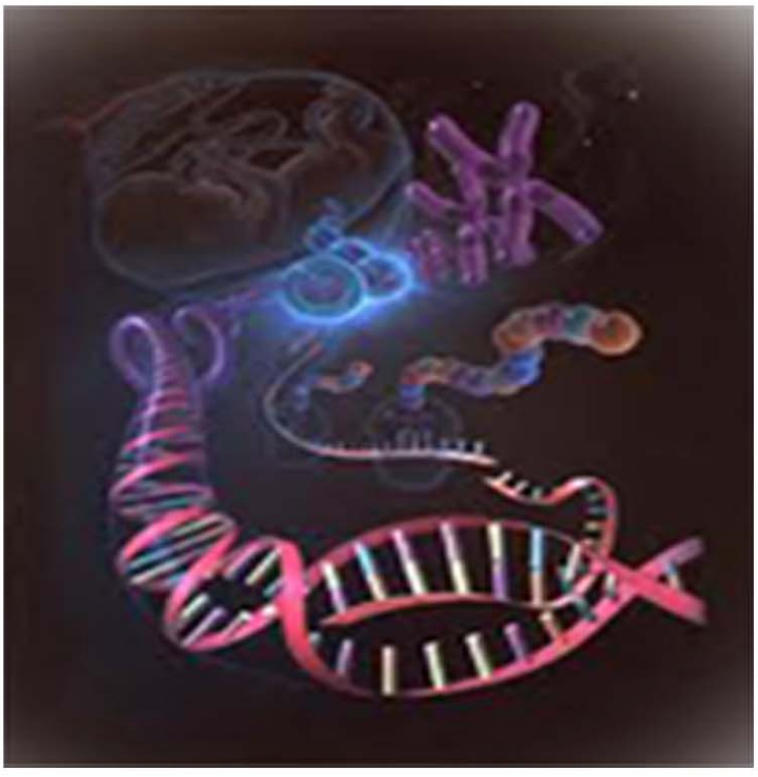
IJLBPR

ISSN 2250 - 3137
Vo1. 2, No. 2, April 2013

International Journal of

Life Sciences Biotechnology and Pharma Research



International Journal of Life Sciences Biotechnology and Pharma Research
Hyderabad, INDIA

www.ijlbpr.com

Email : editorijlbpr@gmail.com or editor@ijlbpr.com

International Journal of Life Sciences Biotechnology and Pharma Research

ISSN 2250-3137 www.ijlbpr.com
Vol. 2, No. 2, April 2013

Research Paper

VEGETATION ANALYSIS AT BANDIYABEDI FOREST IN SURENDRANAGAR DISTRICT OF GUJARAT STATE OF INDIA

N B Parejiya[1*], S S Detroja[1] and N S Panchal[1]

Corresponding Author:* ***N S Panchal,* ✉ *dr_nilesh_panchal@yahoo.co.uk*

Tree vegetation of Bandiyabedi forest of Surendranagar district in Gujarat state of India was quantitatively analyzed. *Acacia senegal, Acacia leucophloea, Acacia catechu* and *Prosopis specigera* were dominant tree species while *Bauhinia racemosa, Anogeissus latifolia and Adansonia digitata* were with minimum IVI value at different study sites. The composition of tree layer was markedly similar among various sites. Diversity index is minimum at site 3 on density, basal cover and IVI basis. Concentration of dominance was higher at site 3 on density and IVI basis and at site 4 on basal cover basis and lower at site 3 on density, basal cover and IVI basis. The total basal cover was ranged from 235 to 443 cm^2 100 m^{-2} for tree.

Keywords: Bandiyabedi forest, Total basal cover, IVI, Concentration of dominance, Diversity index

INTRODUCTION

The plant community of a region is a function of time; however, altitude, slope, latitude, aspect, rainfall and humidity play a role in the formation of plant communities and their composition (Kharkwal *et al*., 2005). Variation in species diversity along environmental gradient is a major topic of ecological investigation and has been explained by reference to climate, productivity, biotic interaction, habitat heterogeneity and history (Givnish, 1999; Willig *et al*., 2003; Currie and Francis, 2004; Gonzalez-Espinosa *et al*., 2004; Qian and Ricklefs, 2004). The high rate of extinction of tropical species is aggravated by the conversion of forest land for agriculture, harvesting non timber forest products, extraction of mature trees, collecting fuel wood and plantations which threatens to erode the biodiversity seriously (Mishra *et al*., 2004, Laloo *et al.,* 2006). As understanding of forest structure is pre-requisite to describe various ecological processes and also to model the functioning and dynamics of forest (Elouard *et al.,* 1997; Sukumar *et al.,* 1992), the aim of the present study is to generate quantitative information on analytical characters, tree diversity and regeneration status

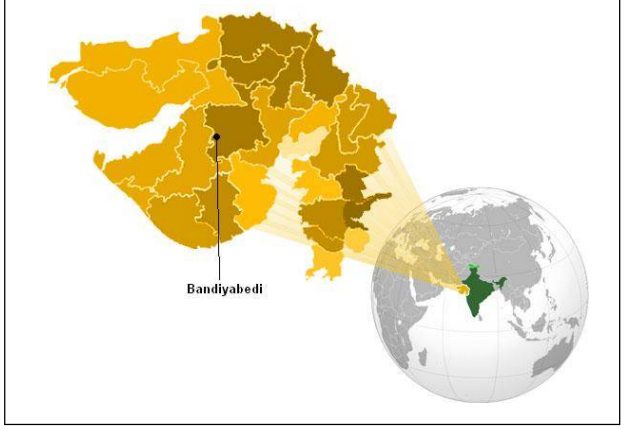
[1] Department of Biosciences, Saurashtra University, Rajkot-360005, India.

of Bandiyabedi (Mandav) scrub forest. Tropical forests constitute the most diverse plant communities on earth.

STUDY AREA

The study area Bandiyabedi (Figure 1) is about 9 km North of Than (22° 312 323 N lat. and 71° 112 043 E long) on the way to Wankaner to Than in Surendra Nagar district of Gujarat State, in the Western India. Fore forests sites were earmarked for the present study, i.e., forest site 1, site 2, site 3 and site 4. The forest is locally known as Mandav vidi. This forest spreads in big area of about 1843 ha and lacks quantitative details of its vegetation. The climate of the area is monsoonal with warm moist summer and cool dry winter. The mean maximum temperature varied from 39 °C (May) and the mean minimum temperature ranged from 15 °C (January). The annual rainfall is 1198 mm in 2011, out of which 95% occurs during the rainy season. In general, the eco-climate of the forest locality is of semi-arid type (Pandey *et al.,* 1977). The average relative humidity of air varied between 20-30% in past July to October.

Figure 1: Map of Gujarat Showing Location of Study Area



MATERIALS AND METHODS

For the study of plant biodiversity the selected sites were divided roughly into four parts. Each part was sampled using 25 (10 x 10 m) randomly laid quadrates. From each quadrate sample species of trees, shrubs and herbs were collected and identified. The vegetation analysis was conducted during October. A total of 25 (10 x 10 m) quadrates for trees, or shrubs and 1 x 1 m for herbs were laid. Quadrate data were used for computation of analytical features such as density, frequency, abundance, A/F ratio, basal cover and Importance Value Index (IVI), following standard phytosociological methods as given by Curtis and McIntosh (1950). Diameter at breast height (dbh at 1.37 m from the ground) of all the trees with >30 cm circumference in each quadrate was measured and recorded for each species. The IVI for the tree species was determined as the sum of the relative density, relative frequency and relative dominance (Curtis; 1959). The ratio of abundance to frequency for different species was determined for eliciting the distribution patterns (Curtis and Cottom, 1956). The tree species diversity was determined by using Shannon-Wiener information function (H') (Shannon and Wiener, 1963). Concentration of dominance was measured by Simpson's index (Simpson, 1949). Similarity index was determined by as per formula given by Sorenson (1948).

RESULTS AND DISCUSSION

In forest site 1, only one species were recorded, of which highest density, frequency and IVI was recorded for *Acacia senegal* (Table 1). *Phoenix dactylifera* exhibited maximum MBC, due to low values of RD and RF, its IVI lower then *Acacia senegal* and *Acacia catechu*. On the basis of IVI value, *P. dactylifera* appeared second dominant species. *Acacia leucophloea* and *Bauhinia racemosa* had lowest value of IVI among all species.

Table 1: Analysis of Bandiyabedi Forest Only Tree ≥ 31.5 cm CBH are Considered in this Table

S. No.	Species	Frequency %	Density (tree 100 m^{-2} ±1SE)	Abundance (trees 100 m^{-2})	A/F	Mean Basal area (cm^2 $tree^{-1}$)	Total Basal Cover (cm^2 100 m^{-2} ±1SE)	Relative Frequency %	Relative Density %	Relative Dominance %	Importance Value Index IVI
1.	*Acacia senegal(L.) Willd*	56	1.00 ± 0.37	1.79	0.03	101.54	101.54 ± 19.42	30.43	35.71	22.92	89.07
2.	*Tarminalia tomentosa T.*	12	0.24 ± 0.07	2.00	0.17	157.85	37.88 ± 15.28	6.52	8.57	8.55	23.65
3.	*Phoenix dactylifera L.*	36	0.56 ± 0.10	1.56	0.04	344.91	193.15 ± 34.37	19.57	20.00	43.60	83.17
4.	*Acacia catechu Willd (L.) wild oliv*	44	0.60 ± 0.34	1.36	0.03	81.41	48.85 ± 11.81	23.91	21.43	11.03	56.37
5.	*Prosopis specigera,L.*	12	0.12 ± 0.07	1.00	0.08	325.98	39.12 ± 17.69	6.52	4.29	8.83	19.64
6.	*Acacia leucophloea (Roxb) Willd*	12	0.16 ± 0.08	1.33	0.11	100.56	16.09 ± 5.04	6.52	5.71	3.63	15.87
7.	*Bauhinia racemosa Lam*	12	0.12 ± 0.05	1.00	0.08	52.81	6.34 ± 3.92	6.52	4.29	1.43	12.24
	Total		**2.80**						**442.96**		
1.	*Acacia senegal(L.) Willd*	52	0.80 ± 0.34	1.54	0.03	107.52	86.02 ± 27.97	30.95	32.26	31.05	94.26
2.	*Tarminalia tomentosa T.*	12	0.16 ± 0.05	1.33	0.11	400.56	64.09 ± 10.24	7.14	6.45	23.14	36.73
3.	*Acacia catechu Willd (L.) wild oliv*	36	0.48 ± 0.14	1.33	0.04	96.69	46.41 ± 15.23	21.43	19.35	16.75	57.54
4.	*Acacia leucophloea (Roxb) Willd*	36	0.60 ± 0.19	1.67	0.05	37.08	22.25 ± 8.19	21.43	24.19	8.03	53.65
5.	*Prosopis specigera,L.*	20	0.32 ± 0.11	1.60	0.08	163.69	52.38 ± 16.89	11.90	12.90	18.91	43.72
6.	*Bauhinia racemosa Lam*	12	0.12 ± 0.05	1.00	0.08	48.81	5.86 ± 1.77	7.14	4.84	2.11	14.10
	Total		**2.48**						**277.00**		
1.	*Acacia senegal(L.) Willd*	48	0.84 ± 0.27	1.75	0.04	118.46	99.51 ± 35.41	34.29	42.86	42.26	119.40
2.	*Acacia catechu Willd (L.) wild oliv*	40	0.48 ± 0.23	1.20	0.03	134.41	64.52 ± 20.06	28.57	24.49	27.40	80.46
3.	*Acacia leucophloea (Roxb) Willd*	24	0.28 ± 0.12	1.17	0.05	106.66	29.86 ± 8.96	17.14	14.29	12.68	44.11
4.	*Prosopis specigera,L.*	16	0.16 ± 0.07	1.00	0.06	184.09	29.45 ± 7.47	11.43	8.16	12.51	32.10
5.	*Anogeissus latifolia Roxb ex DC*	12	0.20 ± 0.08	1.67	0.14	60.56	12.11 ± 3.19	8.57	10.20	5.14	23.92
	Total		**1.96**						**235.45**		
1.	*Acacia senegal(L.) Willd*	56	1.00 ± 0.28	1.79	0.03	173.4	173.40 ± 54.04	36.84	47.17	55.07	139.08
2.	*Acacia catechu Willd (L.) wild oliv*	28	0.28 ± 0.05	1.00	0.04	130.27	36.48 ± 5.66	18.42	13.21	11.58	43.21
3.	*Acacia leucophloea (Roxb) Willd*	20	0.24 ± 0.06	1.20	0.06	73.69	17.69 ± 5.76	13.16	11.32	5.62	30.10
4.	*Prosopis specigera,L.*	12	0.16 ± 0.03	1.33	0.11	98.6	15.78 ± 4.57	7.89	7.55	5.01	20.45
5.	*Adansonia digitata L.*	8	0.08 ± 0.03	1.00	0.13	259.6	20.77 ± 7.16	5.26	3.77	6.60	15.63
6.	*Anogeissus latifolia Roxb ex DC*	16	0.24 ± 0.05	1.50	0.09	74.81	17.95 ± 5.45	10.53	11.32	5.70	27.55
7.	*Bauhinia racemosa Lam*	12	0.12 ± 0.02	1.00	0.08	273.38	32.81 ± 7.66	7.89	5.66	10.42	23.97
	Total		**2.12**						**314.87**		

At forest site 2 *A. senegal* was recorded highest density, frequency, TBC, RD, RF and IVI. and *B. racemosa* had lowest value of IVI, RD, RF and TBC among all species. *A. leucophloea and A. catechu* appeared next dominant species.

P. specigera exhibited maximum MBC, due to low value of RD and RF, Its IVI value is lower than *A. senegal, A. leucophloea* and *A. catechu.* Whereas *A. latifolia* exhibited minimum RF among all species. *A. senegal,* had maximum IVI, due to high value of RD and RF, although MBC was lowest for this species. *P. specigera* had lowest value of IVI among all species at site 3.

At site 4 *B. monosperma* exhibited maximum value of MBC, but its lower RD, RF and IVI then *A. senegal, A. catechu, A. leucophloea, P. specigera, A. latifolia.* Whereas *A. digitata* exhibited minimum RD, RF, and IVI among all species.

The value of diversity index in the present study ranged from 0.626 to 0.736 on IVI basis (Table 2). The diversity index is generally higher in tropical forests, which is reported as 5.06 and 5.40 for young and old stand respectively (Knight; 1975), whereas for Indian forests it ranged between 0.83 to 4.1 (Parthasarathy *et al.,* 1992; Singh *et al.,* 1984; Visalakshi, 1995) and between 1.16 to 3.40 for temperate forest (Braun 1950; Monk 1967; Pandey *et al.,* 1996; Singhal *et al,.* 1986). The value of diversity index of the present study, therefore, lies within the range reported for tropical forests. The low species diversity suggests for conservation of biodiversity because the dry regions of Gujarat state of India is vulnerable to desertification (Pandey *et al.,* 1999).

The concentration of dominance of the present study sites ranged from 0.181 to 0.233 on IVI basis (Table 2). According to Whittaker and Niering (1965); Risser and Rice (1971); Singhal *et al.* (1986) and Pandey *et al.* (1996), the value of Concentration of Dominance (CD) for temperate forests falls within the range of 0.10 to 0.99; however, for tropical forests the average value is 0.06 as reported by Knight (1975). The range of CD reported for tropical forest of India varies from 0.285 to 0.328 on IVI basis. The value reported in present study corresponds well with the reported range for tropical forest by Panchal and Pandey (2004). The concentration of dominance on density basis was highest at site 3 and lowest at site 2, on cover basis highest at site 4 and lowest at site 2 and on IVI basis highest at site 3 and lowest at site 1. Risser and Rise (1971) have

Table 2: Number of Species, Diversity Index ($\overline{H}$) and Concentration of Dominance (cd) for Tree Species of Forest

Site	No. of Species	Diversity Index ($\overline{H}$)			Concentration of Dominance (cd)		
		On Density	On Basal Cover Basis	On IVI Basis	On Density	On Basal Cover Basis	On IVI basis
1	7	0.7226	0.6725	0.7361	0.2278	0.2715	0.2153
2	6	0.7008	0.6949	0.7252	0.2232	0.2207	0.2059
3	5	0.6180	0.6051	0.6264	0.2811	0.2881	0.2698
4	7	0.6933	0.6376	0.7055	0.2759	0.3408	0.2679

Table 3: Similarity Index of Trees Species at Forest Sites

	Site 1	Site 2	Site 3	Site 4
Site 1	100	92.3	66.7	57.1
Site 2		100	72.72	61.53
Site 3			100	83.33
Site 4				100

reported values for concentration of dominance for certain temperate vegetation; these range between 0.10 to 0.99. For a tropical forest Knight (1975) reported an average value of 0.06. The value of concentration of dominance was between 0.30 and 0.43 on density basis, 0.22 and 0.52 on cover basis and 0.28 and 0.33 on IVI basis in the scrub forest (Panchal and Pandey, 2004). These relativity high values for concentration of dominance are in accordance with low species diversity at the studied scrub forest because species diversity ($\bar{H}$) behaves inversely to the index of dominance (Odum, 1971).

The similarity index between four forest tree species site is more than 50%. Most similar plant shown in site 1 with site 2, but site 1 and site 4 had lowest similarity index value (Table 3). *A.catechu, P. specigera, A. senegal* is the most common species shown in this forest.

CONCLUSION

In conclusion, different tree species were predominant at different forest sites. The dominant tree species were *A. senegal, A. leucopholea, A. catechu* and *P. specigera.* Total tree species at the forest sites were merely 5 to 7. These tree species grow naturally on moisture and nutrient deficient soils in saurashtra region and also in other parts of western India. The values of diversity index and concentration of dominance do not fall in the range of values reported for tropical forests. This low value, with further human activity leads easily degradation of forest and vulnerable to desertification and suggests sustainable use and conservation of biodiversity.

REFERENCES

1. Braun E L (1950), *The Ecology of the Forest of Eastern North America, their Development, Composition and Distribution. Deciduous Forest of Eastern North America*, McGraw Hill, New York - Blakiston.
2. Curtis J T (1959), *The Vegetation of Wisconsin*, *An Ordination of Plant Communities*, University Wisconsin Press, Madison, Wisconsin.
3. Curtis J T and Cottom G (1956), *Plant Ecology Work Book. Laboratory Field Reference Manual*, Burgess Publishing, Minnesota Co.
4. Curtis J T and McIntosh R P (1950), The "Interrelations of Certain Analytic and Synthetic Phytosociological Characters", *Ecology,* VOl. 31, No. 434-455.
5. Currie D J and Francis A P (2004), "Regional versus Climate Effect on Taxon Richness in Angiosperms: Reply to Qian and Ricklefs", *American Naturalist*, Vol. 163, pp. 780-785.
6. Elouard C, Pascal J P, Pelissier R, Ramesh

B R, Houllier F, Durand M, Aravajy S, Moravie M A and Gimaret-Carpentier C (1997), "Monitoring the sTructure and Dynamics of a Dense Moist Evergreen Forest in the Western Ghats (Kodagu District, Karnataka, India)", *Tropical Ecology*, Vol. 38, pp. 193-214.

7. Givnish T J (1999), "On the Causes of Gradients in Tropical Tree Diversity", *J. Ecol.,* Vol. 87, pp. 193-210.

8. Gonzalez-Espinosa M, Rey-Benayas J M, Ramirez-Marcial N, Huston M A and Golicher D (2004), "Tree Diversity in the Northern Neotropics: Regional Patterns in High Diverse Chiapas, Mexico", *Ecography*, Vol. 27, pp. 741-756.

9. Kharkwal G, Mehrotra P, Rawat Y S and Pangtey Y P S (2005), "Phytodiversity and Growth Form in Relation to Altitudinal Gradient in the Central Himalayan (Kumaun) Region of India", *Current Science*, Vol. 89, No. 5, pp. 873-878.

10. Knight D H (1975), "A Phyto-Sociological Analysis of Species Rich Tropical Forest on Barro-Colorado Island: Panama", *Ecological Monograph,* Vol. 45, pp. 259-289.

11. Laloo R C, Kharlukhi L, Jeeva S and Mishra B P (2006), "Status of Medicinal Plants in the Disturbed and the Undisturbed Sacred Forests of Meghalaya, Northeast India: Population Structure and Regeneration Efficacy of Important Tree Species", *Current Science,* Vol. 90, pp. 225-232.

12. Mishra B P, Tripathi O P, Tripathi R S and Pandey H N (2004), "Effect of Anthropogenic Disturbance on Plant Diversity and Community Structure of a Sacred Grove in Meghalaya, Northeast India", *Biodiversity and Conservation,* Vol. 13, pp. 421-436.

13. Odum E P (1971), *Fundamentals of Ecology*, W.B. Saunders Co. Philadelphia.

14. Panchal and Pandey (2004), "Analysis of Vegetation of Rampara Forest in Saurashtra Region of Gujarat State of India", *Tropical Ecology,* Vol. 45, No. 2, pp. 223-231.

15. Pande P K, Negi J D S and Sharma S C (1996), "Plant Species Diversity and Vegetation Analysis in Moist Temperate Himalayan Forests*",* A*bstracted in First Indian Ecological Congress*, New Delhi, Dec. 27-31 , 1996.

16. Pandey A N, Parmar T D and Tanna S R (1999), "Desertification: A Case Study from Saurashtra Region of Gujarat State of India", *Tropical Ecology,* Vol. 40, pp. 213-220.

17. Pandeya S C, Sharma S C, Jain H K, Pathak S J, Paliwal K C and Bhanot V M (1977), *The Environment and Cenchrus Grazing Lands in Western India: An Ecological Assessment*, p. 451, US PL 480 Project Report, Rajkot, India.

18. Parthasarathy N, Kinbal V and Kumar L P (1992), "Plant Species Diversity and Human Impact in the Tropical Wet Evergreen Forests of Southern Western Ghats. Indo-french Workshop On Tropical Forest Ecosystem", *Natural Functioning and Anthropogenic Impact*, French Institute, Pondichery.

19. Qian H and Ricklefs R E (2004), Taxon Richness and Climate in Angiosperms: Is There a Globally Consistent Relationship

That Precludes Region Effect?", *American Naturalist,* Vol. 163, pp. 773-779.

20. Risser P G and Rice E L (1971), "Diversity in Tree Species in Oklahoma Upland Forests", *Ecology,* Vol. 52, pp. 876-880.

21. Shannon C E and Wiener W (1963), *The Mathematical Theory of Communication*. University of Illinois Press, Urbana.

22. Simpson E H (1949), "Measurement of Diversity", *Nature,* Vol. 163, p. 688.

23. Singh J S, Rawat Y S and Chaturvedi O P (1984), "Replacement of Oak Forest with Pine in the Himalaya Affect the Nitrogen Cycle, *Nature,* Vol. 311, pp. 54-56.

24. Singhal R M, Rawat V R S, Kumar P, Sharma S D and Singh H B (1986), "Vegetation Analysis of Woody Species of Some Forest of Chakarta Himalaya, India", *Indian Forester,* Vol. 112, pp. 819-823.

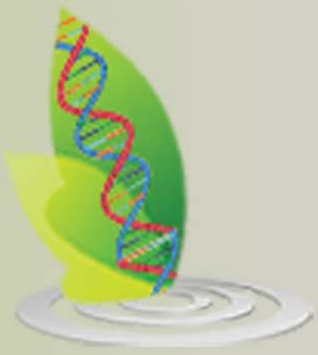
25. Sukumar R, Dattaraja H S, Suresh H S, Radhakrishna J, Vasudeva R, Nirmala S R and Joshi N V (1992), "Long Term Monitoring of Vegetation in a Tropical Deciduous Forest in Mudumalai, Southern India", *Current Science,* Vol. 62, pp. 608-616.

26. Sorensen T (1948), "A Method of Establishing Groups of Equal Amplitude in Plant Sociology Based on Similarity of Species Content", *Dent Kong Dansk Vindensk*. (Copenhegen), Vol. 5, pp. 1-34.

27. Visalakshi N (1995), "Vegetation Analysis of Two Tropical Dry Evergreen Forest in Southern India", *Tropical Ecology,* Vol. 36, pp. 117-127.

28. Whittaker R H and Niering W A (1965), "Vegetation of the Santa Catalina Mountains. II. A Gradient Analysis of the South Slopes", *Ecology,* Vol. 45, pp. 429-452.

29. Willig M R, Kaufman D M and Stevens R D (2003), "Latitudinal Gradients of Biodiversity: Pattern Process, Scale and Synthesis", *Annu. Rev. Eco. Evol. Sys.*, Vol. 34, pp. 273-30.



International Journal of Life Sciences Biotechnology and Pharma Research
Hyderabad, INDIA. Ph: +91-09441351700, 09059645577
E-mail: editorijlbpr@gmail.com or editor@ijlbpr.com
Website: www.ijlbpr.com

ISSN 2250-3137
02
9 772250 313001