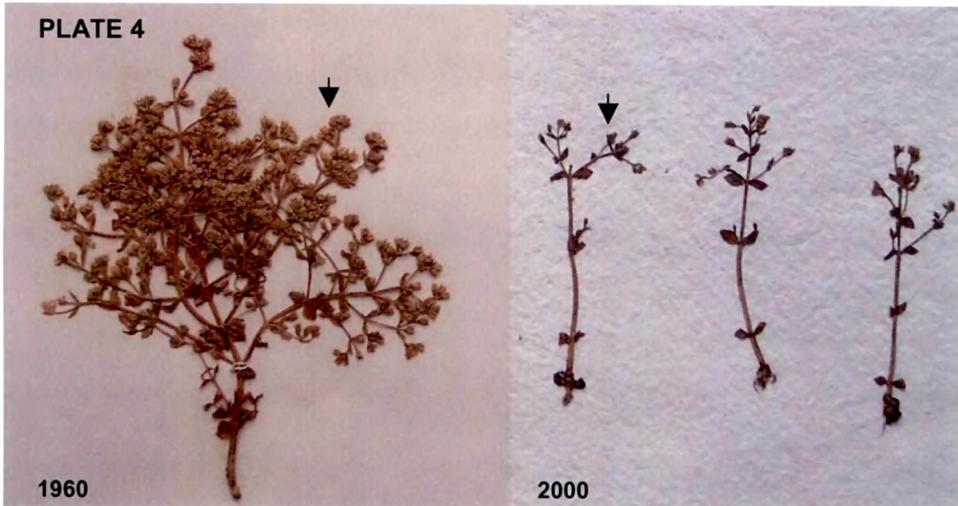


Plate 4-Herbarium specimens of *Hoppea dichotoma* showing variation in flower number and plant height of years 1960 & 2000

Plate 5-Herbarium specimens of *Exacum pedunculatum* showing variation in flower number and plant height of years 1980 & 2000

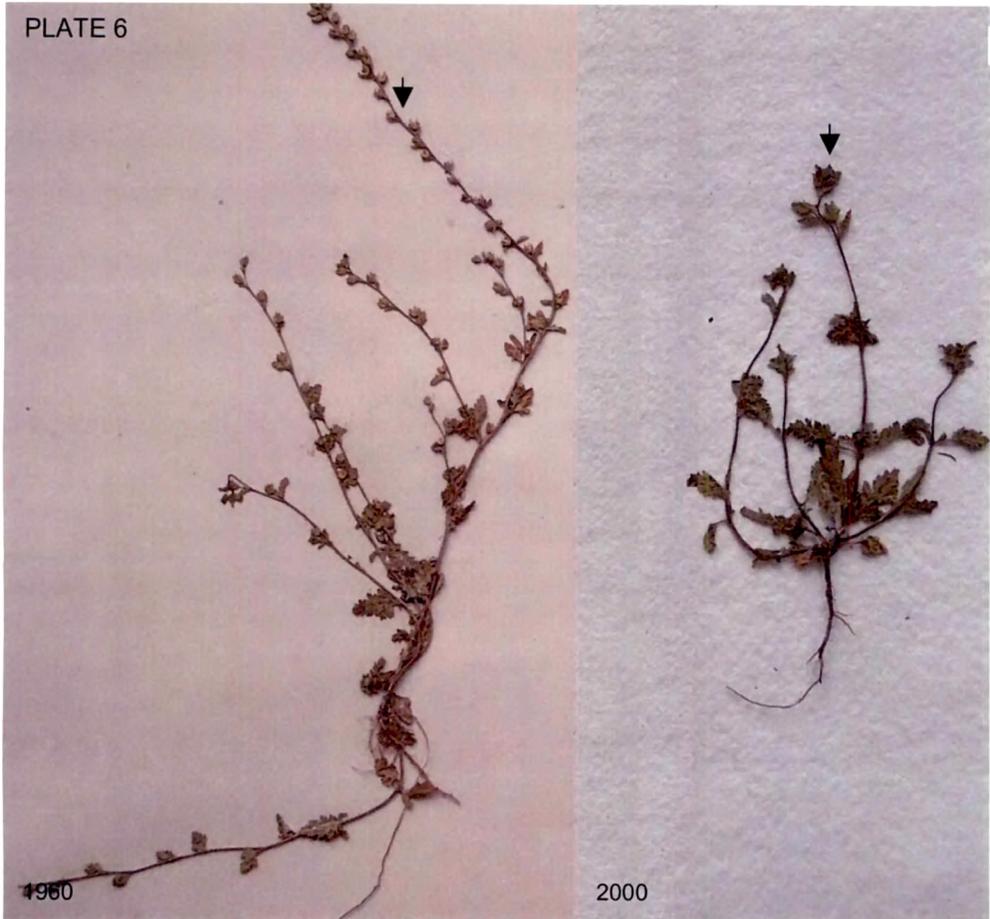


Plate 6-Herbarium specimens of *Sutura dissecta* showing variation in flower number and plant height of years 1960 & 2000

Plate 7-Herbarium specimens of *Biophytum sensitivium* showing variation in inflorescence number and plant height of years 1960 & 2000

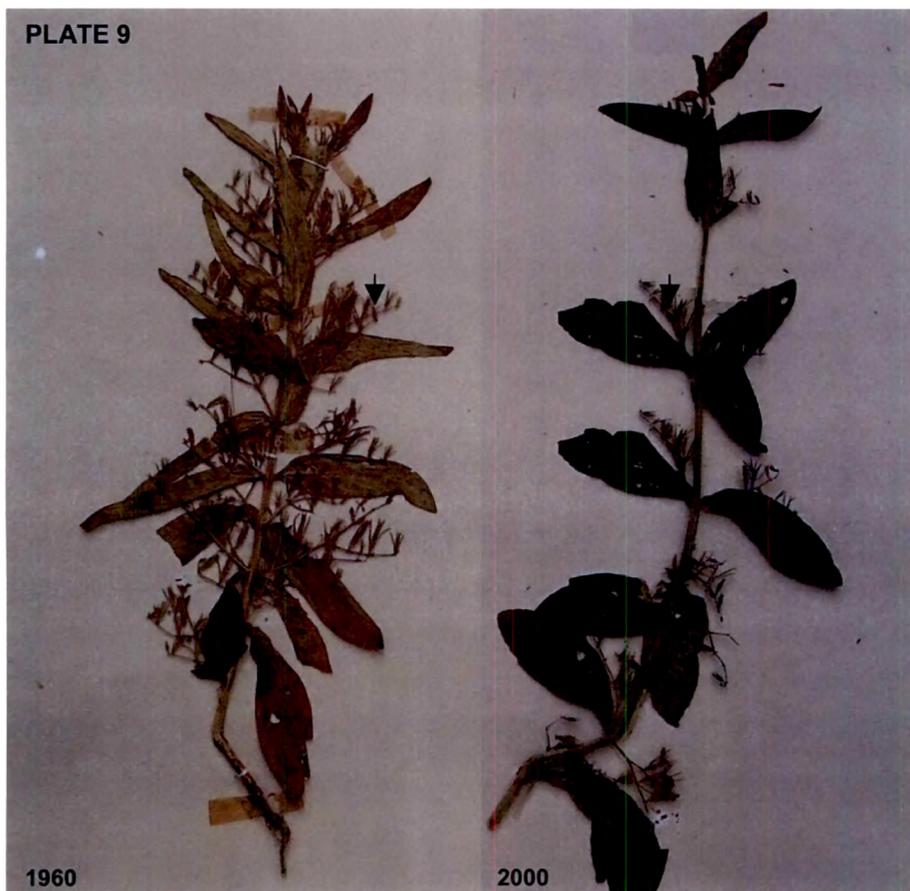
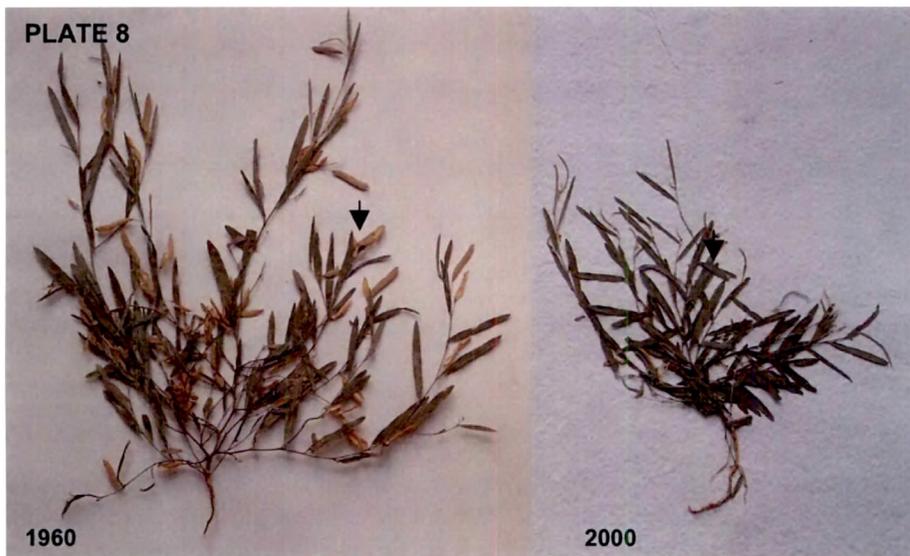


Plate 8-Herbarium specimens of *Tephrosia strigosa* showing variation in fruit number of years 1960 & 2000

Plate 9-Herbarium specimens of *Indoneesiella echioides* showing variation in spike length and flower number of years 1960 & 2000

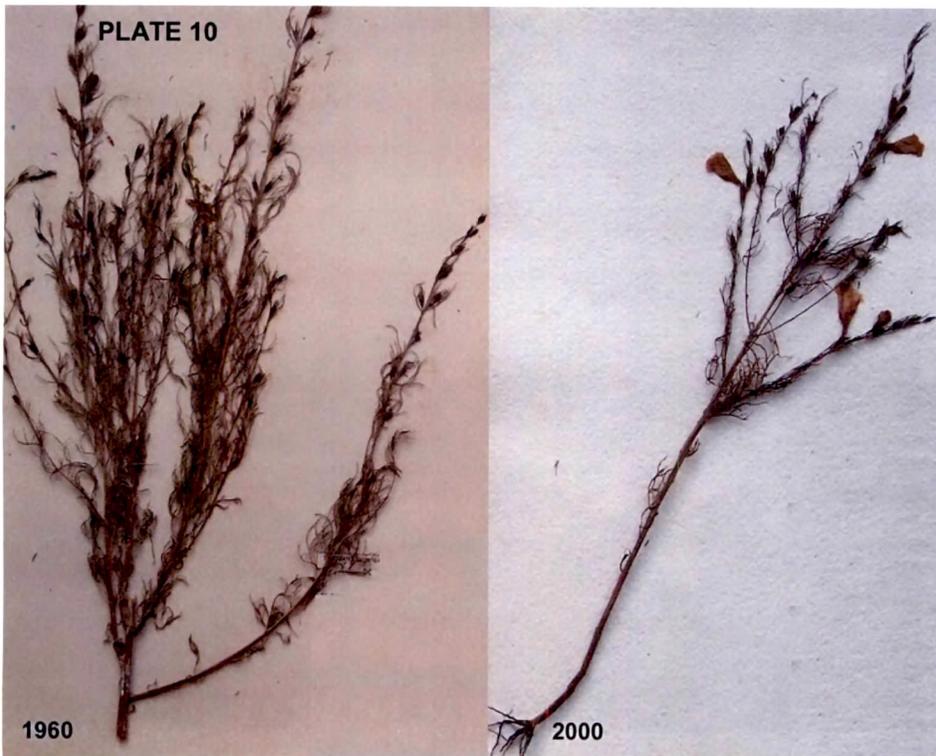


Plate 10-Herbarium specimens of *Sopubia delphinifolia* showing variation in flower number and plant height of years 1960 & 2000

Plate 11-Herbarium specimens of *Cleome simplicifolia* showing variation in plant height of years 1960 & 2000



Plate 12-Herbarium specimens of *Clitoria biflora* showing variation in flower number of years 1960 (flowers present at each node) & 2000 (flowers present at an interval of 3-4 nodes)

Plate 13-Herbarium specimens of *Sida alba* showing variation in flower number of years 1960 & 2000

PLATE 14



Plate 14-Pods of *Desmodium gangeticum* showing variation in seed number per pod of years 1960 & 2000