INTERNATIONAL JOURNAL OF ANTHROPOLOGY Vol. 4, n. 4: 255-268, 1989

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Genetic structure of a tribal population: 1. Breeding isolation among the Yanadis

Extent of breeding isolation was estimated by two different sources among the Yanadi tribe, who inhabit different geographical regions and show wide cultural differences.
The estimate based on marriage frequency shows the formation of more or less well defined regional breeding populations, whereas the estimate based on surname frequency indicates past migration, gene flow and common affinity between regional populations. Both the sources consistantly show the process of fission, but the surnames are more useful and advantageous in defining the breeding isolation among the Yanadis.

Key Words: The Yanadi tribe. Breeding Isolation. Marriage Frequency. Surname analysis.

A few human populations, by virtue of their unique setup in their eco-cultural milieu, provide unusual advantages for investigating some of the key-issues in human population genetics. Some of the multipurpose studies (HIERNAUX, 1956; LIVINGSTONE, 1961; NEEL et al., 1964; Friedlaender *et al.*, 1971; Neel, 1972) have revealed the nature and tempo of genetic divergence and opened up a series of hypotheses and generalizations on the origin and mechanism of such wide genetic divergence. The validity of these hypotheses about the maintenance of diversity has been substantiated in a few studies (FIX, 1975a, b; FLEISHMAN, 1980 and several of the results remain unverified, unclarified due to the fast disappearance of such primitive groups nowadays.

In this context the tribal population Yanadi, provide many features, especially, wide geographical distribution and isolation, differences in subsistence pattern and other associated cultural traits, common ethnohistorical origin which are suitable to investigate the process of genetic differentiation in relation to cultural differentiation in different geographical regions. Therefore, a multipurpose study was undertaken so as to quantify the breeding structure and to study biological implications and microgenetic differentiation. It is planned to bring out the results of the investigation in a series of publications. In this section, a brief description of the population, settlement pattern and breeding isolation is given which will help in understanding the observed micro-differentiation in anthropometric (VASULU & PAL, 1988, 1989), dermatoglyphic and genetic parameters in a series of papers on the Yanadis.

Population

Distribution

The Yanadis are the second largest tribal population of the state of Andhra Pradesh (A.P.) India. There are about 239 thousand Yanadis (CENSUS, 1971), coexisting along with other «caste» populations of the villages and towns mainly in southern districts of A.P. Nearly fifty per cent of them are found in Nellore district and 28 per cent in Chittoor, Guntur and Prakasam districts.

Two recognised endogamous groups of the Yanadis exist: 1. The Challa and 2. the

ISSN 0393-9383

Manchi Yanadis. The Challa Yanadis are even today nomadic and feed on refuge materials and are considered «inferior». They neither interdine, intermarry nor intermix with the Manchi Yanadis' (RAGHAVAIAH, 1962). There are no written records available on the distribution of the Challa Yanadis and the present field investigation suggests that they are confined to Nellore district (A.P.). From the enquiries it appears that the word «Challa» means the «fermented rice» in local language Telugu, which these tribal people cherish as a staple food item even today. They still retain their traditional pattern of life style that can be noticed from their food habits, house types — low conical huts without the support of the mud wall. The Manchi (which means «good» in Telugu language) Yanadis are «superior» in the sense that they are settled mostly as agricultural labourers in the villages and are rapidly changing in tune with the other «caste» populations.

Origin

The earliest reference of the Yanadi tribe can be traced as early as from the period of Vijayanagara Kings (1600 AD), the famous Hindu empire in the Deccan, during the fall of the Moghul kingdom in North. There were no available written records from which we can know about the origin and historical migration of the Yanadis. The earlier ethnographers were of the opinion that they were the earliest inhabitants of the area. This is based on the interpretation of the term «Yanadi» derived from the Sanskrit word «Anadi», which means ancient or has no beginning. Based on physical appearance, VON EICKSTADT (1934) classified the Yanadi as *Homo sapiens veddalis malicus,* the Malid subrace of Weddid racial group of the Indian subcontinent.

There exist several hypotheses regarding their original inhabitation and their ethnic affiliation with the two neighbouring tribal populations: the Chenchu and the Irula. 1. It has been said that the original home of the Yanadi is the wilds of Pulikate lake i.e., the islands in the Sulurupet Taluk, Nellore district, A.P., and surrounding thick forest areas around Pulikate town in Tamil Nadu (STUART, 1891; THURSTON & RANGACHARI, 1909; RAGHAVAIAH, 1962; AIYAPPAN, 1948). 2. Sriharikota, the largest island in the area was referred to as the «head quarters» of the Yanadis. 3. But MACKENZIE (1835) records a legend where he mentioned that about 60 families came from «Pakanadu» (part of Kurnoeorl district, A.P.) and settled at Sriharikota from where they spread to other places. 4. Another contrasting view is that the Chenchus, another jungle tribe of Nallamalai region of Eastern Ghats, ran down the hills and became the Yanadis, due to oppression and violence caused by Muslim Sulthan domination of the area around the 16th century (THURSTON & RANGACHARI, 1909). 5. A folk song of the Chenchu tribe, recorded describes the Yanadis as the codescendants of a Chenchu chief (REDDY, 1945).

The above references suggest (1) about their indigenous origin, distribution over a wide geographical area and exposure to different levels of culture contact; (2) the process of fusion and fission and migration as a result of culture contact for a period of more than a century, implying the possibility of geneflow from other neighbouring populations.

Present Circumstances and levels of culture contact

From the present field work, it has been observed that the Yanadfis in different areas of their occupation differ widely in their subsistence economy and other associated cultural traits, which can be described under three categories.

Insular Yanadis

Until recently, the Yanadis living in and around Sriharikota island in Pulikate lake (Nellore district, A.P.) were geographically isolated (10 to 17 km of lake) and lived totally by hunting-gathering-fishing subsistence pattern. The traditional life pattern is seen among the Insular Yanadis. They live in low conical huts in clusters of varying size (4 to a maximum of 30 huts) at one location (settlement) and distributed throughout the island. They hunt, collect forest produce, fish and gather prawns, shrimps during monsoon seasons. In small settlements a Yanadi couple live an independent life. But in a few settlements, where the size swells to about 30 huts, they have a leader.

Plateau and Hill-forest Yanadis

In the main land in plateau and hill forests, the Yanadis live along with other villagers and are exposed to various levels of culture contact. Their settlement size varies from about 20 to a maximum of 100 in a few cases. In the smaller settlements, which are hamlets of a Panchayat village, the Yanadis are mostly field labourers and gatherers. In the large settlements they are independent and are settled agriculturists. Thatched roofs, brickwalled tribal colonies are different from the typical conical huts of insular region. Their food includes vegetables, pulses and processed food items. They are politically, socio-economically linked with the other caste villages.

Urban Yanadis

The Yanadis living in urban towns, are mostly employed by the local municipalities, as sweepers, scavengers etc. Some of them are rickshaw pullers. In their dress pattern, food habits, customs, they are part of the urban slum life.

Nature of settlements

There is a considerable variation in size, pattern and distribution of settlements related to the changing subsistence economies of the tribe in different regions. On the basis of size and socioeconomic criteria, the settlements can be described to form three types — (1) the neighbourhood «Nb», (2) «satellite» or «accessory» («s»), (3) the «core» or «focal» («f») settlements.

Neighbourhood settlement (Nb)

These are the smallest in size and range to a maximum of 15 to 20 huts of mostly related families. They are mostly independent units generally located near the tank bund, fields and forests. They are gatherers or field labourers and have temporary settlements. These are commonly found among the Challa Yanadis and insular region and a few in plateau and hill forest regions.

«Satellite» or «accessory» settlements («s»)

The settlement size ranges to a maximum of fifty houses at one location. They are formed by either the fusion of a few neighbourhood (Nb) settlements or by the growth of a Nb settlement. They are mostly field labourers and gatherers and economically depen-

dent on other non-tribal land lords or farmers. They form «satellites» to the main villlages in the sense that they are dependent on the caste populations for survival and also in socio-political activities. They contract their marriage partners with other satellite or core settlements. A few splinter families fission out and fuse with the core settlements.

The «core» or «focal» settlements («f»)

These are the largest populated tribal colony or village units initiated by the local government under rehabilitation scheme. The size swells to a maximum of 100 houses. They are formed by the fusion of a few splinter groups (families) from nearby smaller settlements, the accessory or satellites. They are settled cultivators and are the nerve centre (or core) of reference for all the welfare activities. Socio-economically they form an independent tribal village which is generally the hub of political network as well. What is of genetic interest is that they form the «focal» centres of breeding units in a region and exchange a greater proportion of mates with other neighbouring «satellite» and «neighbourhood» settlements.

Unit of study and selection of settlements

The nature, distribution and formation of the settlements among the Yanadi tribe, suggest that a settlement cannot be considered as a breeding unit. Since the three types of settlements [core (f), satellites (s) and the neighbourhood (Nb) settlements] exchange mates in a region and form a cluster of closed network which from the genetic point of view represents the spatial distribution and extent of gene pool; therefore, the breeding population in a region includes the above three types of settlements, which can be represented

$$BP = F\ (f + ps + q\ Nb)$$

where BP is the breeding population. f, s, and Nb are the core, satellite and Nb settlements. p, q are constants. F indicates the marital relation by which the three settlements are closely linked.

Based on the above model, the settlements have been selected in each region in different cultural stages. First, from the official records, the largest tribal settlement «f» has been selected. At the second stage, from the genealogical and migrational history obtained from the focal «f», other satellite settlements which had a greater proportion of exchange of mates or historical migration of splinter families were identified and followed up for the detailed investigation so that they represent the greater proportion of gene pool. However, Nb settlements are too numerous and have not been studied. This possibly underestimates the extent of gene pool in a region, the magnitude of which however, is negligible in view of their small size and proportion of exchange of mates.

Data and Methods

Thus altogether 13 settlements have been selected (*Figure 1*) consisting of 4 focal settlements — [(03 VND in insular, 07 VDP in upper plateau (P_1), 10MLC in hill forest and 11 GKP in lower plateau (P_2 regions)] and 9 satellite settlements [(01 MPD, 02 KTR, in coastal; 04 PND, 05 IR in insular; 06 ALD, 12JP, 13 ATR in plateau, and 08 VRP, 09 PTR in hill forest regions)] in different regions.

A multi-stage field work was carried out during 1978-80 and demographic, geneologi-

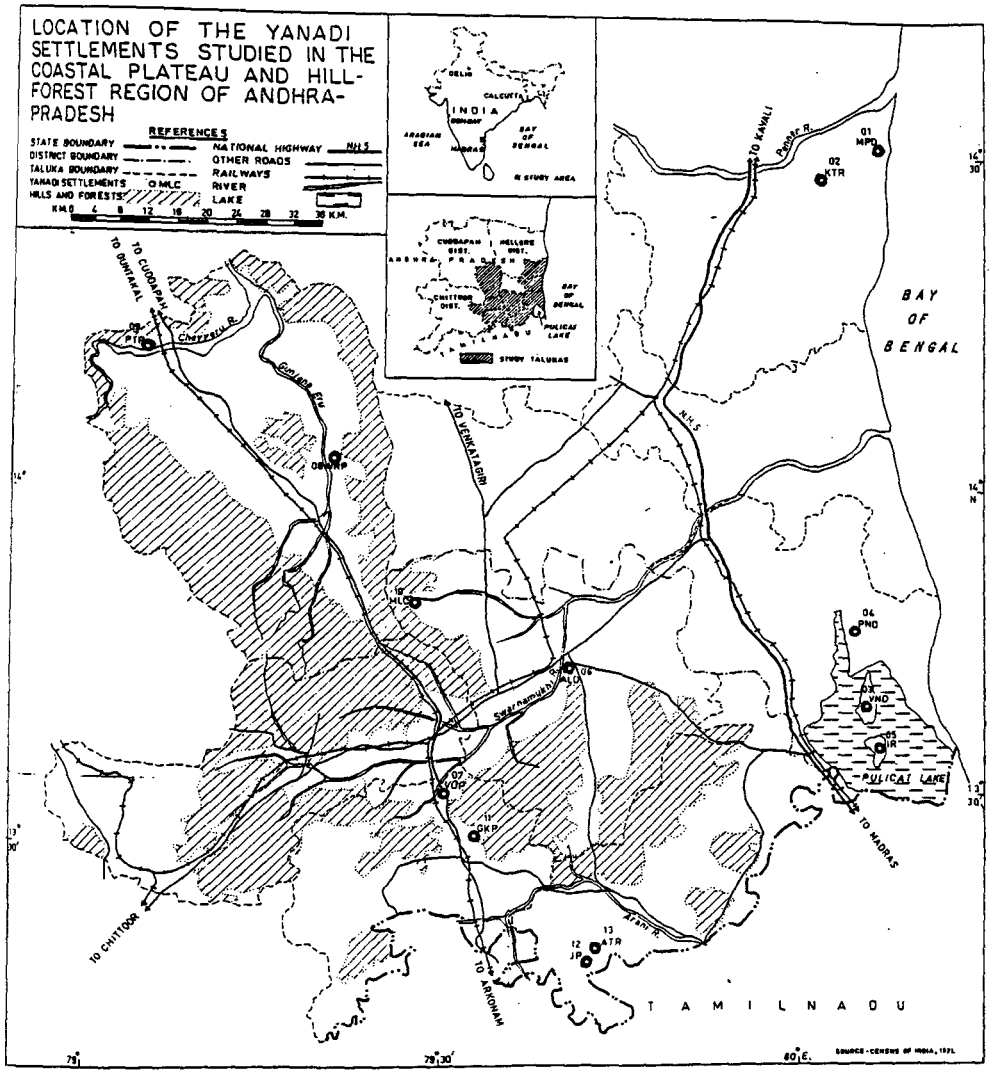


Figure 1.

cal data, anthropometric, genetic and dermatoglyphics data were obtained from the thirteen settlements. The extent of breeding isolation was estimated by two different sources for consistency based on marriage frequency and based on localisation of surnames (which are most frequent in a region) of husbands and wives (maiden surname).

The admixture rate has been calculated by taking proportion of husbands and/or wives who came to live in a settlement, from other populations, through marriage. The «ancestral surname migration index» (SMI) has been calculated by taking the proportion

of surnames of husbands and/or wives of a region, that belong to other regions, which were infiltered due to their ancestral migration (also marital) in the past. Chi-square values were calculated by following principles as explained by Cochran (1954).

Results

Breeding isolation

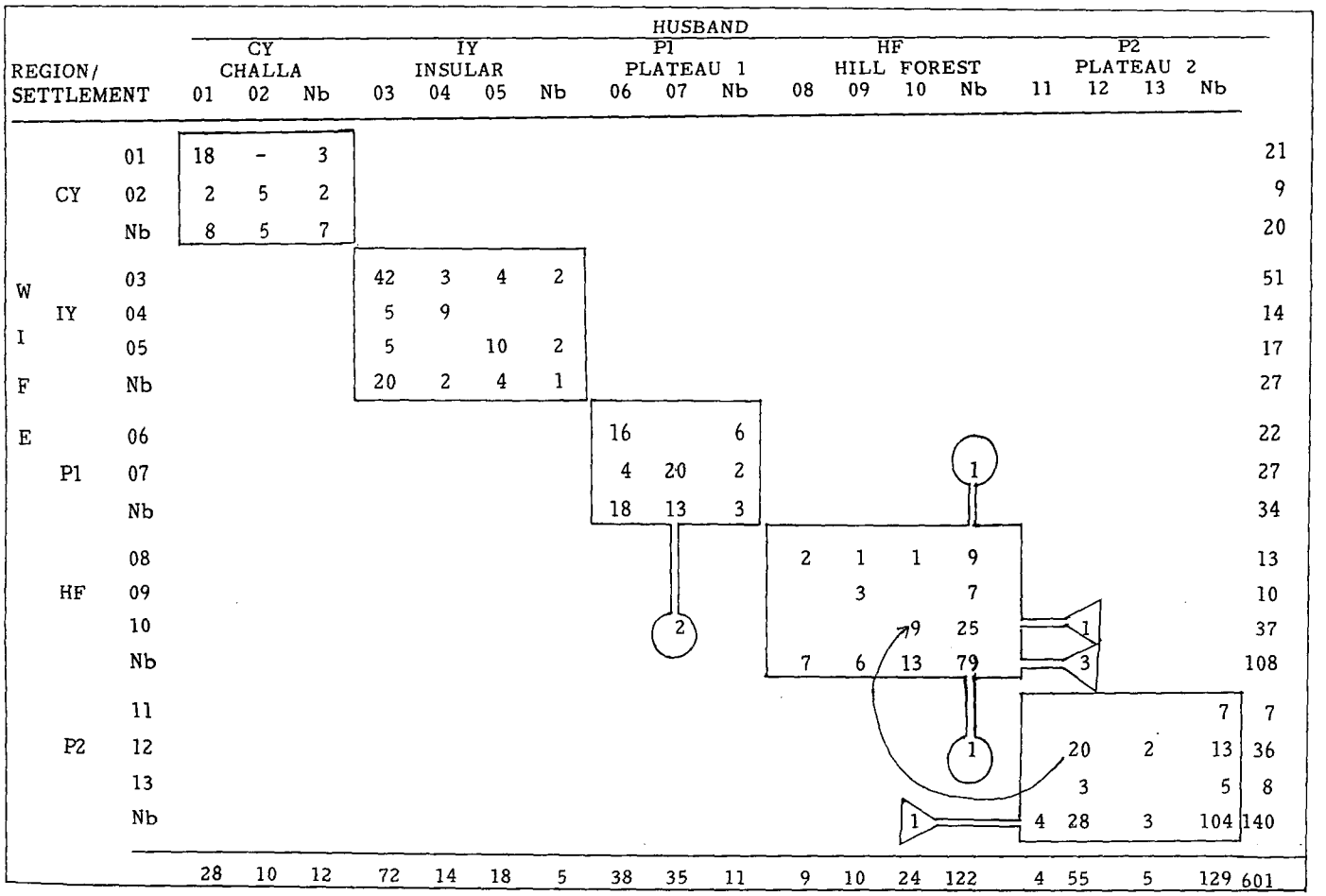
The formation and extent of breeding isolation among the Yanadis in the respective geographical regions can be identified from the analysis of inter marriage frequencies between settlements. *Table 1* shows the distribution of birth places of husbands and wives of thirteen settlements (the focal «f» and the accessory «s») and the respective «neighbourhood» settlements, under the «Nb» category for each region. The Nb refers to the proportion of spouses that are born in other propinquous Yanadi settlements mostly of the neighbourhood type. There are altogether 216 neighbourhood «Nb» settlements in the five regions, which contribute 582 spouses out of 1202 spouses (i.e., 48.4 per cent of the total spouses) directly studied in the 13 settlements.

The figures scored in the square frames indicate the marriages contracted within a region. The vertical projections from these squares indicate inter regional marriages where the wives have come from other regions and the horizontal projections indicate from where the husbands have come. Only in one case both the husband and wife have migrated from «P2» region to «HF» region which was indicated by an arrow. The figures in the appendages indicate the amounts of geneflow into the Yanadi populations of specific regions. For example, a woman from the upper plateau (P_1) region is married to a man from the hillforest (HF) region. This is indicated by the upward projection from the square from HF region. Similarly the downward projection of P_1 region, where two wives come from HF region.

The table indicates that the Challa Yanadis in the coastal region and the insular section of the Manchi Yanadis exchange their spouse entirely within their region whereas plateau (P_1 and P_2) and hill forest (HF) regions, exchange a greater proportion of spouses within the regions and also a small fraction of marriages between these regions. Out of the total number of 601 marriages recorded, there are 5 instances of either wife or husband or both migrating from one adjacent region to another among P_1, P_2 and HF regions. Besides the internal exchange of spouses between the Yanadi populations of specific regions, immigration has also been identified in four cases in which non-Yanadi husbands have come to stay with their Yanadi wives in two settlements: 06ALD, 11GKP. It is clear from the matrix that most of the marriages occur within the region and the clustering within the regions is highly significant ($\chi^2 = 1127.63$, df 16). Therefore, it can be reasonably assumed that the Yanadi population forms several regional breeding populations.

Endogamy-Exogamy

The extent of endogamy is a criterion for defining the breeding population. This has been represented in *Figure 2*. The five large circles drawn are in proportion to their number of marriages in the respective regions in the map. The inner concentric circles indicate the proportion of «exogamous» marriages of the settlements of the respective regions and the shaded area indicates proportion of spouses who came from the neighbouring settlement (Nb). The connecting lines between circles indicate the extent of admixture



Inter-regional Marriage - Vertical projection: Indicates the migration of wife. Horizontal projection: Indicates the migration of husband. → Both H & W of 12th settlement came to live in 10th settlement (one case only).

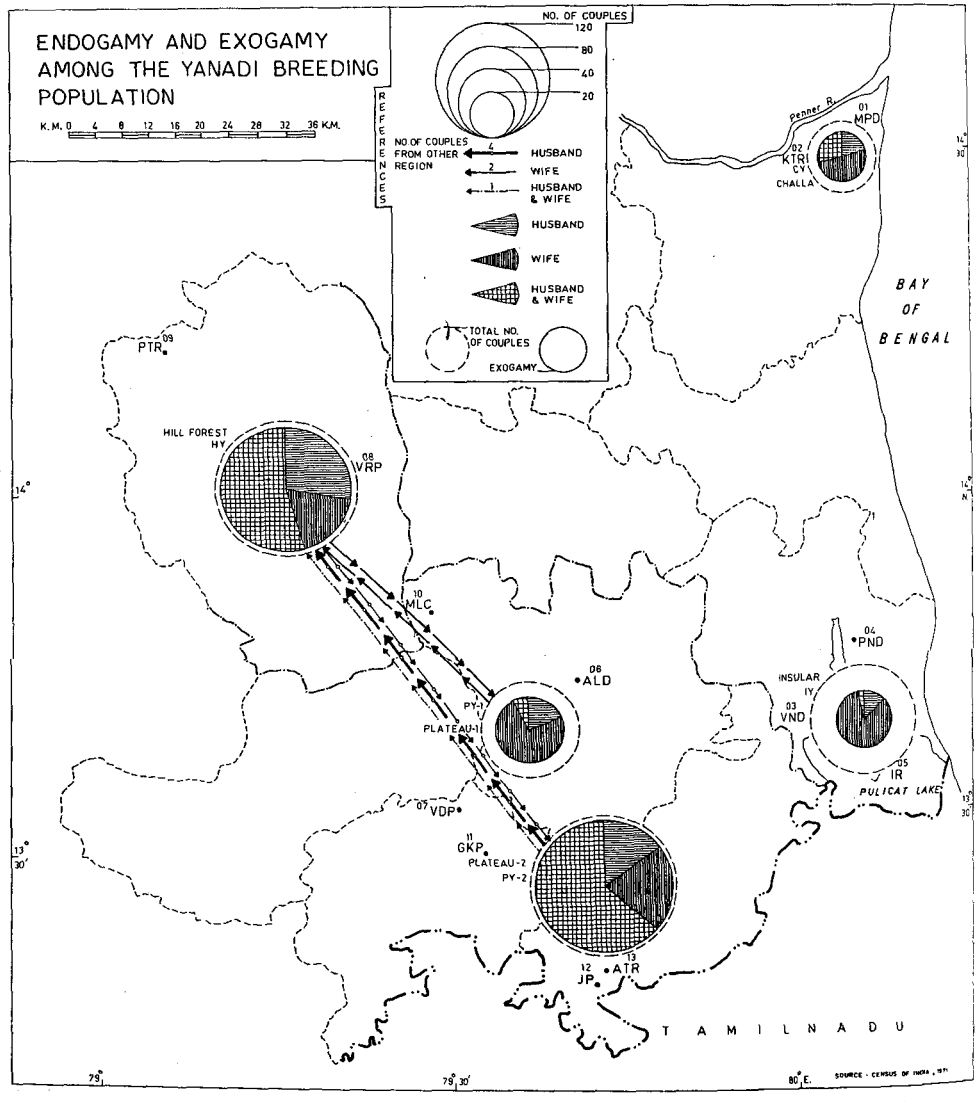


Figure 2.

between the regions. Given the geographical isolation between regions it is expected that CY, IY show two separate breeding populations. But in plateau (P_1 and P_2) and hill forest region (HF), the figure shows the formation of three breeding populations, with low admixture rates between them.

The Challa (CY), insular (IY) and upper plateau (P_1) populations show a high percentage of endogamy marriages within the settlement- (50.0 and 81.6 per cent) and low percentage from other Nb settlements of the respective regions, whereas hill forest (HF) and lower plateau (P_2) regions show the opposite trend (9.5 and 12.8 per cent). These wide

differences are expected in the wake of geographic, cultural, ethnohistorical development of the regional settlements. The Challa (CY) and insular Yanadis (IY) are the aboriginals of the region, inhabiting at least for more than a hundred years, almost confined to the hunting-gathering-fishing subsistence economy and are least influenced by other communities. The size of the settlements of CY are small (a few huts at one locality) temporary in nature and move out according to changing seasons and availability of subsistence. As such they tend to show a greater percentage of husband and wife migration. The insular Yanadis (IY) are mostly confined to the islands and survive by exploiting the natural resources of the insular environment as such and show almost no husband and wife migration. Since they are patrilocal type of marriage, they show a greater proportion of exchange of wives from the «Nb» settlements.

In *plateau 1* region, the Yanadis of the two settlements are the original inhabitants of the area and depend on casual labour and gathering. A few additional nearby families have been resettled in nearby government colonies, therefore they show an equal proportion of endogamy-exogamy ratio.

In the hill forest (HF) and lower plateau (P_2) regions, the settlements are tribal colonies established by the local government a few decades ago. The majority of families were resettled from nearby settlements as such they show low endogamy (within settlement) rates. Since the Yanadi marriage is patrilocal type, they show greater percentage of wife migration than husbands. The low rates of admixture between plateau (P_1, P_2) and hill forest (HF) regions (the connecting lines in the figure) recorded, were from the younger generation. This process of fusion between HF and P_1, P_2 can be expected in view of the effect of tribal welfare activities of economic development, better communication facilities such as roads, and transport.

Marriage isolation by generationwise

Inter marriage frequencies were regrouped according to age cohorts of interval of 21 years (one generation) in order to check the consistency of the breeding isolation through generations. The approximate age of 21 years duration represents a generation as it has been generally observed among the other Indian tribes (MUKHERJEE, 1978-79).

Table 2 and *Figure 3* describe the four types of marriages (P, Q, R, S) contracted in four generations, in the five regional breeding populations of the tribe. It is seen that the intermarriage frequencies with «Nb» and other accessory settlements are of a recent phenomenon (since 40 years). Challa Yanadis (CY) show an equal proportion of endogamy and an equal proportion of exchanges with the «Nb» settlements in the age cohort 22-42. In the 43-63 age cohort, the endogamy rates are proportionately smaller than the exchanges from «Nb» settlement ($P = Q$ in 22-42 group and $P < Q$ in 43-63 group). There is a greater marital mobility in recent decades among Challa Yanadis (CY) than in the earlier generation. In insular Yanadis (IY), the endogamy rates are consistently higher than the exchanges with Nb and other regional settlements in the age cohorts 43-63 and 22-42 ($P > Q > R$).

In the P_1, there is a consistent increase of exchange of spouses from the Nb settlement in the age cohorts 22-42 and 43-63 ($Q > P$). Since these two settlements of P_1 region are situated nearby urban centres and are most exposed to outside contact, they therefore reflect a greater proportion of exchanges from the Nb settlement. In the case of both HF and P_2 region, they show greater exchange with their «Nb» settlement than within regional endogamy. That is because the focal settlement 11GKP (*Figure 1*) was

TABLE 2 - *Marriage frequency by generation-wise.*

Regional population	Generation	Within the region: Spouse from the same & other settlement «P» + «R»		Within the region: Spouse from «Nb» settlement «Q»		Spouse from other region «S»	
		H	W	H	W	H	W
	<21	4.0	10.0	4.0	14.0	—	—
CY	22-42	32.0	30.0	32.0	28.0	—	—
	43-63	10.0	10.0	12.0	8.0	—	—
	64 +	2.0	0.0	2.0	0.0	—	—
	n =	25	25	25	25	—	—
	<21	4.4	15.3	—	6.5	—	—
	22-42	41.4	43.6	19.6	24.0	—	—
IY	43-63	31.6	22.9	14.2	3.3	—	—
	64 +	7.7	3.3			—	—
	n =	78	78	31	31	—	—
	<21	—	9.5	—	8.3	—	—
	22-42	27.2	25.0	34.4	30.9	2.4	2.4
P_1	43-63	21.4	11.9	14.3	10.7	2.4	2.4
	64 +	—	1.2	1.2	—	—	—
	n =	40	40	42	42	4	4
	<21	—	3.0	1.2	18.9	—	0.6
	22-42	4.2	4.2	47.3	43.8	0.6	0.6
HF	43-63	3.6	2.4	33.1	25.5	1.2	0.6
	64 +	1.8	—	6.6	—	—	—
	n =	16	16	146	146	3	3
	<21	—	1.0	—	15.6	—	0.5
	22-42	8.1	10.3	59.7	58.1	2.2	2.2
P_2	43-63	3.2	—	23.7	14.5	0.5	—
	64 +	—	—	4.8	—	—	—
	n =	21	21	164	164	5	5

established during the early 1970s, therefore the Yanadi, who were resettled at the colony were originally from «Nb» settlements. In the case of HF region, the colony 1OMLC was established during the early 1950s, and the residents who came from other nearby settlements continue to keep marital relationships with their original settlements.

The age cohort analysis of inter marriage frequency between and within regional settlements suggest that the breeding isolation was consistent over (at least) two generations. As expected, CY and IY show the formation of two well defined regional breeding populations. In the case of P_1, P_2 and HF regions intra regional marriages (admixture) are of a recent period — a process of fusion that could be associated with better comunication facilities and socio-cultural developments in the main land.

Surname analysis

The surname analysis is carried out as an additional evidence to investigate the breeding isolation among the tribe. *Table 3* shows marital migration matrix between regions based on the localisation of surnames in each region.

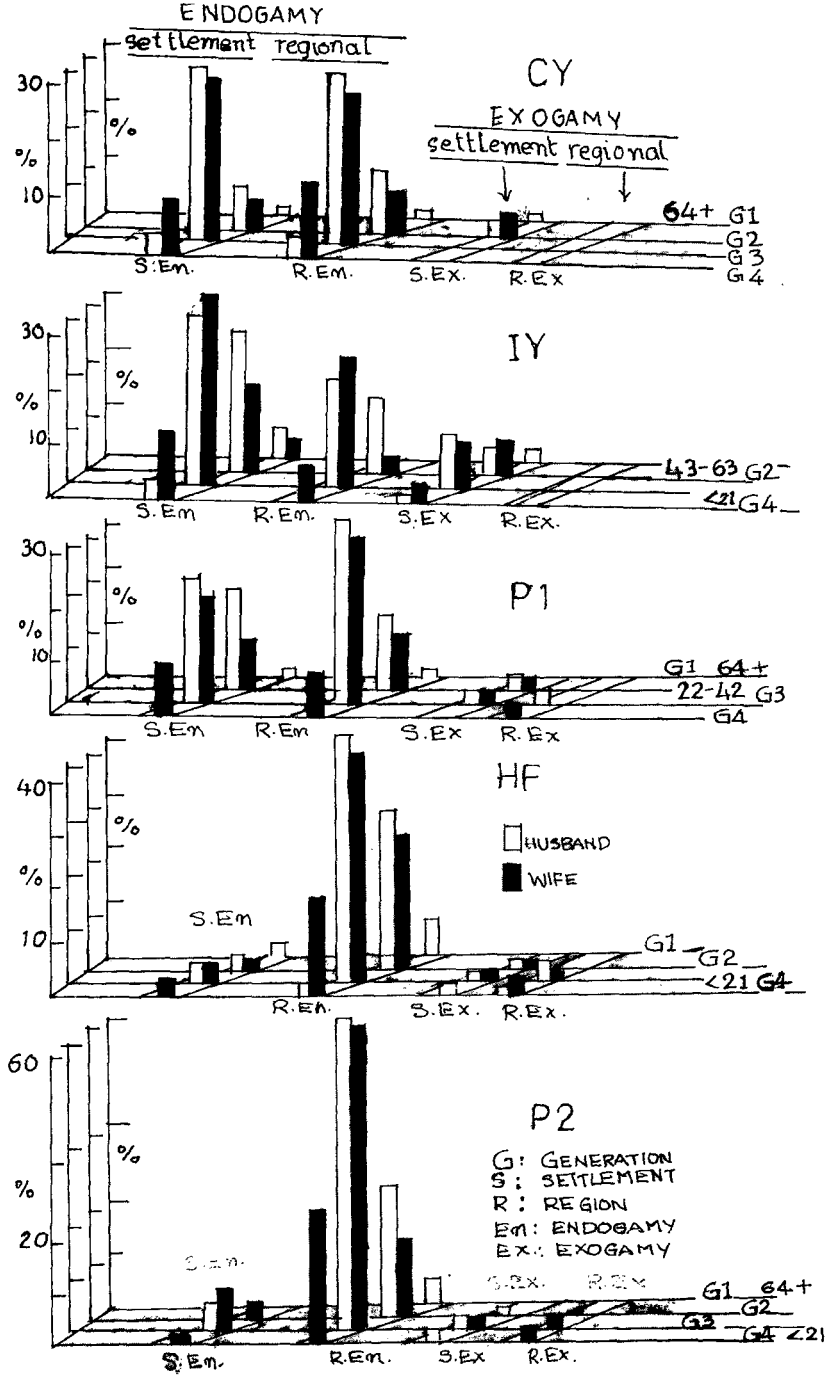


Figure 3 - Intermarriage frequency by age cohorts.

TABLE 3 - *Frequency of Marriage between regions based on the localisation of surnames among the Yanadis.*

			HUSBAND												TOTAL NO. OF SURNAMES H/W
			CY		IY		P1		HF		P2				
			H	H_O	H	H_O	H	H_O	H	H_O	H	H_O			
NO. OF SURNAMES			12	2	12	1	13	4	25	8	19	5	= 101		
W	CY	W	31	3	4		5		7		1		51		12
		W_O	1										1		1
	IY	W			108	4	9	3	7	1	27	1	60		12
		W_O			1								1		1
	P1	W	3		8		30	2	9	1	12		65		13
		W_O			1		1	1	2				5		3
	HF	W	3		2		5	1	103	10	9	1	134		25
		W_O					1		8	3			12		9
	P2	W			26		9	1	17		70	6	129		19
		W_O			1						7	2	10		9
TOTAL			38	3	151	4	60	8	153	15	126	10	568		104

H, W : Number of marriages, which include common set of surname among husbands and wives.
H_O, W_O : Number of marriages, which include different set of surnames in husbands and wives.

The diagonal boxes indicate those marriages which were contracted within the region. In each region there are square boxes, the figures scored in it, indicate the number of marriages contracted between the common set of surnames of husbands and wives. For example, in CY region there are 31 marriages out of 12 common surnames between husbands (H) and wives (W). The Ho, Wo indicate the husbands and wives whose surnames are different. The figures scored off the diagonal elements are between regional marriages. A few surnames are unique to a particular region. And a few surnames are common between regions which indicate the past migration and possibly common origin. There were 17 common surnames which reveal 26.6 per cent of common genetic background.

It can be inferred from the table that a greater proportion of exchange of spouses was between the common surnames of husbands and wives in each region indicating localisation of surname to a particular region. And there is a greater proportion of marriages within the region than when compared to between regions. The clustering is highly significant (χ^2 = 753.63, df 25), indicating breeding isolation between regional populations of the Yanadis.

Admixture rate and Surname migration index (SMI)

The total admixture rates based on marriages and surname migration index (SMI) by surname analysis (*Table 4*) show wide differences. By marriage data, the admixture rates appear to be less than five per cent significant among HF, P_1 and P_2 populations

TABLE 4 - *Estimates of admixture rate (m) and surname migration index (SMI) for the Yanadi regional populations.*

Regional popuation	No. of spouses	Immigrants			Admixture rate (m)	No. of spouses	Immigrants			Surname migration index (SMI)
		H	W	Tot.			H	W	H&W	
CY	100	—	—	—		100	9	4	2	17.0
IY	218	—	—	—		234	4	2	0	2.56
P_1	168	0	2	2	1.2 ± 0.8	180	23	22	12	38.3
HF	338	5	3	8	2.4 ± 0.8	312	9	24	2	11.8
P_2	378	1	0	1	0.3 ± 0.3	310	29	38	5	24.8

suggesting the formation of regional breeding populations. The SMI rates estimated on the basis of surname analysis indicates the extent of breeding isolation of the populations for several generations. The wide results obtained suggest that IY alone can be considered a breeding isolate for several past generations. The *plateau 1* and *plateau 2* are contiguous regions and the formation of breeding population is only recent phenomenon, since few generations. They still share greater proportion of common genes between them. The Challa Yanadis contradictory to the marriage frequency data and ethnographic evidence show common surnames indicating the possible common origin.

Discussion

The analyses based on marriage frequency and on surname frequency suggest an overall consistency in the formation of regional breeding populations among the Yanadi tribe. But the estimates, differ in the degree and extent of breeding isolation. Especially, the marriage frequency data suggest no marital exchange between CY and IY, whereas the surname analysis suggests possible geneflow or migration in the past. Even in Plateau (P_1 and P_2) and hill forest (HF) regions, the surname analysis indicates greater admixture than the marriage frequency. These differences indicate the different levels of the process of fission among the Yanadi populations. IY seems to form a breeding isolate since several generations. HF region possibly got separated earlier than the P_1 and P_2 regional populations as can be inferred from the wide admixture rates between them. Since the genealogical records collected extend to a maximum of five generations, the marriage frequency analysis refers to the recent stages of breeding isolation. The surnames in this context, have an additional advantage since they refer to several past generations provided the surnames do not mutate and are hereditary. A comparison of surnames with the surnames of 1891 (CENSUS, 1891) suggest consistency of a few surnames for the last hundred years, however, there are a few new surnames. For example, the surname «Sreerama», which is a mutation from the surname Tupakula since a generation. The surname MADDINI is infiltered through a nontribal man and a Yanadi woman at least 6 or 7 generations ago, as per the enquiries from the field from the settlement 1OMLC in hill forest region. This has not been possible from the marriage records. In spite of a few recent surnames, the surname analysis indicates the process of fission and breeding isolation among the Yanadis. This is expected to lead to changes in population structure and genetic differentiation.

ACKNOWLEDGEMENTS — This work was partly supported by a fellowship grant from Anthropological Survey of India, Calcutta. The author acknowledges help received from Prof. D.P. MUKHERJEE, Anthropology Department, Calcutta University, Calcutta.

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Received: Nov. 16, 1988; Accepted: May 2, 1989.