THE SEMSA : A POPULATION GENETICAL S1

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I, **Dhruba Kumar Limbu**, hereby declare that the subject matter of thesis is the record of work done by me, that the contents of this thesis did not form basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and that the thesis has not been submitted by me for any research degree in any other University/Institute.

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CHAPTER I

INTRODUCTION

Like any other scientific discipline, physical anthropology has been undergoing changes since its inception. Initially, the physical anthropologists were mainly interested in taxonomic classifications of human population. They used mostly anthropometric and anthroposcopic techniques in classifying populations, and such types of researches continued till the middle of the present century.

With the advent of science of genetics, the physical anthropologists have become more interested in genetical study of human populations. They have been trying to understand the genetic basis of human variations and the various processes of microevolution. Kirk (1973) has very rightly pointed out that the main purpose of physical anthropology today is to understand the nature and extent of human variations at both micro and macro levels of evolution. Even before Kirk made this observation, Washburn (1953), Laughlin (1960) and some others have also suggested that the physical anthropologists should look into the biological variabilities in populations since such variabilities are due to the cumulative effect of various evolutionary forces. So, since the middle of this century, the physical anthropologists have diverted their attentions to the study of the population genetics. Kirk (1978) is of the opinion that population genetics have become the backbone of physical anthropology in recent time. Long back Wright (1931) suggested that evolution of the present populations is referred to as the changes in gene frequencies in subsequent generations due to various evolutionary forces like selection, drift, mutation, etc.

After the recommendations, made by the scientific groups of the World Health Organization (1964, 1968), the physical anthropologists, all over the world, have become more interested in studying the small and isolated population groups from genetical points of view. Dobzhansky (1951) has referred to such small groups as 'Mendelian Populations', which mean that the members of such a population share a common gene pool. Keith (1950) has called such breeding isolated communities as 'evolutionary units', which, in contemporary world, may certainly reveal various important facts, regarding the mechanisms and processes of human evolution.

To study human populations, various models have been suggested. Wright (1943) has proposed the 'Island

Model' and 'Isolation by distance model' for studying populations. "In Island Model every population exchanges genes equally with every other and there is no effect of distance between populations" (Cavalli-Sforza and Bodmer, 1971), whereas under the model of Isolation by distance there are two ways of expressing the geographic variations in gene frequency. Cavalli-Sforza and Bodmer (1971) say, "One expression of the geographic variation is the variance between clusters in the discontinuous model, or between samples taken from different neighbouring locations in the continuous model" and "The other is the correlation between clusters or between samples at a given distance." However, in either case, formulae can be derived in terms of the kinship coefficient or variances in gene frequencies. Under the isolation by distance model, two types of theoretical suggestions can be made: i) a continuous one - in which population density is constant at any point (Wright, 1943), and ii) a discontinuous one - in which a population is clustered at the nodes of a lattice (Malecot, 1950). Both types exist in two versions: i) linear one, and ii) two dimensional one. For the linear one, there is approximately one dimensional distribution of population. For the two dimensional one, it is a representative of the more usual population distributions found in the areas, where there are no barriers against dispersion in any direction. However, Kimura and Weiss (1964) have called the discontinuous one as "Stepping Stone Model". The stepping stone model can be represented in the form of one and two dimensional lattices. In the first one, a number of individuals should be same in each cluster and migration takes place equally in both directions, whereas in the second one each cluster contributes equally to every neighbouring cluster. However, Cavalli-Sforza and Bodmer (1971) are of the opinion that the stepping stone model is only a theoretical possibility. Since most of the tribal populations in India, specially in the North-Eastern region, are fully or partially isolated and are, therefore, liable to evolve, to some extent, independently. So, the island model is the best suited model to study such isolated populations. In the present study, we have essentially relied on the island model.

In the present study, we shall deal with the population genetics of the Semsa, which includes both genetic and demographic structures. Harrison and Boyce (1972) define genetic structure as "the way genes are organised into genotypes in human populations" and "the extent to which individuals share a common gene pool", which shows "the degree of biological relatedness" among the members. They define demographic structure as "Patterns of fertility and mortality, emigration and immigration and the effects of these on age and sex composition". The relationship between genetic and demographic structures is very well known and needs no further elaboration.

As mentioned earlier, population genetical studies are gaining interest in physical anthropology, and studies on racial origin and history are no more at the centre-stage. Even the expert groups of the World Health Organisation (1964 and 1968) have suggested that population genetical research among the primitive communities of the world should be taken up urgently in the view of the fact that the culture of most of such groups is gradually disintegrating due to increasing contact with civilisation, and such disintegration will have far reaching biological consequences. Now the question is which population should be considered as "Primitive"? To our mind, the term "Primitive" is a relative one. So, it is better to consider the relatively isolated populations for such studies, since such populations, in the contemporary world, may reveal many important facts, concerning the mechanisms and processes of human evolution.

With this idea Roberts (1956) has published his article on the Dinka of southern Sudan. He has taken into consideration many demographic parameters with a view to finding out various evolutionary forces that are acting on this population and their magnitudes. Sutter (1963) has worked on the relationship between human population genetics and demography. Bonne (1963) has made an interesting study on demographic aspects of the Samaritans in order to estimate the effect of random drift for determining the biological characteristics of this small and isolated population. The most extensive and intensive work on population genetics has been carried out on the Xavante Indian by Neel *et al*. (1964). They have been taken into consideration not only all possible demographic parameters, but also anthropometry, blood groups, red cell enzymes, etc. to make out how the evolutionary forces are acting on this population. Kuchemann *et al*. (1967) have carried out a population genetic study, based on demographic parameters in a Oxfordshire village. They have suggested that evolutionary forces such as selection, mutation, drift and geneflow determine the genetic structure of a population through demographic parameters like population size, fertility, mortality and mating patterns. Neel (1967), while discussing on the genetic structure of primitive human population, has suggested that differences in gene frequencies between small and even larger ethnic groups may be due to non-deterministic factors. Roberts (1967) has dealt with development of inbreeding in the population of Tristan da Cunha and suggested that inbreeding has developed in this island population due to its small size. Salzano et al. (1967) have made a further demographic-genetic study on the Xavante Indian of Brazil. Neel and Weiss (1975) have extensively used various demographic parameters to study the genetic structure of the Yanomama Indian of southern Venezuela and Northern Brazil whereas Chagnon (1975) has considered demographic, social and genetic parameters to understand the micro differentiations at both cultural and biological levels, that are taking place among them due to constant inter-village rivalries. Roberts and Bear (1980) studied the measures of genetic change in an evolving population. Barbujani and Sokal (1991a, b) have reported the association of cultural barriers with differences in gene frequencies among the Italian populations. O'Rourke et al. (1992) have studied the genetic variations in the Native Americans taking into consideration various blood group systems.

Fix and Lie-Injo (1975) have described the genetic micro differentiation in the Semai Senori of Malaysia taking into consideration the genetic, demographic and cultural parameters. They have suggested that genetic micro differentiation among the Semai is due to founder effect. Perez-Diez and Salzano (1978) have studied the evolutionary implications of ethnography and demography among the Ayoreo Indians of southern Bolivia and northern Paraguay. On the basis of this study, they have suggested that though the historical evidence shows that there is a demographic stability among the Ayoreo Indians, their ecological adaptation and social organization indicate the existence of a high acculturation process among them with population disruption. They have also found that the index of opportunity for selection is highest, so far reported for many human populations.

Tripp-Reimer (1980) has made a historical-demographic-anthropological study on an urban Greek Community in Columbus (Ohio). He has suggested that the gene flow is the major evolutionary force, operating in this community.

Sanghvi et al. (1971) have studied the genetic distance among Australian aborigins whereby they attempted to apply the genetic analysis to find out the local and regional differentiations and to examine the distance values, obtained in relation to geographic separation and linguistic differences. Fernando *et al.* (1974) have compared gene frequencies and anthropometric distance matrices among the four Indian tribes and proposed that the environmental factors are very important for influencing the phenotypes. Friedl and Ellis (1974) have studied inbreeding, isonomy and isolation in a Swiss community, where both ethnographic and demographic data have been combined to examine the genetic structure and its potential for the evolution of an isolate. Chakravarty *et al.* (1976) have studied genetic variability of the Chilean Indian populations and its association with geography, language and culture. In the same year, Reid (1976) has studied the effect of consanguineous marriages and inbreeding on couple fertility and offspring mortality in Sri Lanka. Swedlund *et al.* (1976) have made a population study in the Connecticut Valley, considering demographic evolution of human populations. Nurse *et al.* (1976) have undertaken a sero-genetic study among the Dama of South-West Africa. It is found that the Dama have received very little genetic contribution from the other negroid populations like the Khoikhoi and Sam (Bushman). Salzano and Jacques (1979) have studied the four Brazilian Indians, taking into consideration demographic and genetic parameters. In analysing their data, they have made an attempt to relate the demographic findings with the genetic results with a view to understanding the microevolutionary processes. Ferak et al. (1980) have reported the genetic distances and migrations between four villages of a single region in Slovakia. Jorde (1980) has reviewed the genetic structures of subdivided human populations of Slovakia. Kobyliansky et al. (1982) have studied genetic similarities and differences among the Jewish populations of the world. Koertvelyessay (1983) has made a study on demography in the light of microevolution in a Hungarian settlement in Louisiana (U.S.A.). Douglas (1985) has examined the demographic structure and the changing opportunity for selection in a small, agricultural community in Central Pennsylvania and pointed out that both fertility and mortality components of the opportunity for selection tends to decrease in this population, and gene flow is more important component of evolution than selection in Halfmoon Township. Relethford (1986) has reported the effect of population size on marital migration distance. He has suggested that small populations draw mates from relatively local gene pools, whereas larger populations draw mates from relatively larger gene pools.

Relethford (1991) while working on Irish populations, has reported that a change in population size always leads to a new equilibrium, but the speed at which this new equilibrium is reached, depends on migration and time depth, and a decline in population size in one generation always leads to an immediate increase in the degree of microdifferentiation. He (1991) has further observed to what extent genetic drift, local, migration and admixture may influence the demographic-genetic structures of the Irish populations. Williams (1993) has carried out a study on the origin and structure of the Icelanders, and explained the genetic differences from other northern European countries on the basis of Founder Principle.

In India, several studies have been carried out on population genetics, taking into considerations both demographic and biological parameters. Basu (1969) has made a population genetic study on the Pahira of Ajodhya and Dalma hills of eastern India. He has not only described the genetical and demographic characteristics of the population, but also adequately dealt with the problem of fission and fusion in this population. Das et al. (1982) have dealt with a population genetic study on two isolated mountain village populations of northern Sikkim. They have considered both demographic as well as genetic parameters in the study.

Ghosh (1970, 1972, 1973, 1976) and Ghosh et al.

(1977) have worked on the Kota of Nilgiri Hills. They have considered demographic, genetic and morphological traits to explain the population structure of the Kota in terms of 'Founder Principle'. Malhotra (1978) has made a very interesting study on four groups of the Nandiwalla of Maharashtra. He has based his study on demographic, genetic, dermatoglyphics and some morphological characters. With these data he has shown the intensity of natural selection and the founder effect on these four Mendelian populations. Deka (1980) has reported selection potential among the Sonowal Cachari of Upper Assam. Mukhopadhyay (1981) has made a comparative microdemographic study on two occupationally distinguished caste communities of Balaram-chak and Bamanchak in the Midnapore district, West Bengal. He has extensively used various demographic parameters in order to assess the selection pressure on these populations. Basu et al. (1980) have reported the demographic structure of a very small population of Mirpur of Midnapore district, West Bengal and discussed about the possible relationship between high fertility, malnutrition and high parasitic loads. They have also made an attempt to assess the magnitude of selection and drift in this population. Barua (1982) has reported the demographic structure of the Hajong of West Garo Hills, Meghalaya and has suggested that in this population, selection is acting moderately. Sirajuddin and Basu (1984) have discussed the population structure of the Chenchu of Andhra Pradesh. In this connection, one may recall the work of Sirajuddin (1993) on the Chenchu. He has comprehensively dealt with demographic, morphological and genetical parameters in this population and applied various statistical methods with a view to assessing the phylogenetic relationship of the Chenchu with other populations. Das (1985) has reported the fertility and mortality among the Khamyang and Turung populations of Jorhat district of Assam. Deka (1989) has reported that among the Jaintia of Sa-Phai village in Meghalaya, fertility is high and infant mortality low, but selection acts with moderate intensity. Guha and Mukherjee (1990) have discussed the influences of cultural tradition and social movement on the genetic structure of the Boro Kachari population of Upper Assam. Khongsdier (1990) has also reported selection intensity among the Pnar of Sutnga and Moopala village. Khongsdier (1993) has reported fertility differentials among the various religious groups in the War Khasi of Meghalaya. Sirajuddin et al. (1994) has extensively discussed on population structure of the Chenchu and other south Indian tribal groups. They have tried to find out the relationship between genetic, anthropometric, dermatoglyphics, geographic and linguistic distances. Singh (1994) have worked out on Bathudi and Sounti tribes of Orissa. He has studied demographic, morphometric and genetic characters in these two populations and has made an extensive comparison with other populations. He has also dealt with the fission and fusion problem as well as the nature of migration in these two populations to explain their demographic-genetic structures. Das et al. (1985a, 1985b, 1986a, 1986b, 1986c) and Heidi Danker-Hopfe et al. (1988) have made some important studies on five mongoloid population groups, six Muslim population groups, three Brahmin groups, five regional groups of the Kalita and four caste groups (Jogis, Hiras, Kumars and Koibratas) of Assam. They have mostly dealt with anthropometric, anthroposcopic and dermatoglyphic traits as well as some genetic markers to show genetic distances among these populations.

Recently, Khongsdier and Ghosh (1996) have suggested, on the basis of a population genetic study among the War Khasi of Meghalaya, that the demographic structure of a population should be taken into consideration before making any population genetical study since many of the populations in this country are not, in general sense, "Mendelian Populations;" but comprising of several demes. Sengupta and

Kalita (1996) have reported intensity of selection among the Sonowal of Assam. Buzurbaruah and Rizvi (1996) have made a biodemographic study among the Garia's of Assam.

We have never tried to make here any exhaustive review of the work so far done on population genetics on Indian and non-Indian populations. We are aware of the fact that we must have certainly missed out many papers. Our main purpose is to show the trend and development of researches in human population genetics.

It is also true that long before the people started working on intensive population genetic studies, taking into consideration the demographic parameters, many researchers, all over the world, did population genetical studies with limited number of genetical, morphological and behavioural traits, and even today plenty of such studies are regularly being carried out in all countries. Very recently Bhasin, Walter and Danker-Hopfe (1992) have compiled all data on genetic, morphological and behavioural traits, published upto 1991, on the populations of India, Pakistan, Bangladesh, Bhutan, Sri Lanka, Nepal and Maldive Islands. So, we shall not venture to deal with such studies, so far carried out in India, separately. However, it may be pointed out here that no thorough population genetic study, taking into consideration demographic, genetic, dermatoglyphic, anthropometric and anthroposcopic data, on any population of North-East India has so far been carried out.

With this end in view, we propose to undertake a population genetic study on a small-isolated population known as the Semsa, which is confined only in one village, known as 'Semkhor' in the North Cachar Hills District of Assam with the following objectives:

1. To describe the demographic structure and mating patterns of the Semsa;
2. To describe the genetic composition of the population;
3. To find out how the evolutionary forces like selection, drift, etc. are acting on this population;
4. Finally, to compare the present findings with those existing on other populations, particularly with those reported for the populations of Assam and Meghalaya.

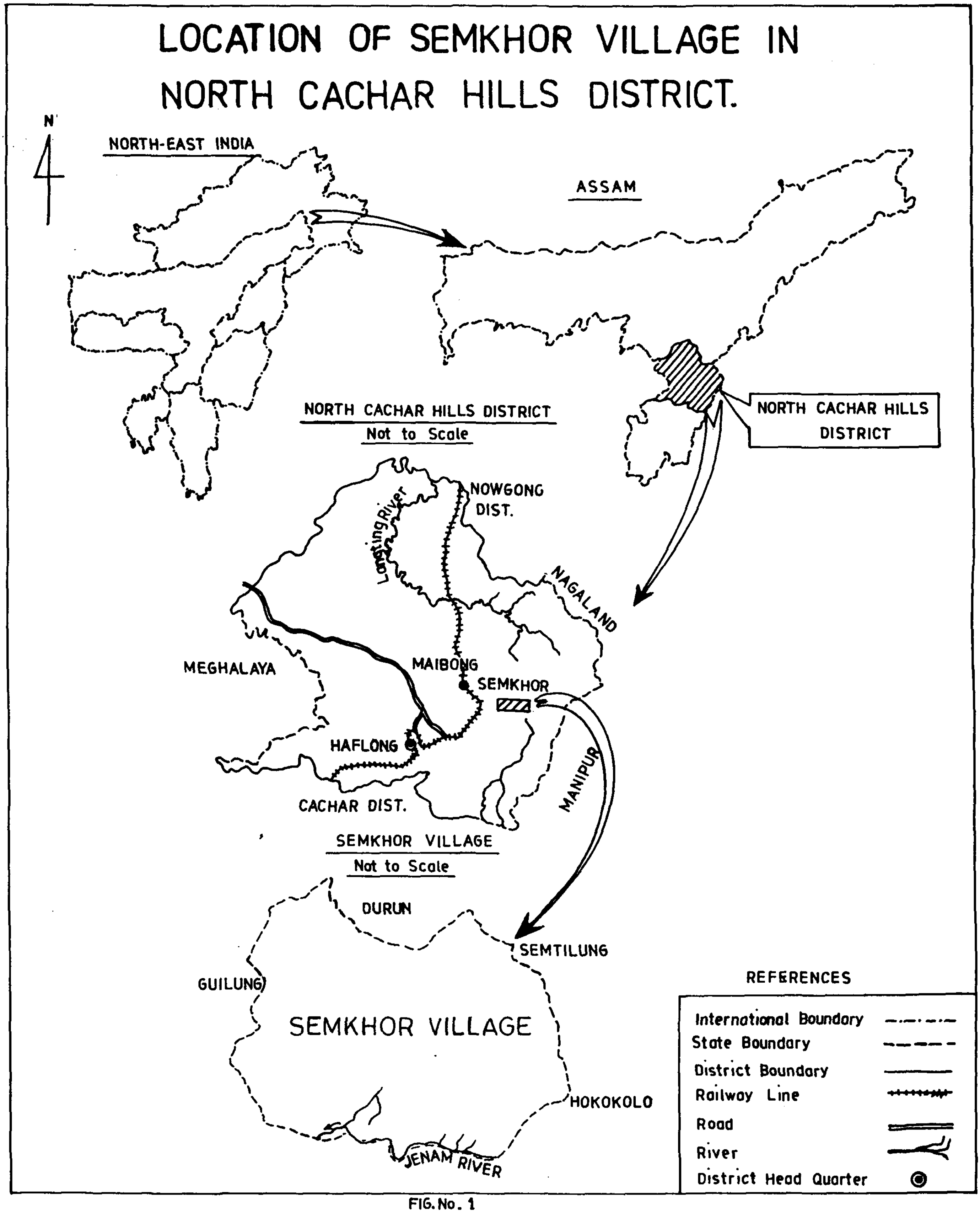
The United Mikir and North Cachar Hills District, was created within Assam on 17th November, 1951, with some parts of Nowgong, Sibsagar, Cachar and United Khasi and

Jaintia Hills Districts with a total area of 5,883 square miles (15,237 square kilometres). It was comprising two subdivisions namely, Mikir Hills and North Cachar Hills (District Handbook of United Mikir and North Cachar Hills, 1972).

On 2nd February, 1970, these two subdivisions formed two separate districts - Karbi Anglong and North Cachar Hills. According to the 1972 Statistical Handbook, the North Cachar Hills District covers 4,890 square kilometres. Haflong is the district headquarters of the North Cachar Hills District. This district is bounded on the West by Meghalaya state and a part of the Karbi Anglong district, on the east by Nagaland and Manipur and a part of the Karbi Anglong district, on the north by the Nowgong district and on the south by the Cachar district. (Fig. 1).

The North Cachar Hills region is constituted with the eastern flanks of the Jaintia Hills and the northern flanks of the Barail range. The hills of this region are steeper, more rocky and rugged. There are of course gentle slopes towards Lumding. Some small tracts of plains lie here and there between the ridges.

Physiographically, the district can be divided into three main divisions - (a) the low lying areas, i.e., the



LOCATION OF SEMKHOR VILLAGE IN
NORTH CACHAR HILLS DISTRICT.
N
NORTH-EAST INDIA
ASSAM
NORTH CACHAR HILLS
DISTRICT
NORTH CACHAR HILLS DISTRICT
Not to Scale
NOWGONG
DIST.
Langting River
NAGALAND
MEGHALAYA
MAIBONG
SEMKHOR
HAFLONG
MANIPUR
CACHAR DIST.
SEMKHOR VILLAGE
Not to Scale
DURUN
SEMTILUNG
GUILUNG
SEMKHOR VILLAGE
HOKOKOLO
JENAM RIVER
REFERENCES
International Boundary
State Boundary
District Boundary
Railway Line
Road
River
District Head Quarter

FIG. No. 1

valleys of the rivers namely, Diyung, Langting, Mahur and Jatinga, (b) the high hills of the Barail range covering the eastern and southern positions. The highest peak of this range is Hempenpet, a plateau of Gungung Khorongma and Garampani areas with an average height of 762 m, (c) the plateau of Gungung Khorongma and Garampani areas with an average height of 762 m. (Statistical Handbook, North Cachar Hills District, 1976).

The main rivers of the area are Diyung and Jatinga. The soil in the district vary from sandy loam to clayey loam in texture, usually acidic in reaction, somewhat deficit in potash, but rich in Nitrogen and organic matters. Owing to porosity of soil in most of the hill areas, the capacity to retain water is less. (Statistical Handbook, North Cachar Hills District, 1976).

The climatic condition of the district differs from place to place. The district falls within the temperate heat zone. During summer atmosphere becomes very sultry being near to the Tropic of Cancer.

Rainfall is very heavy during the months from May to September but is not evenly distributed throughout the district. The average mean maximum temperature is 27°C

(80'60°F) and the mean minimum temperature is 17'2°C (62'96°F). The annual rainfall ranges from 1424 to 2160 millimeters (District Handbook of United Mikir and North Cachar Hills, 1972).

Topographically the North Cachar Hills District has a blend of hills and plains. As such the varying climatic atmosphere in the district is associated with a variety of flora and fauna. (District Handbook of United Mikir and North Cachar Hills, 1972).

Sufficient rainfall has helped tropical vegetation to grow abundantly throughout the district. The forest is chiefly of miscellaneous type. A greater part of the hilly region of the district abounds in various types of bamboo and tall grass. (Statistical Handbook, North Cachar Hills District, 1976).

The reserve forest area of the district is 63,333 hectares. The main forest reserves are (1) Langting Mupa, (2) Khurungming, and (3) Barail part. In addition to the area under reserved forests, the tract bears an extensive area of unclassed state forests.

Flora and Fauna

The important flora of the district are sam (*Artocarpus chaplasha*), sonaru (*Cassia fistula*), amari (*Amoora wallichii*), champa (*Michelia champaca*), gonseroi (*Cinnamomum cecicodaphne*), peepal (*Ficus*) etc.

The district was the original home of the famous one horned rhinos (*Rhinocerus unicornis*). Wild animals like elephant (*Elephas india*), tiger (*Felis tigris*), deer (*Cervus*), bear (*Ursus*), buffalo (*Syncerus*), leopard (*Felis pardus*), monkey (*Macaca*), flying fox (*Galeopithecus*), black buck (*Antilope cervicapra*), wild pig (*Sus*) are found in the district. Various types of reptiles and birds are seen. Jatinga, a place in the North Cachar Hills District, is famous since it is known that many birds come from different parts of the world to commit suicide there.

General populations of the district

The Dimasa is the major population of North Cachar Hills District. Besides, there are numerous other small groups of tribal population, residing in different pockets in this district. The Zemi Naga, Kuki, Hmar, Khasi and Jaintia, Mizo, etc. are found here.

The present study has been carried out among the Semsa of Semkhor village in the North Cachar Hills District of Assam.

The Semkhor Village

The Semkhor village (Fig. 1) is situated in the hills of Barail range. It covers an area of 406 hectares and lies between 93°15'E and 93°22'6"E latitude and 25°20'N and 25°15'27"N longitude. The village is bounded by hills and rivers from all sides. The main rivers of the village is the Langting, which has many tributaries, such as Seling, Phara, Wami, Samphari, Sakroma, Laikrima, Dimbram etc. (District Handbook of United Mikir and North Cachar Hills, 1972).

In this village there were five saline pits (Semdikhor), but at present there are only three in usable condition. The name of village has been derived from these natural saline pits. It happens to be one of the oldest villages in the district (Danda and Ghatak, 1985).

It is said that the people from nearer villages came to the Semkhor and settled there. There is another view that a section of the Dimasa people took shelter in this village during the Cachari King's encounter with the Ahom (Danda and Ghatak, 1985). However, this village is bounded by hills on all sides, and consequently the inhabitants of the village still maintain a relative cultural isolation. The population of this village are called as Semsa, after the name of the village Semkhor.

The Semsa

The Semsa is an off-shoot of the Dimasa. This population is restricted only in the Semkhor village, as mentioned earlier. They have been maintaining their cultural isolation for more than two hundred years (Danda and Ghatak, 1985). The Semsa are still having traditional cultural traits, including the language of the Dimasa tribe. Marriage rule among the Semsa is strictly guided by the principle of double descent system. As well they strictly follow village endogamy. Initally there were seven patriclans among the Semsa. But at present they are having only five patriclans. Danda and Ghatak (1985) have mentioned that at present, the Semsa of Semkhor village still have 16 matriclans. At the time of marriage a man is not allowed to take a bride from his own patriclan and it is also a rule that a man should not marry a girl, who belongs to the same matriclan (Danda and Ghatak, 1985). However, cross-cousin marriage, though not being practised, is not prohibited among the Semsa. But they are very particular about maintaining the village endogamy. No one is supposed to marry outside the village. Sometime in the past a stray instance of marriage between a Semsa boy and a Dimasa girl took place. But the boy was forced to leave the Semkhor village, and he is no more considered as a Semsa.

Ghosh and Dasgupta (1991) are of the opinion that in order to safeguard the ecological advantage (the use of saline pits) the Semsa people gave up all relations with their parental group i.e., the Dimasa. The Semsa also have no culture contact with any of the surrounding populations like Zemi Naga, Hmar and others for about last two hundred years. Whatever it may be, the Semsa of Semkhor village is an isolated population, having no contact, till today, with other populations including the Dimasa.

The occupation of the Semsa people is mostly shifting and settled cultivation. However, they also earn their livelihood through various types of activities like weaving, basket making, rearing of domestic animals, etc. The Semsa are largely dependent on forest for their survival.

The Semsa do not distinguish between man and woman labour. To them no work is superior or inferior. Both sexes take equal responsibility in productive system, and there is no differential treatment in terms of payment between males and females.

The entire community forest among the Semsa is divided among the different patriclans, and the Semsa are aware of the fact that which part of the village belongs to which clan.

The Semsa food habit is very simple and that is why they need very little things to buy from the market. So, the Semsa do not feel the need to produce more than what they require. They are primarily rice eaters. They usually take food thrice in a day i.e., in the morning, mid-day and evening.

The Semsa are also fond of taking meat, particularly buffalo meat. Rice beer is also their favourite drink. The literacy level among the Semsa is very poor. It is true that the village has a primary school, but rarely any student attends that school. To the Semsa, the formal education appears meaningless.

In the Semkhor village, there is no medical facility. For medical treatment, they have to go to Maibang hospital, which is almost 30 Km away from Semkhor village. The Semsa people hardly visit the hospital. However, generally the health condition of the people is not good. (Danda and Ghatak, 1985).

According to the District Handbook of the United Mikir and North Cachar Hills District, there were 118 households in the Semkhor village with a total population of 558 souls, of which 297 were males and 261 females. Danda and Ghatak (1985) have reported that the Semkhor village consists of 187 households with a total population of 692 of which 336 are males and 356 females.

With this brief introduction we shall present our findings on the Semsa in the subsequent chapters.

CHAPTER II

MATERIALS AND METHODS

In this chapter we shall discuss the materials collected for the present study and the methods that have been applied. The present research study on population genetics among the Semsa of North Cachar Hills district, Assam, has been carried out in three phases, between July 1991, and February, 1995. In July 1991, a pilot survey was carried out. In the next field trip i.e., between January, 1992 and September, 1992, a detailed demographic work was done, and data on anthropometry; genetic traits viz., ABO and Rh blood groups, P.T.C. taste-blindness and colour-blindness; behavioural traits like arm-folding, hand-clasping and tongue-rolling; morphological traits like mid-phalangeal hair and ear-lobe attachment and dermatoglyphics were collected. Again during the period between December, 1994 and February, 1995, the 3rd phase of the field work was undertaken with a view to rechecking some of the data, collected during the earlier field works and also making some demographic data up-to-date.

As already mentioned, the Semsa are confined to one village only, i.e., Semkhor village. Therefore, application of statistical sampling of villages does not arise.

Nature of Data

A. Demography

For collection of demographic data among the Semsa, we have taken into consideration the entire village, i.e., a complete enumeration has been done. All households of the Semsa were visited and surveyed.

Demographic data were collected through indepth interview with each of the married woman, or head of the household, using household and fertility schedules (given in Appendix B). For collection of demographic data, we have followed the recommendations of the World Health Organization (1964, 1968), which are as follows:

Individual Records

For the individuals examined, including temporary absentees, the following information was obtained:

(a) date and place at which record was taken;

(b) name of the informant and his/her relationship to the head of the family (mother, father, etc.);

(c) sex and marital status of each member of the community;

(d) Age: Age of each inhabitant was recorded. Age was estimated, specially in the case of the older people with reference to some important local events. Consequently, some amount of error might have occurred in age estimation. However, these were checked and rechecked on several occasions, at the time of collecting pedegrees from various people, including relations and neighbours. For younger generation, the child's deciduous as well as permanent dentition was also considered for assessing age.

(e) Birth-place: As the Semsa are confined only in one village, and have been living in that village for more than last two hundred years, all the individuals are found to be born in the same village.

(f) Clan: For each and every individual, both patriclan and matriclan were recorded.

(g) Mating records:

(i) Pregnancy history of each married Semsa woman was recorded, taking into consideration total number of pregnancies and approximate age at each conception, outcome of each pregnancy (abortion, still birth and livebirth), sex of each offspring, multiple births, number of surviving children and their age and sex and marital status, number of deceased children with age at death, etc.

(ii) Social factors affecting fertility and survival:

Consanguinity: Each of the marriages was specially investigated with a view to finding out the degree of consanguinity between couples before their marriage. This information was verified by drawing a genealogy in each case.

Genealogy: Finally, in order to check all demographic information, including consanguineous marriages, several genealogies were drawn for the entire community. Some of the genealogies, given in Appendix A, show all consanguineous marriages. These genealogies have been specially drawn.

Anthropometry

The anthropometric measurements were taken on 82 adult males, aged from 21 years to 63 years, i.e., 40.20% of the total males in the same age group.

Thirteen measurements were considered for the present study. They are as follows: Height vertex, Sitting height, Chest-girth, Head length, Head breadth, Bizygomatic breadth, Nasal height, Nasal breadth, Weight, Least frontal breadth, Head circumference, Bigonial breadth and Mid-arm circumference on all the subjects. It may be mentioned that the instructions, given by IBP (Weiner and Lourie 1981) were followed in the present study.

Precautions

All subjects were asked to wear minimum clothes without any foot-wear, headgear, etc. Care was taken to select apparently healthy, normal and disease free individuals. Also care was taken, as far as possible, to select unrelated individuals (for example, only one adult male person from one household was taken).

Anthropometric Measurements

Height vertex: It measures the vertical distance from floor to vertex.

Vertex (v): It is the highest point on the head, when the head is in eye-ear plane.

Sitting height: It measures the vertical distance from vertex to the sitting surface of the subject, when stretched i.e., when the vertical column is stretched to its maximum.

Chest girth: The girth of the chest is measured, putting the tape around the chest in horizontal position and allowing it to pass over nipples in the front and the lower scapular angle at the back.

Head length (g-op): It is the straight distance from glabella to the opisthocranion.

Glabella (g): It is the point on the protuberance of the lower forehead above nasal root between the eyebrow ridges, intersected by mid-sagittal plane.

Opisthocranion (op): It is the most posterior point on the posterior protuberance of the head in the mid-sagittal plane. This point is determined by measuring maximum head length.

Head breadth (eu-eu): It is the straight distance between the two euryon points.

Euryon (eu): It is the most laterally placed point on the sides of the head.

Bizygomatic breadth (zy-zy): It is the straight distance between two zygion points.

Zygion (zy): It is the most laterally placed point on the zygomatic arch.

Nasal height (n-sn): It measures the straight distance between nasion and subnasale.

Nasion (n): It is the point on the nasal root intersected by mid-sagittal plane.

Subnasale (sn): The point, where the lower margin of the nasal septum meets the upper lip.

Nasal breadth (al-al): It measures the straight distance between the two alare points.

Alare (al): It is the most laterally placed point on the nasal wing.

Weight: Weight is taken by means of a standard spring type of weighing machine.

Least frontal breadth (ft-ft): It measures straight distance between the two frontotemporal points.

Frontotemporale (ft): It is the most anterior and inner point on the linea temporalis on the frontal bone.

Head Circumference (g-op-g): It measures the maximum circumference of the head taken horizontally.

'Bigonial' breadth (go-go): It measures the straight distance between two gonion points.

Gonion (go): It is the lowest posterior and most lateral point on the angle of the jaw.

Mid-arm circumference: It measures the maximum circumference of the upper arm taken horizontally.

These definitions have been adopted from Singh and Bhasin (1989).

Techniques: The techniques of taking anthropometric measurements on the subjects, suggested by Martin (1928), Das and Deka (1992-93), and Singh and Bhasin (1989), have essentially been followed in the present study.

Genetic Markers:

Serology: Blood samples on 106 individuals (65 males and 41 females), which constitutes 12.65% of the total population, were collected, following the standard techniques, suggested by Lawler and Lawler (1951) and Mourant (1954). Blood samples were obtained by pricking the fourth finger of the left hand of each individual with the help of a sterilized disposable needle. Before pricking, the finger was cleaned with absolute alcohol and dried. The blood sample was collected in 0.85% normal saline. Before performing the agglutination tests, the red cells were washed thrice in normal saline. For washing of red cells every time centrifugation was done at 1000 r.p.m. and the supernatent was removed and finally 2 per cent suspension of red cells was prepared with normal saline. Anti-A, anti-

B and anti-D sera were obtained from STANGEN, Hyderabad. For performing agglutination test each time a control sample was used to find out potency of all anti-sera. Tests were carried out by a standard tube method.

ABO - blood groups: One drop of anti-A and the same amount of anti-B sera were placed in two precipitin tubes. Then equal volume of red cell suspension was added each to anti-A and anti-B sera, already taken in tubes and left at room temperature for some time. Each tube was agitated by tapping with finger, and then the results were noted accordingly.

Rh(D): For Rh blood grouping one drop of anti-D serum was taken in a precipitin tube and one drop of packed red cell was mixed thoroughly with anti-sera. The tube was incubated for about a minute in order to activate the reaction. Agglutination confirms positive reaction i.e., Rh^+ and lack of agglutination implies negative result i.e., Rh^-.

Dermatoglyphics

Finger ball (digital) and Palmar dermatoglyphics: The standard methods, suggested by Cummins and Midlo (1961), have been followed to collect finger ball and palmar prints on 130 individuals (91 males and 39 females), which constitute 15.51% of the total population. The materials, required for taking prints, were white sheets of paper, tube or ordinary printing ink, a plate of spreading ink, pencil, soap, thin piece of cloth, cotton and rectified spirit.

The ink printing method, as suggested by Cummins and Midlo (1961), was adopted. The subjects were asked to wash their hands with soap and water in order to remove all dust, hairs, grease, etc. from hands, and in case of stubborn grease the hands were cleaned with a piece of cotton dipped in rectified spirit. The palm and fingers were allowed to dry for sometime. A small quantity of ink was placed on the inking plate and spread evenly all over it with a view to making a thin film by a cotton pad (Das and Deka, 1992-93). While spreading ink by smearing on the plate, the bulging surface of the cotton pad got uniformly inked.

Digital Prints: To make a rolled impression, the bulb of the finger was smeared evenly by the inked cotton pad. The finger was then placed upon the paper with the nail at right angle to the plane of the paper, and it was slowly turned over until the bulb surface, which was originally facing to the left, turned to right. In this way a clear rolled impression of the finger surface was obtained.

Palmar Prints: The subject's palm was smeared with the inked cotton pad in such a way that all the ridges of the palmar surface would be properly inked. In this process the palmar surface from first bracelet area to the first phalangeal crease was properly inked and then the palm was placed on the paper. To transfer the print on the paper a little pressure was exerted on ulnar and radial borders, interdigital areas and mid-palmar region.

For convenience the palmar prints were taken on the centre of the sheet and the fingers on the sides. The digits were rolled from ulnar to the radial border.

Following precautions were taken in order to avoid the errors in printing. Care was taken not to press the finger too hard on the paper. The plate used for spreading ink was made clean to make it free from dust, hairs or any other foreign bodies. A very thin film of ink was applied with a view to getting a clean and sharp print. The persons with depression or severe cuts were not included in the present sample.

Morphological and Behavioural traits

Data on arm folding, hand clasping, tongue rolling, ear-lobe attachment and mid-phalangeal hair were taken from 154 individuals (108 males and 46 females), which constitute 18.38% of the total population.

(a) **Behavioural traits**

(i) Arm folding: The individuals were asked to fold their arms in a natural way. The subjects were classified as R > L (Right over Left) or L > R (Left over Right), depending on how they folded their arms naturally. Accordingly, the observations on arm folding were recorded.

(ii) Hand clasping: The observations on hand clasping were also made in similar manner. The subjects were asked to clasp their hands in a natural way, and the subjects were classified as R > L (Right over Left) or L > R (Left over Right), depending on how they clasped their hands.

(iii) Tongue rolling: The subjects were asked to roll their tongue and extend it from the mouth. Some had the ability to roll the tongue into a distinct U-shape, while others could not. The observations were recorded as +ve (positive) and -ve (negative), respectively.

(b) **Morphological traits**

(i) Earlobe attachment: Left and right ears of all the subjects were examined. The observations were recorded in the following way : attached or free.

It may be noted that in order to avoid arbitrariness in classification or ear-lobe attachment, a simple classification, as mentioned above, was adopted.

(ii) Mid-phalangeal hair: All fingers of both hands of the subjects were swabbed with alcohol and allowed to dry. With the help of a magnifying glass in adequate light, the fingers of both hands were examined. It was noted down, if the hairs were present in the mid-phalangeal region of the fingers.

(c) Other genetic traits

(i) Colour blindess: The Ishihara Chart (1962) was used to collect data on 119 male individuals i.e., 14.20% of total males in the population. The subjects were examined in adequate day-light. The book was kept open and the plates were held at a distance, approximately two and a half feet from the subjects. The subjects were asked to read numerals of the plate Nos. 1-25 within three seconds for each plate. Since majority of the subjects were illiterates, they could not read the numerals, and in such cases they were asked to trace with a clean brush the winding lines between two X's of the plates from No. 26 to 38.

(ii) Test Sensitivity to Phenylthiocarbamide: The serial dilution method, suggested by Harris and Kalmus (1949), was followed to collect data on PTC - taste sentivity. Total 156 individuals were tested (97 males and 59 females), which constitutes 18.62% of the total population.

A stock solution, containing 0.13% phenylthiocarbamide (PTC), was prepared in cold boiled water. 14 identical bottles were kept serially, numbered 1 to 14 and about 40 ml of the stock solution was kept in the bottle No. 1. Then from the bottle No. 1, 20 ml (i.e., one-half of the solution in bottle No. 1) of the stock solution was taken out and poured in the bottle No. 2, in which 20 ml. of water was thoroughly mixed to make 40 ml of the solution. Half of the solution in the bottle No. 2 was transferred to the bottle No. 3 in which 20 ml of water was thoroughly mixed again to make the volume of the solution upto 40 ml. The same procedure was followed until the solution No. 13 was prepared. In this way a serial dilution of PTC was prepared, where the concentration of the solution in each bottle became half of the previous bottle. In the last bottle i.e., bottle No. 14, plain water was kept.

The subjects were asked to wash their mouths before tasting the solutions, specially to them, who were found chewing tobacco or smoking. First of all, a few drops of plain water from the bottle No. 14 were given in the mouth of the subject, and then the solution Nos. 13, 12, 11, etc.

were given in descending order directly in the mouth of the subject. The moment the subject got some taste, the number of the solution was noted as his/her threshold value. Sorting was done by changing the solution numbers, near the threshold number, repeatedly.

As mentioned earlier, the Semsa is a very small population, consisting of 838 souls only. Though all precautions were taken to collect data from the unrelated individuals, still some possibilities are there that some related individuals (of course not like brother and brother; brother and sister; father and son etc.) must have been included in the present sample. It may, however, be mentioned here that such relatedness in the sample from a small population like the Semsa, does not bias the findings (Salzano, 1964).

In the subsequent chapters we shall present the results of our findings on demographic, genetic, dermatoglyphics, morphological, behavioural and anthropometric characters among the Semsa.

CHAPTER III

DEMOGRAPHY

In this chapter, we shall describe the demographic structure of the Semsa of Semkhor village. The Semsa are restricted only in this village. We have covered the entire village with a view to understanding the demographic structure of the population.

Table 1 shows the distribution of total population by age, sex and marital status. The total population in this village is 838 of which 418 are males and 420 females. It shows that in the total population 49.88% are males and 50.12% females. The overall sex ratio is 1 : 1.005, which shows that the number of females is slightly more than that of males, though the overall sex ratio in this population is very near to the ideal sex ratio of 1 : 1. Of all males, it is found that about 55.98%, 38.28% and 5.74% are unmarried, married and widowed/divorced, respectively. In the case of females, these are 52.86%, 38.10% and 9.05%, respectively. Taking males and females together, it is found that 54.42% of all individuals are unmarried, whereas 38.19% are married and 7.40% are widowed/divorced. It is

Table 1. Population by age, sex and marital status.

Age Groups (in years)	Unmarried		Married		Widowed/Divorced		Total	
	M	F	M	F	M	F	M	F
< 1	10 (1.19)	17 (2.03)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	10 (1.19)	17 (2.03)
1 - 4	41 (4.89)	40 (5.01)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	41 (4.89)	42 (5.01)
5 - 9	75 (8.95)	58 (6.92)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	75 (8.95)	58 (6.92)
10 - 14	45 (5.37)	45 (5.37)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	45 (5.37)	45 (5.37)
15 - 19	40 (4.77)	42 (5.01)	3 (0.36)	14 (1.67)	0 (0.00)	0 (0.00)	43 (5.13)	56 (6.68)
20 - 24	22 (2.63)	14 (1.67)	19 (2.27)	24 (2.86)	1 (0.12)	1 (0.12)	42 (5.01)	39 (4.65)
25 - 29	0 (0.00)	3 (0.36)	21 (2.51)	24 (2.86)	0 (0.00)	4 (0.48)	21 (2.51)	31 (3.70)
30 - 34	1 (0.12)	0 (0.00)	20 (2.39)	23 (2.74)	2 (0.24)	1 (0.12)	23 (2.74)	24 (2.86)
35 - 39	0 (0.00)	1 (0.12)	24 (2.86)	24 (2.86)	2 (0.24)	3 (0.36)	26 (3.10)	28 (3.34)

Contd...

Table 1 (Contd.)

Age Groups (in years)	Unmarried		Married		Widowed/Divorced		Total	
	M	F	M	F	M	F	M	F
40 - 44	0 (0.00)	0 (0.00)	25 (2.98)	21 (2.51)	3 (0.36)	2 (0.24)	28 (3.34)	23 (2.74)
45 - 49	0 (0.00)	0 (0.00)	18 (2.15)	11 (1.31)	6 (0.72)	7 (0.84)	24 (2.86)	18 (2.15)
50 - 54	0 (0.00)	0 (0.00)	10 (1.19)	5 (0.60)	2 (0.24)	5 (0.60)	12 (1.43)	10 (1.19)
55 - 59	0 (0.00)	0 (0.00)	10 (1.19)	8 (0.95)	0 (0.00)	4 (0.48)	10 (1.19)	12 (1.43)
60 - 64	0 (0.00)	0 (0.00)	6 (0.72)	5 (0.60)	4 (0.48)	2 (0.24)	10 (1.19)	7 (0.84)
65 - 69	0 (0.00)	0 (0.00)	3 (0.36)	0 (0.00)	3 (0.36)	4 (0.48)	6 (0.72)	4 (0.48)
70 +	0 (0.00)	0 (0.00)	1 (0.12)	1 (0.12)	1 (0.12)	5 (0.60)	2 (0.24)	6 (0.72)
Total	234 (55.98)	222 (52.86)	160 (38.28)	160 (38.10)	24 (5.74)	38 (9.05)	418 (49.88)	420 (50.12)
Grand Total	456 (54.42)		320 (38.19)		62 (7.40)		838	

Figures in parentheses indicate percentage.

Table 2. Population by age, and sex and marital status (extracted from Table 1)

Age group (in years)	Unmarried		Married		Widowed/ Divorced		Total		M + F	Sex ratio
	M	F	M	F	M	F	M	F		
0 - 14	171	162	0	0	0	0	171	162	333	1:0.95
%	(20.41)	(19.33)	(0.00)	(0.00)	(0.00)	(0.00)	(20.41)	(19.33)	(39.74)	
15 - 49	63	60	130	141	14	18	207	219	426	1:1.06
%	(7.52)	(7.16)	(15.51)	(16.83)	(1.67)	(2.15)	(24.70)	(26.13)	(50.84)	
50 +	0	0	30	19	10	20	40	39	70	1:0.98
%	(0.00)	(0.00)	(3.58)	(2.27)	(1.19)	(2.39)	(4.77)	(4.65)	(9.43)	
Total	234	222	160	160	24	38	418	420	838	1:1.005

seen that no individual after the age of 24 years remains unmarried, excepting in case of 1 male and 4 females (0.60%). One male and one female of those five are mentally retarded and other three are physiologically handicapped. However, it is seen from Table 1 that most of the marriages have taken place between 15 and 24 years of age. It holds good for both sexes. It is found that the mean age at marriage for female is 18.42 ± 0.17 years and that for males 22.11 ± 0.18 years in this population.

Table 2, extracted from the Table 1, shows the total population according to age group and sex. It is seen that 20.41% of males and 19.33% of females belong to the age-group of 0-14 years. In the reproductive age group, i.e., 15-49 years, 24.70% and 26.13% are males and females respectively, whereas in the post reproductive age group i.e., 50 + years, 4.77% and 4.65% are males and females, respectively.

In the reproductive age group, 7.52% and 7.16% are unmarried males and females, respectively. In the same reproductive age group 1.67% of males and 2.15% of females are either widowed or divorced. The percentages of individuals, who are widowed or divorced, are 1.19% for males and 2.39% for females in the post-reproductive age group i.e., 50 + years. It is also found that in this population nearly 50.84% of all individuals belong to the reproductive age group, whereas 39.74% belong to the pre-reproductive age group and 9.43% of them are in the post-reproductive age group.

In this population, it is seen that 39.74%, 50.84% and 9.43% of all individuals belong to the age group of 0-14 years (pre-reproductive group), 15-49 years (reproductive group) and 50+ years (post-reproductive group), respectively. According to Sunbarg's classification of population, based on age-group distributions, (Datta, 1972), the Semsa seem to be of progressive type.

As mentioned earlier, the overall sex ratio in this population is 1 : 1.005, which shows that it is slightly tilted in favour of females. But it is further observed that the sex ratio in the pre-reproductive age group i.e., 0-14 years, is 1 : 0.95, which indicates that the number of males is slightly more than that of females. But in the reproductive age group i.e., 15-49 years, it is seen that the sex ratio is 1 : 1.06. It is tilted in favour of females. So, it indicates that male mortality is slightly higher than female mortality in the earlier age group. In the post-reproductive age group i.e., 50+ years, the sex ratio is again slightly tilted in favour of males, which is 1 : 0.98. It indicates that the average longevity is, perhaps, slightly higher in males than in females.

Fig. 2 shows a diagramatic distribution of the population by age groups. The entire population has been classified into 16 age groups. It shows that in below one year age group the population is very small and in the age group of 1-4 years it is comparatively broader, but in the age group of 5-9 years it is broadest. Though it indicates that the population base is broad, in the recent times the population base has shrunk either due to high infant mortality or due to adoption of family planning methods. However, we shall deal with this aspect afterwards. This population further indicates that the frequencies of male and female in various age groups are, by and large, same and as age advances, population decreases.

In this population, it has been calculated that the mean age at first child birth in case of females is 20.58 ± 0.24 years and that in the case of males 24.59 ± 0.29 years. So, the mean age at first child birth, taking both males and females together, becomes 22.59 years. In the present analysis we have taken 23 years as a generation length, following the method, suggested by Glass (1956). It may be noted that it is very difficult to classify any human population into generations since the generations are always overlapping.

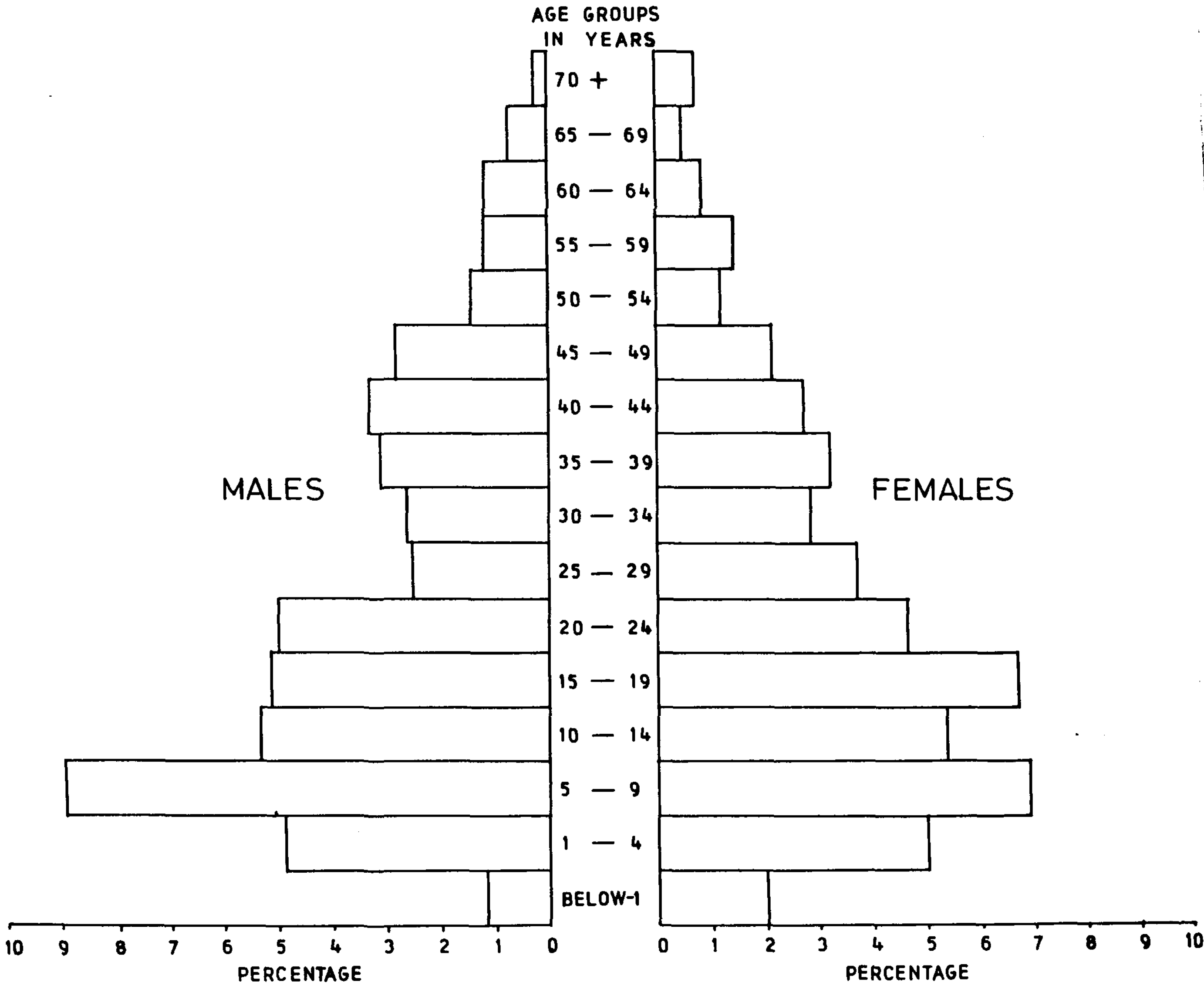


FIG. 2 POPULATION PYRAMID

Table 3 shows the frequency of multiple marriages by age of spouses. In the third generation i.e., upto age 23 years, it is found that 5.56% and 2.94% of males and females respectively have married more than once. In the second generation i.e., 24-46 years, 10.53% and 8.77% of males and females respectively have married two times. In this generation one man (0.88%) has married three times and also one male individual (0.88%) has married more than three times. But no woman has been found to have married more than two times in this generation. In the third generation i.e., 47+ years, 19.23% and 20.00% of males and females respectively have married two times. But no individual has been found to have married more than two times.

Table 3 further reveals that about 12.04% of the total married (including widowed/divorced) individuals have changed their mates. It is seen that the males have changed their mates more often than females (males 13.59% and females 10.61%). However, it is found that the frequency of individuals, who married more than once, increases from the lower, to the higher age group (5.56%, 12.28% and 19.23% in males; 2.94%, 8.77% and 20.00% in females for age groups 23 years, 24-46 years and 47 + years respectively). It is seen that 86.41% and 89.39% of the married (including divorced/widowed) males and females have married only once,

Table 3. Multiple marriages by age of spouses.

Individual Married		- 23 years		24 - 46 years		47 + years		TOTAL		M + F
		M	F	M	F	M	F	M	F	
	Once %	17 (94.44)	33 (97.06)	100 (87.72)	104 (91.23)	42 (80.97)	40 (80.00)	159 (86.41)	177 (89.39)	336 (87.96)
More than once	2 times %	1 (5.56)	1 (2.94)	12 (10.53)	10 (8.77)	10 (19.23)	10 (20.00)	23 (12.50)	21 (10.61)	
	3 times %	0 (0.00)	0 (0.00)	1 (0.88)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.54)	0 (0.00)	
	More than 3 times %	0 (0.00)	0 (0.00)	1 (0.88)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.54)	0 (0.00)	
	Total %	1 (5.56)	1 (2.94)	14 (12.28)	10 (8.77)	10 (19.23)	10 (20.00)	25 (13.59)	21 (10.61)	46 (12.04)
GRAND TOTAL		18 (100.00)	34 (100.00)	114 (100.00)	114 (100.00)	52 (100.00)	50 (100.00)	184 (100.00)	198 (100.00	382 (100.00)

whereas nearly 12.50% of males and 10.61% of females married twice. It is further noticed that among the Semsa there is only one man (0.54%), who has married thrice and another man (0.54%) has married more than thrice.

When both sexes are pooled together, as shown in Table 3A, the frequency of individuals more than once married, increases through the lower age group to the higher age group (3.85%, 10.53% and 19.61% for the age groups ≤ 23 years, 24-46 years and 47 + years respectively). It is seen that as age progresses, both males and females incline to change their mates.

Table 3B, extracted from Table 3, shows the frequency of multiple marriages by sex. Out of 336 individuals, who have married only once, 159 of them (i.e., 47.32%) are males and 177 of them (i.e., 52.68%) females. There are 46 individuals, who have married more than once, out of which 54.35% are males and 45.65% females. In this population, there are 184 married males out of which 13.59% have married more than once, whereas there are 198 married females, out of which 10.61% have married more than once. So, it indicates that the frequency of persons marrying more than once is more among the males than among the females. However, in respect of this, the difference between male and female is not very remarkable. Table 4

Table 3A. Multiple marriages by age of spouses.

Individual Married	- 23 years	24 - 46 years	47 + years	Total
	M + F	M + F	M + F	M + F
Once	50	204	82	336
%	(96.15)	(89.47)	(80.39)	(87.96)
More than Once	2	24	20	46
%	(3.85)	(10.53)	(19.61)	(12.04)
Total	52	228	102	382
%	(100.00)	(100.00)	(100.00)	(100.00)

Table 3B. Multiple marriages by sex.

Individual Married	Male		Female		Total (M + F)	
	No.	%	No.	%	No.	%
Once	159	(86.41)	177	(89.39)	336	(87.96)
%	47.32		52.68		100.00	
More than once	25	(13.59)	21	(10.61)	46	(12.04)
%	54.35		45.65		100.00	
Total	184	(100.00)	198	(100.00)	382	(100.00)
%	48.17		51.83		100.00	

Figures in parentheses indicate the percentages out of total male or female.

Table 4. Binomial Test of proportion in respect of multiple marriages.

Sex	No.	No. of individuals married more than once	T_1	T_2	Inference
Male	184	25	0.0298	0.0333	Insignificant
	%	13.59			
Female	198	21			
	%	10.61			

justifies the above statement. Using the binomial test of proportion, it is found that there is no significant difference between male and female in respect of the frequency of changing mates (T_1 = 0.0298 and T_2 = 0.0333).

Table 5 shows the fertility performances of women by times of marriage. There are 177 women, who have married once, and 21 women, who have married more than once. In the case of women, who married only once, the mean number of pregnancy is found to be 4.49 ± 0.21, whereas in the case of women who married more than once, it is found to be 4.95 ± 0.57. However, the difference between these two groups of women, in respect of total number of pregnancies, is not significant ($t^* = 0.77$, $P > 0.05$). In the case of women who married only once, the mean number of live births is 4.24 ± 0.21 and that, in the case of women who marry more than once, is 4.62 ± 0.54. However, the t-value shows that the difference between these two groups of women, in respect of total number of live births is not significant ($t^{**} = 0.67$, $P > 0.05$).

Table 6 shows the completed fertility size among the Semsa. Only those women, who are aged 45 years and above and lived continuously in wedlock till attainment of 45 years of age, have been taken into consideration to find out the completed fertility size. There are 29 such

Table 5. Fertility by times of marriage.

Times of marriage	No. of married women	Total Pregnancies*		Total Live Births**	
		No.	Mean ± s.e.	No.	Mean ± s.e.
Once married	177	794	4.49 ± 0.21	751	4.24 ± 0.21
More than once married	21	104	4.95 ± 0.57	97	4.62 ± 0.54

t* = 0.77 P > 0.05 t** = 0.67 P > 0.05

Table 6. Completed fertility size.

No. of mothers aged 45 + years	Total pregnancy	Live births			Average No. of live births per mother	Average No. of surviving offspring per mother
		Living	Dead	Total		
29	223	138	80	218*	7.52	4.56

* One twin birth.

mothers, who have had 218 live births. The average number of live births per mother is found to be 7.52, which indicates that the completed fertility is quite high among the Semsa. The average number of surviving offspring per such mother is 4.76.

Table 7 shows the child-woman ratio among the Semsa. It is another measure of fertility in which all children aged 0 to 4 years and all women aged 15 to 49 years, irrespective of marital status, have been taken into consideration. It is found that there are 110 children aged 0-4 years and there are 219 women aged 15-49 years, irrespective of marital status, among the Semsa. The child-woman ratio (fertility ratio) is found to be 50.23, which seems to be quite moderate.

Table 8 shows the frequency of ever-pregnant and never-pregnant women among the Semsa. It is found that out of 198 married women, 182 (i.e., 91.92%) have experienced pregnancy at least once, whereas there are 16 (i.e., 8.08%) women, who have never experienced any pregnancy. It is further seen that as the age advances the percentage of ever pregnant women increases. It is also observed that there is not a single woman, who is aged 44 years and above and has not experienced any pregnancy. So, most of the

Table 7. Child-woman ratio (Fertility ratio)

No. of children (0-4) years	No. of women (15-49) years	Fertility ratio
110	219	50.23

Table 8. Ever-pregnant and never-pregnant married women.

	Age of married women				Total
	- 23 years	24-33 years	34-43 years	44 + years	
Ever-pregnant	25 (12.63)	47 (23.74)	50 (25.25)	60 (30.30)	182 (91.92)
Never pregnant	9 (4.55)	6 (3.03)	1 (0.51)	0 (0.00	16 (8.08)
Never pregnant % of all	26.47	11.32	1.96	0.00	8.08

Figures in parentheses indicate percentage based on total number of married women.

never-pregnant women are in the early part of their reproductive life. However, it shows that most of the married women have experienced pregnancy before reaching the post-reproductive life.

Table 9 shows the frequencies of live births, surviving children and mortality by age of mothers. It is seen that there are 198 mothers, who, have had altogether 935 pregnancies. These 935 pregnancies include 37 pregnancies, which have not yet been matured. 7 mothers of age group below 23 years are still pregnant, whereas 17 mothers in the age group 24-33 years and 13 mothers in the age group 34-43 years are still pregnant. It may also be noted that there are 3 mothers (one each belonging to the age groups 24-33 years, 34-43 years and 44 + years) who have delivered twins. Each of these twin births has been taken as one pregnancy.

It shows that altogether there are 935 pregnancies and the average pregnancy per mother is 4.72. It is seen that the average pregnancy per mother varies from 1.44 in the age group upto 23 years to 6.93 in the age group 44 + years. So it indicates that the average number of pregnancy per mother increases as age of the mothers advances.

Table 9 further shows that altogether there are 848

Table 9. Live births, surviving children and mortality by age of mothers.

Age group (in years)	No.	Total Number of pregnancy	Average No. of pregnancy per mother	Live births *****			% Surviving *****	Average live births	Mortality (based on all live births)
				Living	Dead	Total			
- 23 %	34	49*	1.44	23 (4.22)	13 (4.29)	36	63.89	1.06	36.11
24-33 %	53	180**	3.40	100 (18.35)	42 (13.86)	142	70.42	2.68	29.58
34-43 %	51	290***	5.69	183 (33.58)	84 (27.72)	267	68.54	5.24	31.46
44 + %	60	416****	6.93	239 (43.85)	164 (54.13)	403	59.31	6.72	40.69
Total %	198	935	4.72	545 (64.27)	303 (35.73)	848	64.27	4.28	35.73

* There are 7 women who are still pregnant.

** This age group includes 17 women who are still pregnant; and also includes one twin pregnancy.

*** There are 13 women who are still pregnant and includes one twin pregnancy.

**** Includes one twin pregnancy.

***** Since the above pregnancies have not yet terminated, they have not been included in further analysis.

live births, which include three twin births (for each twin two live births have been counted). Out of 848 live births, 545 (i.e., 64.27%) are still surviving, whereas 303 (i.e., 35.73%) have already died. The number of surviving children varies from 59.31% in the age group 44 + years to 70.42% in the age group 24-33 years. It further shows that the average number of live births among the Semsa varies from 1.06 in the age group upto 23 years to 6.72 in the age group 44 + years. The overall average live births per mother is found to be 4.28. It may further be noted that the average live births per mother increases as age of the mothers advances.

The mortality rate (irrespective of age at the time of death) varies from 29.58% in the case of mothers, aged 24-33 years, to 40.69% in case of mothers, aged 44 + years. So, it is seen from Table 9 that so far as the mortality rate is concerned, no consistent pattern is observed with age of the mothers.

Table 10 shows the frequency of reproductive wastages among the Semsa. Out of 898 pregnancies, 3.34% have terminated into abortions and 2.56% into still births. Combining the frequencies of abortion and still birth together, it is found that the frequency of reproductive wastages is about 5.90% of all pregnancies. Table 10

Table 10. Reproductive wastages by age of mothers.

Age (in years)	No. of mothers	Total Pregnancies*	Reproductive wastage		Total
			Abortion	Still birth	
- 23	34	42	5	1	6
%			(11.90)	(2.38)	(14.29)
24 - 33	53	163**	7	15	22
%			(4.29)	(9.20)	(13.50)
34 - 43	51	277**	8	3	11
%			(2.89)	(1.08)	(3.97)
44 +	60	416**	10	4	14
%			(2.40)	(0.96)	(3.37)
Total	198	898	30	23	53
%			(3.34)	(2.56)	(5.90)

* Current pregnancies are not included.
** Includes one twin birth.

further reveals the frequency of reproductive wastage by age group of mothers. It is found that the frequency of reproductive wastage is highest (14.29%) in the lowest age group i.e., upto 23 years. But it decreases to 13.50% in the age group 24-33 years and 3.97% to age group 34-43 years. This frequency (3.37%) is lowest in the highest age group i.e., 44 + years.

Table 11 shows the frequency of child mortality among the Semsa. It is found that the frequency of mortality is highest (13.09%) in the age group 1-4 years, which is followed by 5-9 years (8.96%), below 1 year (7.55%) and lowest in 10-14 years (2.00%). It shows that the frequency of child mortality is highest in the children aged below 5 years.

This Table further shows that the frequency of child mortality is highest (36.11%) in the case of mothers, aged below 24 years. This frequency is lower (31.51%) in case of the mothers, aged 24-46 years and it is almost same (31.25%) in the case of mothers, aged 47 + years. It shows that between the generations there is not much difference in child mortality in this population. However, the overall percentage of child mortality among the Semsa is found to be 31.60% of all live births.

Table 11. Child-mortality by age-group.

Age of mothers (in years)	No. of mothers	Live births	Child Mortality				Total child mortality	
			Below 1 yr	1 - 4 yr	5 - 9 yr	10 - 14 yr	No.	%
- 23	34	36	8	5	0	0	13	36.11
%		(4.25)	(12.50)	(4.50)	(0.00)	(0.00)		
24 - 46	114	476	44	67	35	4	150	31.51
%		(56.13)	(68.75)	(60.36)	(46.05)	(23.53)		
47 +	50	336	12	39	41	13	105	31.25
%		(39.62)	(18.75)	(35.14)	(53.95)	(76.47)		
Total	198	848	64	111	76	17	268	31.60
%			(7.55)	(13.09)	(8.96)	(2.00)		

Table 12 shows the surviving sibship size by the number of married women. There are altogether 198 married women and they have 545 surviving children. The average number of surviving children is 2.75 per mother.

It is found that there are 31 mothers (i.e., 15.66% of all married women), who have no surviving child. There are 38 mothers (19.19%), who are in majority and are having 3 surviving children. It is followed by 15.66% of all mothers, who have either 1 or 2 surviving children. It is also observed that less than 1% of all mothers (0.51%) have had 8 or 9 surviving children. The rest of the mothers are having 4 to 7 surviving children.

Table 13 shows the age-specific fertility rate of the Semsa women. It is found that the age-specific fertility rate increases from the mothers, aged 15-19 years, to the mothers, aged 30-34 years. The age-specific fertility rate in this period increases from 0.3939 to 1.3206, and thereafter it steeply decreases from 1.0374 in age group 35-39 years to 0.1228 in age group 45 + years. However, the total fertility rate (T.F.R.) in this population is found to be 6.0293, which seems to be fairly high. Fig. 3 depicts the age-specific fertility rate among the Semsa.

Table 12. Surviving sibship size of married women.

Total No. of mothers	No. of surviving children (N = 545)										Average No. of surviving children per mother
	0	1	2	3	4	5	6	7	8	9	
198	31	31	31	38	24	25	12	4	1	1	
%	15.66	15.66	15.66	19.19	12.12	12.63	6.06	2.02	0.51	0.51	2.75

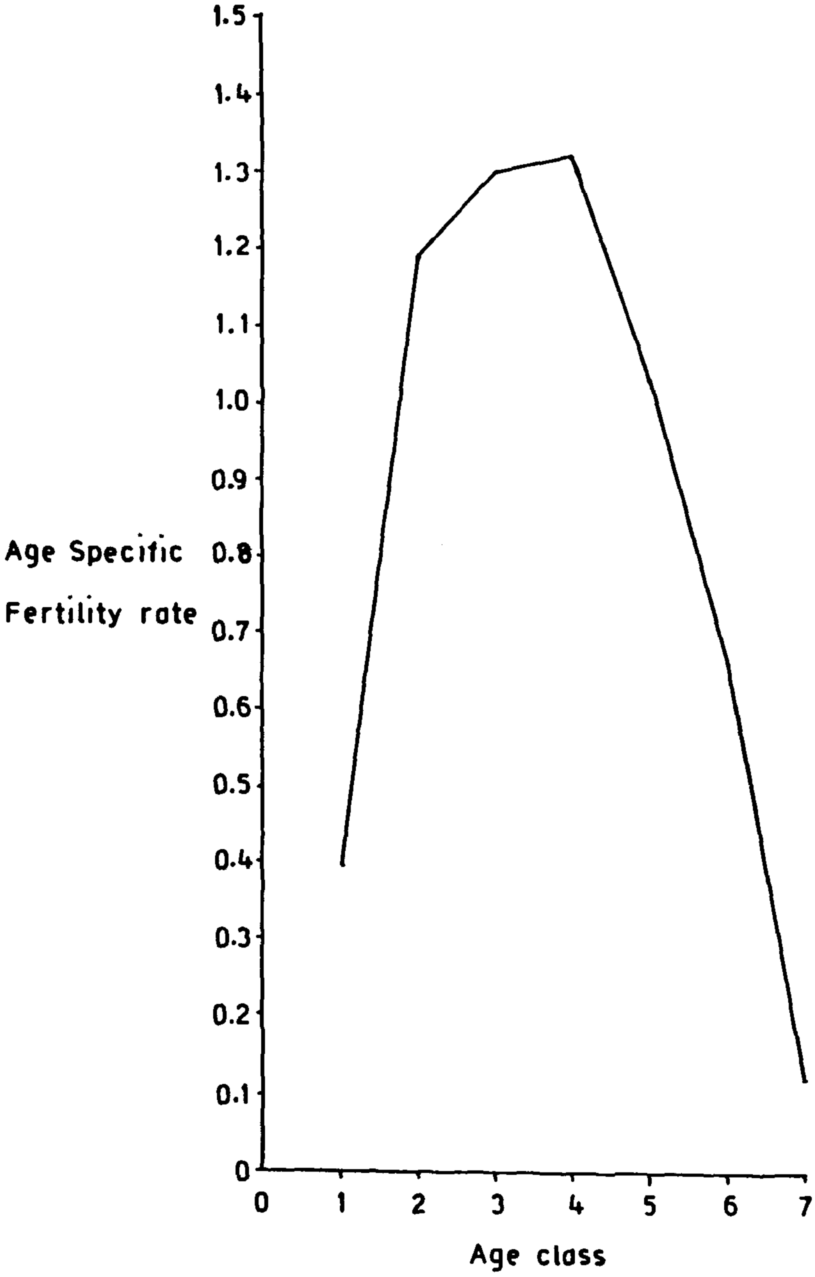


FIG. 3 AGE SPECIFIC FERTILITY RATE BY AGE CLASS(age groups as in Table 13)

Table 13. Age-specific fertility rate.

Age class No.	Age groups (in years)	No. of married women	No. of life births	Age specific fertility
1.	15 - 19	198	78	0.3939
2.	20 - 24	184	219	1.1902
3.	25 - 29	159	207	1.3019
4.	30 - 34	131	173	1.3206
5.	35 - 39	107	111	1.0374
6.	40 - 44	80	53	0.6625
7.	45 +	57	7	0.1228
Total Fertility Rate (TFR)				6.0293

Table 14 gives the breeding size, effective population size, coefficient of breeding isolation and variance due to drift among the Semsa. It is already mentioned that the total population size is 838 of which 316 individuals (i.e., 37.71%) actually constitute the breeding size in this population. It is also found that the effective population size is 205, which means 24.46% of the total population size and 64.87% of the breeding size. Wright (1938, 1940, 1943) has shown that the differentiation due to drift depends upon the product of effective population size and the migration rate (Nem, where Ne = effective population size, and m = migration). In the present study, it has been found that there is not a single case of marriage between the Semsa and non-Semsa. The Semsa people strictly follow village endogamy, and consequently they cannot take any mate from outside. However, this point will be further elaborated afterwards. The Table 14 indicates that the coefficient of breeding isolation (Nem) among the Semsa is zero, which indicates that changes due to genetic drift in this population is very great.

The variance due to random genetic drift in a population per generation, in absence of immigration, selection and mutation pressures, has been calculated according to the following formula, given by Wright (1940).

Table 14. Breeding size, effective population size, coefficient of breeding isolation, variance due to drift, and selection intensity.

Population	Breeding size (N)	Effective population size (Ne)	Coefficient of breeding isolation (Nem)	Variance due to drift (σ^2_{dq}) (where q = 0.5)
Semsa	316	205	0	0.0006098
	37.71%	24.46%		

$$\sigma^2_{dq} = \frac{q(1-q)}{2\,Ne}$$

Where, σ^2_{dq} = Variance due to drift, q = gene frequency (here taken as 0.5) and Ne = effective population size.

In the present population, it is found that the variance due to random genetic drift per generation is 0.0006098 with an initial gene frequency of 0.5 (Table 14).

Table 15 shows the frequency of consanguineous marriages among the Semsa. It is found that only 3.52% of all marriages (total number of marriages = 256, consanguineous marriages = 9) are consanguineous. Of these marriages, there is one case of marriage between half first cousins, three cases between first cousins, two cases between second cousins, two cases between second cousin once removed, and one case between fourth cousins.

Table 15 further indicates the coefficient of inbreeding in each of these categories of consanguineous marriage (All genealogies, showing consanguineous marriages, are given in the Appendix A). The average coefficient of inbreeding is found to be 0.0296166. It may be mentioned here that the Semsa strictly follow the system of double descent, which generally prevents marriages

Table 15. Inbreeding in the Semsa.

Relations	Coefficient of Inbreedings	Frequency of inbred marriages
Half first cousin	0.03125	1
First cousin	0.0625	3
Second cousin	0.0156	2
Second cousin once removed	0.00781	2
Fourth cousin	0.00098	1
		9

Total No. of marriages = 256
Total No. of inbreeding = 9 or 3.52%
Average coefficient of inbreeding (F) = 0.0296166

between close relations. However, this point will be further elaborated subsequently at an appropriate place.

One of the most powerful evolutionary forces, that brings about changes in the genetic make up of a population, is natural selection. In order to estimate the total selection intensity two statistical formulae have been applied. First one is proposed by Crow (1958), which has been subsequently modified by Johnston and Kensinger (1971) by taking into consideration the prenatal mortality.

Crow (1958) has proposed an index, which is known as an index of total selection intensity (now called the index of opportunity for selection) by taking into account differential fertility and mortality. The index is separated into two components, known as the index due to fertility and the index due to mortality. Then, Crow has combined the two indices to calculate the index of opportunity for selection, which is as follows:

1. Proposed by Crow (1958):

$$I = I_m + \frac{I_f}{P_s} ; \qquad I_m = \frac{P_d}{P_s} ; \quad I_f = \frac{V_f}{(\bar{X})^2}$$

Where, I = Index of total selection intensity; I_m = Index of selection due to infant mortality; I_f = Index of selection due to fertility; $\bar{X}$ = average number of live births per woman aged 40 years and above; V_f = Variance in the number of live births due to fertility; P_d = Proportion of premature deaths (deaths before 15 years of age); P_s = Proportion of survivors ($P_s = 1 - P_d$).

The above formula, proposed by Crow, has been modified by Johnston and Kensinger (1971). They have taken into consideration prenatal mortality and suggested the following formula:

$$I = I_{me} + \frac{I_{me}}{P_b} + \frac{I_f}{P_b P_s}\ ; \quad I_{me} = \frac{P_{ed}}{P_b}\ ;$$

$$I_{mc} = \frac{P_d}{P_s}\ ; \quad I_f = \frac{V_f}{(\bar{X})^2}.$$

Where, I = Index of total selection intensity; I_{me} = Index of selection due to embryonic mortality (i.e., Prenatal mortality); I_{mc} = Index of selection due to child mortality (i.e., mortality before 15 years); I_f = Index of selection due to fertility; $\bar{X}$ = Mean number of live births per woman of completed fertility (i.e., 40 years and above); P_{ed} = Proportion of embryonic deaths (i.e., Prenatal deaths); $P_b = 1 - P_{ed}$ (Proportion of survivors to birth); P_d = Proportion of child deaths (i.e., death before 15 years of age); V_f = Variance in number of live births due to fertility; $P_s = 1 - P_d$ (Proportion of survivors, birth to reproduction age).

Livingstone and Spuhler (1965) have suggested that if the index of total selection intensity comes to zero, it means that there will be no change in the genetic make up *of a population through selection.*

Table 16 shows the index of total selection intensity in the Semsa. It has been calculated according to the formula, given by Crow (1958) as well as according to the modified formula, given by Johnston and Kensinger (1971). The results have been set out separately in the Table 16. It shows that there are 80 mothers, who are aged 40 + years. The mean number of live births ($\overline{X}$) is 6.5125 with its variance (V_f) 4.1748. Total number of live births to women, aged 40 years and above, is 521. The number of premature deaths (i.e., before 15 years of age) is 167. According to Crow's formula the proportion of premature deaths (P_d) is found to be 0.3205 and proportion of survivors P_s (i.e., P_s = $1-P_d$) is 0.6795. The index of selection due to mortality (I_m) is 0.4717 and that of due

Table 16. Index of total selection intensity.

According to Crow's formula (1958)	According to Johnston and Kensinger (1971)
Number of mothers aged 40 years and above = 80 Average number of livebirths per woman aged 40 years and above, $\overline{X}$ = 6.5125 Variance in the number of livebirths due to fertility, V_f = 4.1748 Total number of livebirths to women aged 40 years and above = 521 Total number of premature deaths (died before the 15th years of life) = 167 Proportion of premature death, P_d = 0.3205 Proportion of survivors, P_s = 0.6795 Index of selection due to infant mortality, I_m = 0.4717 Index of selection due to fertility, I_f = 0.0984 Index of total selection intensity, I = 0.6165	Number of mothers aged 40 years and above = 80 Mean number of live births per woman of completed fertility (i.e., 40 years and above); $\overline{X}$ = 6.5125 Variance in the number of livebirths due to fertility, V_f = 4.1748 Proportion of child death (i.e. death before 15 years of age) P_d = 0.3205 Proportion of survivors, birth to reproductive age, P_s = 0.6795 Total number of prenatal deaths = 17 Total number of pregnancies = 537 Proportion of survivors to birth, P_b = 0.9634 Proportion of embryonic deaths (i.e., prenatal deaths), P_{ed} = 0.0366 Index of selection due to fertility, I_f = 0.0984 Index of selection due to embryonic mortality (Prenatal mortality), I_{me} = 0.0380. Index of selection due to child mortality (mortality before 15 years of age), I_{mc} = 0.4717 Index of total selection intensity, I = 0.6779.

to fertility (I_f) 0.0984. So, the index of total selection intensity (I), according to Crow's formula, is 0.6165. It is seen that the selection is taking place more due to differential mortality than due to differential fertility. However, selection is operating moderately on this population.

According to Johnston and Kensinger's modified formula, it has been found that proportion of child death, i.e., (P_d), the proportion of survivors (i.e., birth to reproductive age P_s) and the proportion of survivors to birth (P_b) are 0.3205, 0.6795 and 0.9634 respectively. It is also seen that the proportion of embryonic deaths (i.e., abortions and still births) P_{ed} is 0.0366. The index of selection due to fertility (I_f), embryonic mortality (I_{me}) and child mortality (I_{mc}) are 0.0984, 0.0380 and 0.4717 respectively. Basing on all these indices, it is found that the total selection intensity (I) is 0.6779 in the Semsa, which is slightly higher than that found according to Crow's formula (1958). However, it still shows that selection is acting moderately on this population.

In this chapter we have described the demographic structure of the Semsa population and have also tried to find out how various natural forces are acting on this population. We shall make further discussion on these findings in a subsequent chapter.

CHAPTER IV

ANTHROPOMETRY

In this chapter we shall deal with anthropometric characteristics of the Semsa. In the present study altogether thirteen anthropometric measurements have been taken into consideration on 82 adult Semsa males. Table 17 shows the ranges, means and standard errors of these measurements.

It is found that the height vertex among the Semsa males varies between 145.6 and 171 cm, and the mean is 157.26 ± 0.63 cm. So far as the sitting height vertex is concerned, it is seen that it ranges between 70.4 and 89.9 cm, with the mean of 81.02 ± 0.39 cm.

The mean of the chest girth is found to be 83.18 ± 0.48 cm. The minimum chest girth is 74 cm and the maximum 95 cm.

Four measurements have been taken on the head, viz., length, breadth, circumference and least frontal breadth. It is seen that the head length among the Semsa varies from 17.4 to 20.8 cm, and the mean is found to be

Table 17. Anthropometric measurements of the Semsa (male).

Sl. No.	Character	Total No. N	Range (in cm)	Mean ± s.e.	s.d.
1.	Height vertex	82	145.60 - 171.00	157.26 ± 0.63	5.67
2.	Sitting height vertex	82	70.40 - 89.90	81.02 ± 0.39	3.51
3.	Chest girth	82	74.00 - 95.00	83.18 ± 0.48	4.34
4.	Head length	82	17.40 - 20.80	18.78 ± 0.07	0.60
5.	Head breadth	82	13.20 - 15.40	14.22 ± 0.05	0.45
6.	Head circumference	82	51.50 - 59.00	54.70 ± 0.17	1.58
7.	Least frontal breadth	82	10.00 - 14.00	11.58 ± 0.07	0.61
8.	Nasal height	82	3.80 - 5.10	4.43 ± 0.03	0.32
9.	Nasal breadth	82	3.00 - 4.80	3.77 ± 0.03	0.29
10.	Bizogomatic breadth	82	10.90 - 15.80	13.47 ± 0.07	0.65
11.	Bigonial breadth	82	9.00 - 12.70	10.54 ± 0.07	0.66
12.	Mid-arm circumference	82	18.00 - 29.00	23.43 ± 0.19	1.71
13.	Weight	82	35.00 - 65.00 (in kg)	49.02 ± 0.57	5.16

18.78 ± 0.07. The head breadth is found to vary between 13.2 and 15.4 cm and its mean is 14.22 ± 0.05 cm.

The circumference of head varies from 51.5 to 59.0 cm, and the mean is 54.70 ± 0.17. The least frontal breadth varies between 10 and 14 cm and its mean is 11.58 ± 0.07.

Two measurements have been taken on nose i.e., nasal height and nasal breadth. It is observed that the nasal height and nasal breadth vary from 3.80 to 5.10 cm and from 3.00 to 4.80 cm, respectively. The mean nasal height is 4.43 ± 0.03 cm, whereas the mean nasal breadth is 3.77 ± 0.03 cm.

Two measurements on face have been taken. These are bizygomatic breadth and bigonial breadth. It is found that the bizygomatic breadth varies from 10.9 to 15.8 cm, whereas the bigonial breadth varies from 9 to 12.7 cm. The mean of bizygomatic breadth is found to be 13.47 ± 0.07 cm and that of the bigonial breadth is 10.54 ± 0.07.

Only one measurement is taken on limb i.e., mid-arm circumference. The range for this measurement varies between 18 and 29 cm and the mean is found to be 23.43 ± 0.19 cm. Body weight of 82 adult Semsa men has been taken. It is found that body weight among the adult Semsa men varies between 35 Kg and 65 Kg. The mean body weight is found to be 49.02 ± 0.57 Kg.

Indices

Ten indices have been calculated from the above measurements. The results are shown in Table 18.

The mean of cephalic index is found to be 75.79 ± 0.29, varying between 68.20 and 82.28.

The nasal index among the Semsa males varies from 68.08 to 117.07. The mean for this index is found to be 85.21 ± 0.92, which means that the average nose shape among the Semsa is platyrrhine.

The relative Sitting Height Vertex index (Cormic Index) among the Semsa males varies between 46.9 and 56.33. Its mean is found to be 51.33 ± 0.20. The Relative Chest Girth index varies between 48.0 and 59.02. The mean for this index is found to be 52.91 ± 0.28. The ponderal index varies between 21.78 and 24.84. Its mean is 23.24 ± 0.07. The Jugo-Frontal index is found to vary between 78.57 and 128.44 and its mean is 86.09 ± 0.69. The value of Jugo-mandibular index varies between 66.46 and 109.17. Its mean is found to be 78.41 ± 0.69.

Among the Semsa the mean Pignet-Vervaek index is found to be 84.05 ± 0.46. The range varies from 76.06 to 95.41. The Transverse Fronto-Parietal Index varies from

Table 18. Indices.

Sl. No.	Character	N	Range	m ± s.e.	s.d.
1.	Cephalic index	82	68.20 - 82.28	75.79 ± 0.29	2.67
2.	Nasal index	82	68.08 - 117.07	85.21 ± 0.92	8.34
3.	Relative sitting height vertex indes	82	46.90 - 56.33	51.53 ± 0.20	1.80
4.	Relative chest-girth index	82	48.00 - 59.02	52.91 ± 0.28	2.51
5.	Ponderal index	82	21.78 - 24.84	23.24 ± 0.07	0.61
6.	Jugo-frontal index	82	78.57 - 128.44	86.09 ± 0.69	6.23
7.	Jugo-mandibular index	82	66.46 - 109.17	78.41 ± 0.69	6.20
8.	Pignet-vervaek index	82	76.06 - 95.41	84.05 ± 0.46	4.19
9.	Transverse fronto-parietal index	82	71.43 - 100.72	81.49 ± 0.47	4.27
10.	Trans-cephalo -facial index	82	78.42 - 110.49	94.74 ± 0.49	4.44

71.43 to 100.72 and its mean is 81.49 ± 0.47. The mean of the Trans-Cephalo-Facial Index is found to be 94.74 ± 0.49 and its range is found to be varied from 78.42 to 110.49.

Table 19 shows the classification of all anthropometric characters considered in the present study. These classifications have been adopted from Das and Deka (1992-1993).

Stature: It is seen that nearly 57.32% of all Semsa adult males are of short stature. 19.51% and 10.98% belong to below medium and very short stature respectively. The rest are medium, upper medium and tall statured people.

Cephalic index: The cephalic index shows that nearly 57.32% of all adult males are of dolicocephalic type, whereas 36.58% are found to be mesocephalic and 4.88% brachycephalic. Only 1.22% are of hyperdolicocephalic type.

Nasal index: Nearly 50% of all adult males have mesorrhine type of nose, which is followed by 37.8% of platyrrhine type of nose. The frequencies of leptorrhine and hyperleptorrhine are 4.88% and 7.32% respectively.

Jugo-Mandibular index: The majority (45.12%) of all Semsa adult males have medium type. The frequencies of broad and narrow types are found to be 21.95% each. The

Table 19. Classification of Anthropometric characters.

Characters	**Frequency**	**Percentage**
Stature		
Very short	9	10.98
Short	47	57.32
Lower (Below) Medium	16	19.51
Medium	5	6.10
Upper (Above) Medium	4	4.88
Tall	1	1.22
Total	82	100.00
Cephalic Index		
Hyperdolichocephal	1	1.22
Dolichocephal	47	57.32
Mesocephal	30	36.58
Brachycephal	4	4.88
Total	82	100.00
Nasal Index		
Leptorrhine	4	4.88
Mesorrhine	41	50.00
Platyrrhine	31	37.80
Hyperplatyrrhine	6	7.32
Total	82	100.00
Jugo-Mandibular Index		
Very narrow	2	2.44
Narrow	18	21.95
Medium	37	45.12
Broad	18	21.95
Very Broad	7	8.54
Total	82	100.00

Contd...

Table 19 (Contd.)

Characters	Frequency	Percentage
Jugo-Frontal Index		
Very narrow	1	1.22
Narrow	0	0.00
Medium	5	6.10
Broad	26	31.71
Very Broad	50	60.97
Total	82	100.00
Relative Chest-Girth Index		
Narrow Chest	20	24.39
Medium	51	62.20
Broad	11	13.41
Total	82	100.00

frequencies of very broad and very narrow types are 8.54% and 2.44% respectively.

Jugo-Frontal index: Among the Semsa adult males the frequencies of very broad and broad types are found to be 60.97% and 31.71% respectively. Only 6.10% of all adult Semsa males are of medium type and 1.22% of very narrow type.

Relative Chest-Girth index: The majority of the Semsa adult males have medium chest (62.20%), whereas only 24.39% have narrow chest and 13.41% have broad chest.

In Table 19 the classifications for various anthropometric characteristics have been given. It shows that the Semsa are mostly of short statured people with dolicocephalic type of head, mesorrhine nose, medium chest. The jugo-frontal index and jugo-mandibular index indicate that they have got medium to very broad face. In short, to characterise the average Semsa man, one may say that the Semsa are generally short stature with medium chest girth, dolicocephalic head, mesorrhine nose and very broad face.

In order to compare the Semsa men with other neighbouring mongoloid populations of this region, in respect of anthropometric characters, we have taken into consideration 17 populations, viz., Dimasa, Garo (plains), Koch, Rabha, Lalung, Mikir, Ahom, Deuri, Mishing, Chutia, Moran and Khamyang of Assam and Garo (Hill), Khynriam, Pnar, Bhoi and War of Meghalaya. It may be mentioned here that for all these 17 populations, whatever measurements are available, have been taken for comparisons.

The anthrompometric measurements for all these 17 populations have been given in Table 20, which is self explanatory.

Table 21 shows the results of t-test, carried out between the Semsa and each of the other 17 populations. It is seen that, with respect to the height vertex and sitting height vertex, the Semsa differ significantly from the Dimasa, Garo (both plains and hill), Koch, Rabha, Lalung, Mikir, Ahom, Deuri, Mishing, Chutia, Moran and Khamyang. But they do not differ significantly from any of the Khasi subgroups i.e., Khynriam, Pnar, Bhoi and War. But, in respect of the head length and head breadth, the Semsa do not differ significantly from any of these 17 populations.

So far as bizygomatic breadth is concerned, it is seen that the Semsa do not differ from any of these populations, excepting the Rabha. The t-value (6.12) shows that

Table 20. Anthropometric characteristics (Mean) of 17 populations of Assam and Meghalaya.

Populations	Total No.	CHARACTERS													Authors
		Height vertex	Sitting Height vertex	Chest Girth	Head length	Head breadth	Bizygomatic breadth	Nasal height	Nasal breadth	Least frontal breadth	Head circumference	Bigonial breadth	Mid-arm circumference	Weight	
Dimasa	100	159.87	82.85	-	18.77	14.51	13.49	5.09	3.75	9.30	54.55	10.48	-	-	Phukan (1969)
Hill Garo	100	159.49	83.21	-	18.79	14.10	13.87	4.69	4.00	10.62	54.74	10.10	-	-	Das (1960)
Plains Garo	100	161.92	83.80	-	18.72	14.19	13.77	4.78	3.94	10.48	55.14	10.08	-	-	Das (1960)
Koch	50	165.11	84.79	-	18.29	14.76	13.61	4.87	3.60	-	55.43	-	-	-	Sengupta (1991)
Rabha	300	161.25	84.36	-	18.85	14.20	15.50	4.76	3.83	-	53.56	10.70	-	-	Das (1960)
Lalung	70	165.29	86.29	-	18.54	14.09	13.37	4.61	3.68	-	55.73	-	-	-	Das et al. (1980)
Mikir	280	160.57	83.23	-	18.49	14.52	13.30	4.77	3.91	-	55.37	-	-	-	Deb (1979)
Ahom	100	162.83	84.72	86.36	18.24	14.88	13.65	5.27	3.78	-	55.45	-	-	54.50	Das et al. (1985)
Deuri	99	163.86	83.95	87.51	18.38	14.63	13.54	5.21	3.80	-	55.71	-	-	56.42	Das et al. (1985)
Mishing	100	161.13	84.05	87.70	18.63	14.78	13.65	5.28	3.69	-	55.94	-	-	54.67	Das et al. (1985)
Chutia	83	164.11	84.13	84.78	18.38	14.68	13.44	5.04	3.78	-	55.16	-	-	52.92	Das et al. (1985)
Moran	100	162.97	84.59	87.85	18.80	14.46	13.39	5.39	3.80	-	55.81	-	-	54.35	Das et al. (1985)
Khamyang	85	159.90	84.90	-	18.72	14.56	13.71	4.98	3.84	10.17	54.91	10.18	-	-	Das and Bhagabati (1963)
Khynriam	100	156.62	82.36	-	18.82	14.64	13.51	4.54	3.92	10.41	54.60	10.16	-	-	Das (1967)
Pnar	100	157.35	81.12	-	19.10	14.53	13.51	4.79	3.72	10.05	54.59	10.22	-	-	Das (1967)
Bhoi	100	157.00	82.36	-	18.34	14.24	13.44	4.87	3.95	10.46	51.79	9.95	-	-	Das (1967)
War	100	155.68	81.57	-	18.67	14.43	13.47	4.58	3.80	10.51	54.16	10.05	-	-	Das (1967)

Table 21. t-test of 12 different anthropometric measurements.

Populations	Height vertex	Sitting height	Chest girth	Head length	Head breadth	Bizygomatic breadth	Nasal height	Nasal breadth	Least frontal breadth	Head circumference	Bigonial breadth	Weight
Semsa x Dimasa	2.40*	2.20*	-	0.03	0.92	0.06	2.46*	0.08	6.87*	0.27	0.19	-
Semsa x Garo (H)	2.05*	2.58*	-	0.03	0.40	1.21	0.94	1.03	2.89*	0.08	1.36	-
Semsa x Garo (P)	4.59*	3.35*	-	0.18	0.09	0.90	1.20	0.69	3.32*	0.82	1.26	-
Semsa x Koch	6.61*	3.75*	-	1.31	1.56	0.36	1.52	0.69	-	1.20	-	-
Semsa x Rabha	3.64*	3.99*	-	0.20	0.06	6.12*	1.13	0.24	-	2.12*	0.43	-
Semsa x Lalung	7.10*	6.13*	-	0.58	0.39	0.30	0.60	0.37	-	1.88	-	-
Semsa x Mikir	3.25*	2.74*	-	0.84	1.00	0.51	1.25	0.63	-	1.22	-	-
Semsa x Ahom	4.98*	4.16*	3.10*	1.39	1.91	0.52	2.93*	0.04	-	1.27	-	-

Contd...

Table 21 (Contd.)

Populations	Height vertex	Sitting height	Chest girth	Head length	Head breadth	Bizygomatic breadth	Nasal height	Nasal breadth	Least frontal breadth	Head circumference	Bigonial breadth	Weight
Semsa x Deuri	5.69*	3.48*	4.62*	1.15	1.30	0.20	2.57*	0.12	-	1.76	-	7.15*
Semsa x Mishing	3.64*	3.67*	4.82*	0.42	1.69	0.50	2.97*	0.36	-	2.19*	-	5.29*
Semsa x Chutia	6.31*	3.59*	1.73	1.07	1.33	0.08	2.00*	0.04	-	0.75	-	3.49*
Semsa x Moran	5.11*	4.21*	4.84*	0.06	0.76	0.22	3.36*	0.12	-	1.96 *	-=	4.77*
Semsa x Khamyang	2.55*	4.84*	-	0.18	1.13	0.72	2.20*	0.31	4.46*	0.41	1.07	-
Semsa x Khynriam	0.60	1.57	-	0.12	1.27	0.12	0.45	0.61	3.38*	0.23	1.13	-
Semsa x Pnar	0.08	0.11	-	0.89	1.03	0.12	1.32	0.22	4.42*	0.20	0.95	-
Semsa x Bhoi	0.24	1.58	-	1.27	0.06	0.09	1.52	0.73	3.23*	5.07*	1.73	-
Semsa x War	0.49	0.65	-	0.30	0.66	0.00	0.49	0.12	2.97*	0.99	1.44	-

* Significant at 5% level of probability.

there is a significant difference between the Semsa and Rabha in respect of this anthropometric trait.

In respect of the nasal length, it is found that out of these 17 populations, the Semsa significantly differ from the Dimasa, Ahom, Deuri, Mishing, Chutia, Moran and Khamyang, whereas in respect of the nasal breadth, no significant difference is observed between the Semsa and any of these 17 populations, considered for comparison.

Data on least frontal breadth are not available for the Koch, Rabha, Lalung, Mikir, Ahom, Deuri, Mishing, Chutia and Moran. However, it is found that the Semsa differ significantly from the Dimasa, Garo (both hill and plains), Khamyang and four Khasi groups (i.e., Khynriam, Pnar, Bhoi and War).

So far as the head circumference is concerned, the Semsa differ significantly from the Rabha, Mishing, and Bhoi. But the Semsa show no significant difference with the other 14 populations.

Data on bigonial breadth are not available for the Koch, Lalung, Mikir, Ahom, Deuri, Mishing, Chutia and Moran. It is seen that the Semsa do not significantly differ from the Dimasa, Rabha, Garo (both hill and plains), Khamyang and four Khasi subgroups (Khynriam, Pnar, Bhoi and War).

Data on chest girth are available only on five populations, i.e., Ahom, Deuri, Mishing, Chutia and Moran. It is seen that there is no significant difference in respect of this character between the Semsa and Chutia but the Semsa differ significantly from the Ahom, Deuri, Mishing and Moran.

Data on body weight are available only for four populations, i.e., Deuri, Mishing, Chutia and Moran. It is seen that the Semsa differ significantly from each of these populations.

In the present study, as mentioned earlier, altogether 13 anthropometric measurements have been taken on the adult Semsa males. For comparison with the Semsa some populations from Assam and Meghalaya have been considered. Out of these 13 measurements mentioned, only eight measurements viz., height vertex, sitting height vertex, head length, head breadth, bizygomatic breadth, nasal height, nasal breadth and head circumference are available on these seventeen populations. So on the basis of those eight anthropometric measurements, we have calculated the distance measures between the Semsa and those seventeen populations, following the method of the coefficient of racial likeness, suggested by Rao (1952).

Table 22 shows the distance measures, calculated on the basis of the values for eight anthropometric measurements among 18 populations including the Semsa of Assam. The least distance is observed between the Semsa and War Khasi (3.41), followed by between the Semsa and Khynriam (6.91) and between the Semsa and Pnar (10.42). The maximum distances are observed between the Semsa and Rabha (80.89), between the Semsa and Ahom (50.67), and between the Semsa and Bhoi (39.99). The point to note here is that the distance between the Semsa and Dimasa is found to be 28.20.

Having based on these distances, a dendrogram has been drawn and presented in the Fig. 4. It shows that the Semsa come closer to three of the Khasi subgroups, viz., Khynriam, War and Pnar. It may be noted that, on the basis of these anthropometric measurements, the Semsa stand quite apart from the rest of the populations.

The Dimasa, on the basis of these anthropometric distance measures, come closer to the Khamyang, but it stands away from the Semsa. As mentioned earlier, it is believed that the Semsa is an offshoot of the Dimasa (Danda and Ghatak, 1985). The dendrogram, shown on the basis of eight anthropometric measurements, does not show any close relationship between the Semsa and Dimasa. In the subsequent chapters we shall examine this relationship with the help of other traits.

Table 22. Genetic distance values for eight anthropometric measurements among 18 populations.

Populations	Khyn-riam	Pnar	Bhoi	War	Ahom	Deuri	Mishing	Chutia	Moran	Khamyang	Semsa	Dimasa	Hill Garo	Plains Garo	Koch	Rabha	Lalung	Mikir
Khynrian	0.00																	
Pnar	10.78	0.00																
Bhoi	34.75	41.64	0.00															
War	3.37	6.82	23.80	0.00														
Ahom	56.64	34.37	53.45	41.75	0.00													
Deuri	42.30	33.23	57.67	39.27	2.35	0.00												
Mishing	56.04	29.54	71.35	42.42	4.16	5.29	0.00											
Chutia	31.64	23.58	38.56	28.16	3.82	1.58	7.63	0.00										
Moran	68.02	34.13	67.55	47.41	9.18	6.09	6.30	8.50	0.00									
Khamyang	51.42	18.88	50.78	25.57	12.98	14.22	14.66	10.13	17.55	0.00								
Semsa	6.91	10.42	31.99	3.41	50.67	40.22	48.74	30.77	53.71	37.19	0.00							
Dimasa	37.58	9.79	33.47	16.93	13.54	12.58	11.54	8.48	13.01	7.66	28.20	0.00						
Hill Garo	16.45	23.63	42.90	17.91	40.43	34.99	45.82	27.16	41.95	19.85	13.65	24.70	0.00					
Plains Garo	21.44	23.71	49.09	24.66	24.99	19.10	27.94	14.85	24.79	10.61	19.20	16.76	4.03	0.00				
Koch	32.11	23.16	48.48	27.28	7.23	5.61	10.37	3.47	16.24	16.72	29.03	14.87	32.16	19.57	0.00			
Rabha	103.46	102.42	109.48	105.24	102.31	106.86	98.44	91.38	16.58	77.92	80.89	101.83	67.19	77.67	53.57	0.00		
Lalung	33.56	35.75	66.79	38.92	29.72	20.98	32.41	14.18	29.17	33.90	27.11	32.05	31.92	20.34	11.79	91.29	0.00	
Mikir	10.56	15.80	34.29	13.71	19.67	12.81	20.70	7.58	20.83	8.89	13.70	10.57	15.00	9.16	10.46	203.88	15.32	0.00

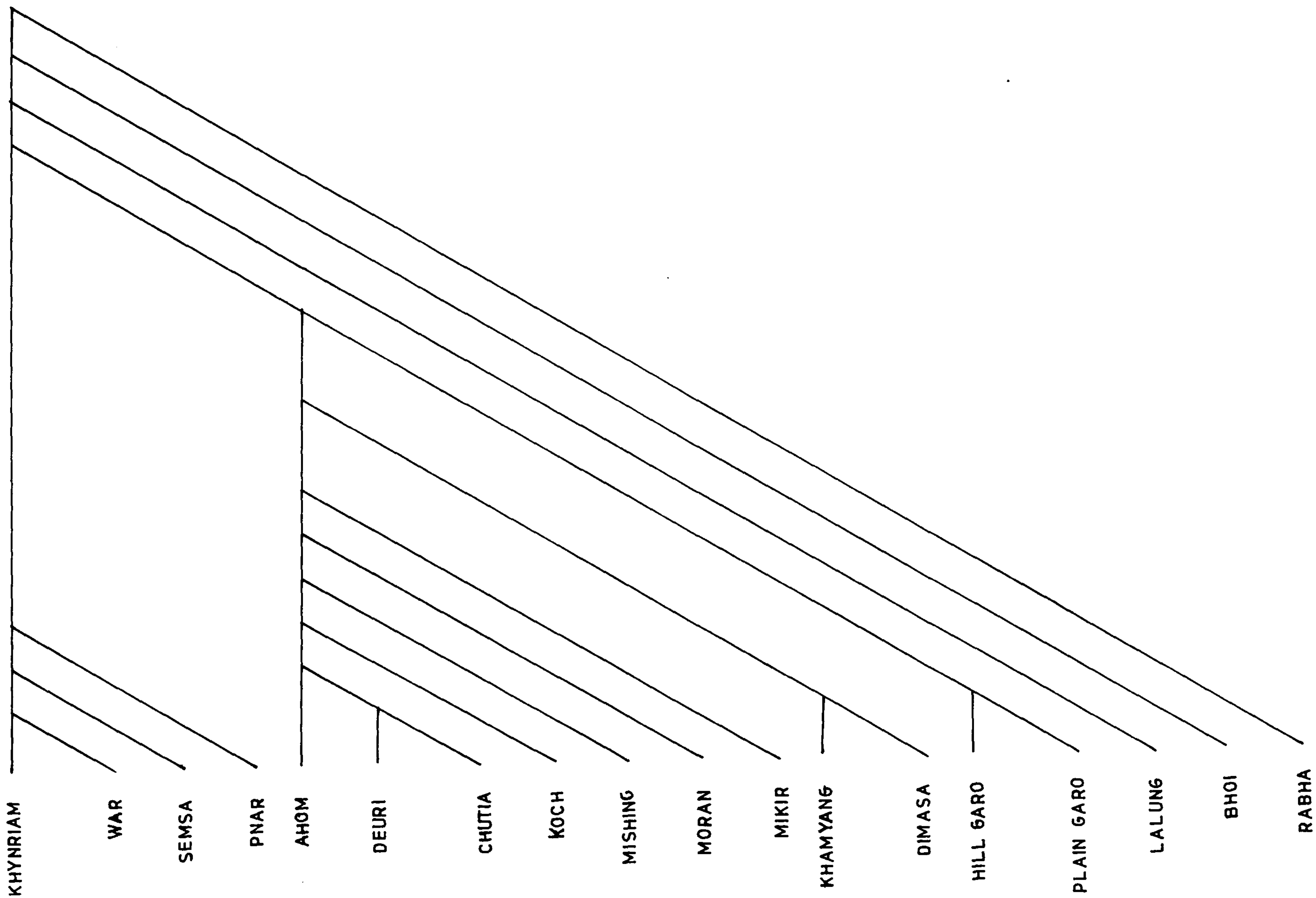


FIG. 4. DENDROGRAM SHOWING RELATIONSHIP OF THE SEMSA WITH OTHER POPULATIONS ON THE BASIS OF ANTHROPOMETRIC CHARACTERS

CHAPTER V

GENETIC MARKERS

In this chapter, we shall deal with some genetic markers among the Semsa of Semkhor village. The details about the methods and samples have been given in Chapter II.

In Table 23, the results for four genetic markers, viz., ABO and Rh blood groups, PTC-taste blindness and colour blindness among the Semsa have been set out. It is found that the phenotypic frequencies of A, B, AB and O blood groups are 21.70%, 27.36%, 4.72% and 46.23%, respectively. The gene frequencies p, q and r are 0.1424, 0.1760 and 0.6816, respectively. The D/σ value is ± 0.0078 and the χ^2 value is 2.8442 (d.f. = 1 and $p > 0.05$). So both the D/σ and χ^2 values indicate that the population is in genetic equilibrium in respect of ABO blood groups. Table 23 also shows the results of Rh blood groups, carried out among the Semsa. 106 individuals have been tested with anti-D antisera. Out of 106 individuals, only one individual is found to be of Rh^- type. So, the frequencies of Rh^+ and Rh^- individuals are 99.06% and 0.94%, respectively. The frequencies

Table 23. Genetic markers among the Semsa.

Genetic markers	No. tested	Phenotype frequencies	%	Genefrequencies	Inferences
ABO blood groups	106	A = 23 B = 29 AB = 5 O = 49	21.70 27.36 4.72 46.23	p = 0.1424 q = 0.1760 r = 0.6816	$D/\sigma = \pm 0.0078$ Insignificant $\chi^2 = 2.8442$, df = 1, $P > 0.05$ Insignificant
Rh blood groups	106	Rh (+) = 105 Rh (-) = 1	99.06 0.94	D = 0.9030 d = 0.0970	$\chi^2 = 0.00001$, df = 1, $P > 0.05$ Insignificant
PTC taste blindness	156	Tasters = 102 Non-tasters = 54	65.38 34.62	T = 0.5884 t = 0.4116	$\chi^2 = 0.00012$, df = 1, $P > 0.05$ Insignificant
Colour blindness	119 (male)	Normal = 110 Colour blind = 9 Protan = 5 Deutan = 3 Total colour blind = 1	92.44 7.56 55.56 33.33 11.11	$\bar{C}$ = 0.0756 (male)	

of D and d genes are 0.9030 and 0.0970, respectively. The χ^2 value (χ^2 = 0.00001, d.f. = 1, $p > 0.05$) shows that, so far as the Rh blood group system is concerned, this population is in genetic equilibrium. It may be mentioned that generally the frequency of Rh^- gene i.e., d, is generally absent or if present, it stays in a very low dose among the Indian mongoloid populations (Bhattacharjee, 1968).

Altogether 156 individuals have been tested for PTC taste-blindness, following the method suggested by Harris and Kalmus (1949). The antimode falls on No. 6. So all the individuals, having threshold value between 0 and 6, have been taken as non-tasters and the rest of the individuals are taken as tasters (Fig. 5). It is found that out of 156 individuals, 65.38% are tasters and 34.62% non-tasters among the Semsa. The frequencies of T and t genes are 0.588 and 0.412 respectively. The χ^2 value (0.00012, d.f. = 1, $p > 0.05$) indicates that the population, in respect of this genetic trait, is in equilibrium.

Table 23 further shows the result of colour blindness among the Semsa. Altogether 119 males have been examined with the Ishihara chart. It is found that 110 (92.44%) are normal and 9 (7.56%) are colourblind. It is also found that out of 9 colourblind individuals among the

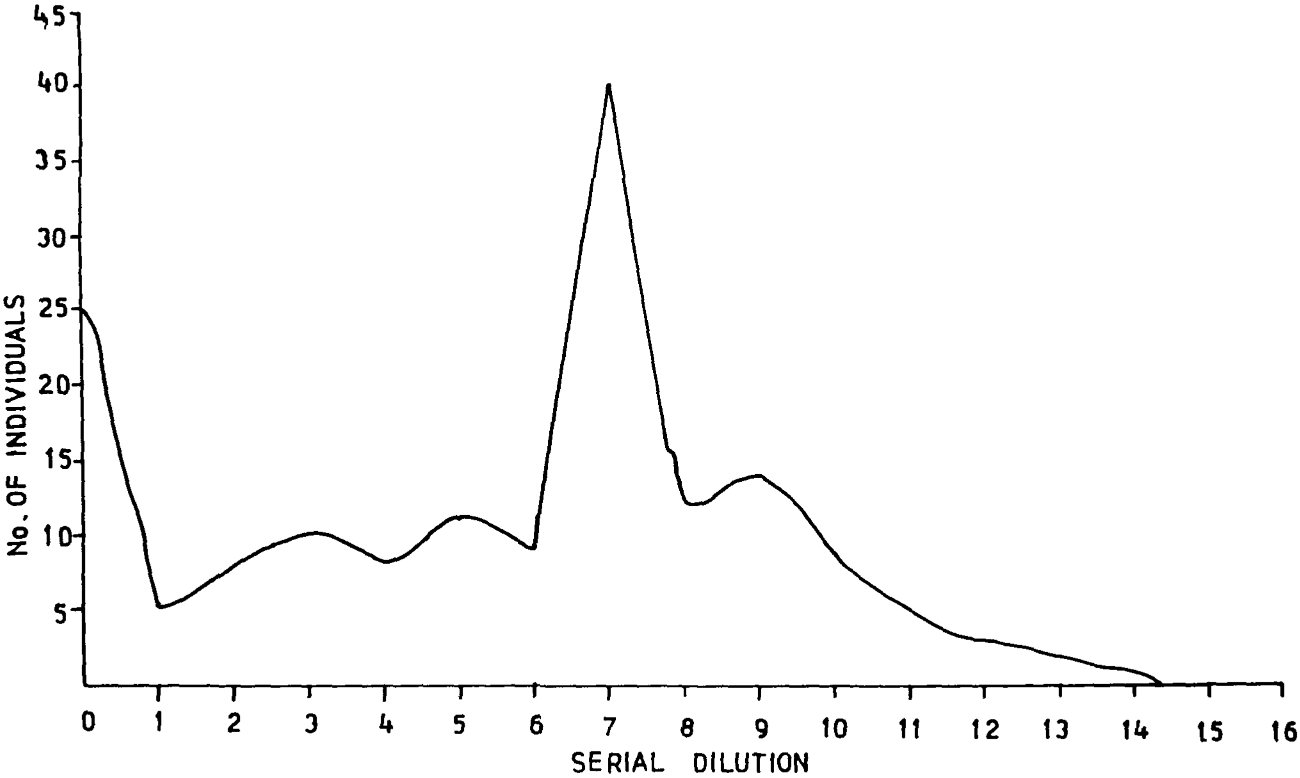


FIG.5. DISTRIBUTION OF PTC TASTE BLINDNESS AMONG THE SEMSA

Semsa, 5 (55.56%) are protan and 3 (33.33%) are deutan, and 1 (11.11%) is complete or total colourblind. However, the frequency of colourblind gene ($\bar{c}$) among the Semsa males is found to be 0.0756. Since, in the present study, no effort has been made to detect colourblind females among the Semsa, it is difficult to calculate the equilibrium gene frequency for colour blindness (Cavalli-Sforza and Bodmer, 1971) among the Semsa. Glass (1956) has suggested that differences in phenotypic frequencies between generations in an isolate may be due to the effect of genetic drift. To understand the effect of genetic drift among the Semsa the entire population has been classified into three generations on the basis of age groups, following the method, suggested by Glass (1956) (Details are given in Chapter III). Each age-group has been taken as the length of a generation. In the Semsa population, the generation length has been found to be 23 years. Consequently, the population has been divided into three generations, i.e., 0-23 years, 24-46 years and 47 + years.

Table 24 shows that there are some differences in blood group frequencies between generations. However, it is seen that the frequencies of O blood group decreases from the first generation to the third generation through the second generation. But in the case of both A and B blood

Table 24. ABO blood groups by generation.

Generations	Age groups (in years)	ABO blood groups					Total
			A	B	AB	O	
III	0 - 23	No.	15	19	3	29	66
		%	22.73	28.79	4.54	43.94	100.00
II	24 - 46	No.	6	8	1	14	29
		%	20.69	27.59	3.45	48.27	100.00
I	47 +	No.	2	2	1	6	11
		%	18.18	18.18	9.09	54.55	100.00

χ^2 (between all generations) = 1.3119, df = 6, $P > 0.05$ Insignificant.

χ^2 (between I and II generations) = 0.8777, df = 2, $P > 0.05$ Insignificant.

χ^2 (between II & III generations) = 0.2206, df = 2, $P > 0.05$ Insignificant.

χ^2 (between I and III generations) = 1.0893, df = 2, $P > 0.05$ Insignificant.

group frequencies, the situation is just reversed i.e., frequencies of both A and B blood groups increase from the first generation to the third generation through the second generation. In the case of AB blood group frequency, no such consistent pattern is observed.

The inter-generational differences in ABO blood group, when tested by χ^2, are found to be statistically insignificant [χ^2 (between all generations) = 1.3119, d.f. = 6, $p > 0.05$; χ^2 (between I and II generations) = 0.8777, d.f. = 2, $p > 0.05$; χ^2 (between II and III generations) = 0.2206, d.f. = 2, $p > 0.05$; χ^2 (between I and III generations) = 1.0893, d.f. = 2, $p > 0.05$]. It indicates that in respect of ABO blood group system, the effect of drift on the Semsa is not apparently perceptable, according to the method suggested by Glass (1956). It may be recalled that while dealing with demographic composition of the Semsa (Chapter III), it has been suggested that there is a strong possibility for the operation of genetic drift in this population.

Table 25 shows the distribution of taste-blindness by generation. It is found that the frequencies of non-tasters in I, II and III generations are 33.87%, 36.49% and 30%, respectively. However, there is no significant diffe-

Table 25. PTC taste-blindness by generation.

Generations	Age groups (in years)	Tasters		Non-tasters		Total		Gene frequency 't'
		N	%	N	%	N	%	
III	- 23	41	66.13	21	33.87	62	100.00	0.5820
II	24 - 46	47	63.51	27	36.49	74	100.00	0.6040
I	47 +	14	70.00	6	30.00	20	100.00	0.5477
Total		102		54		156	100.00	

χ^2 (between all generations) = 0.3158, df = 2, $P > 0.05$ Insignificant.

χ^2 (between I and II generations) = 0.2901, df = 1, $P > 0.05$ Insignificant.

χ^2 (between II and III generations) = 0.1005, df = 1, $P > 0.05$ Insignificant.

χ^2 (between I and III generations) = 0.1026, df = 1, $P > 0.05$ Insignificant.

rence, in respect of PTC taste-blindness, between generations [χ^2 (between all generations) = 0.3158, d.f. = 2, $p > 0.05$; χ^2 (between I and II generations) = 0.2901, d.f. = 1, $p > 0.05$; χ^2 (between II and III generations) = 0.1005, d.f. = 1, $p > 0.05$); χ^2 (between I and III generations) = 0.1026, d.f. 1, $p > 0.05$]. Again in respect of taste-blindness, the effect of drift on the Semsa following the method of Glass (1956), is not apparently perceptable. In this connection, it may be recalled that Basu (1969), following Roberts (1965), has shown that some variations between generations, in respect of PTC taste-blindness may be attributed to drift alone while some others may be due to drift as well as some other evolutionary forces. Adopting the method suggested by Roberts (1965), it is found that among the Semsa the observed variations between generations I and II, and I and III in respect of allele t (non-taster gene) are found to be 0.0563, 0.0343 and 0.0221 respectively. The variance due to drift with initial allele frequencies of t, i.e., 0.5477 for the first generation and 0.6040 for the second generation and with an effective population size of 205 are found to be 0.000604 and 0.000583 respectively. The corresponding standard deviations are found to be 0.024581 and 0.024153 respectively.

So these figures show that the differences between generations I and II, I and III and II and III are 2.29, 1.39 and 0.91 times the standard deviations due to drift respectively. With the exceptions of the difference between the generations I and II, which is more than twice the standard deviation, the observed variation between the other generations may be due to the action of drift. So the operation of drift cannot be altogether ruled out in the present population.

Table 26 shows the pattern of incompatible matings among the Semsa. It is found that on the basis of the ABO blood groups, nearly 42.47% of all matings are incompatible. Since the frequency of Rh^- blood group is less than 1%, incompatible matings, in respect of the Rh system, cannot be significant among the Semsa. However, it may be postulated that through ABO-incompatible matings selection still finds an ample opportunity to play its role in this population.

In the present study, we have compared the Semsa with 17 other populations of Assam and Meghalaya on the basis of anthropometric measurements (Chapter IV). Unfortunately, data on all these genetic markers (Four genetic markers have been considered for the present study) from all these 17 populations are not available. Consequently,

Table 26. Incompatible matings among the Semsa.

Male x Female	Frequency
A x O	0.1238
B x O	0.1816
AB x O	0.0083
A x B	0.0394
B x A	0.0660
AB x A	0.0030
AB x B	0.0026
Total	0.4247 OR 42.47%

we have not been able to consider all those 17 populations for comparison in the present chapter. For the populations, namely, the Deuri, Mishing and Moran, data on such genetic markers are not available. So, we have not taken those three populations for further study. For the Dimasa, data on ABO blood groups are available. So in Table 27, we have compared the Dimasa with the Semsa. It is found that in respect of ABO blood groups, there is a significant difference between the Dimasa and Semsa (χ^2 = 8.7672, d.f. = 3, $p < 0.05$). It may be noted here that such difference between the Semsa and Dimasa has been observed on the basis of the anthropometric traits also (Chapter IV).

Data on colour-blindness are available on the Garo, Khasi, Ahom, Mikir, Boro-Cachari, Miri and Hajong. Table 28 shows the data on colour-blindness among all these populations. It is seen that among the Mikir and Miri no colour-blind individual has been reported. Excluding the Mikir and Miri, the Garo, Khasi, Ahom, Boro-Cachari and Hajong have been taken for comparison with the Semsa. The χ^2 value indicates that in respect of colour-blindness trait, no difference is observed among these populations (χ^2 = 6.4820, d.f. = 5, $p > 0.05$). It is also observed that the Semsa do not differ from the Garo, or from the Khasi, or from the Ahom, or from the Boro-Cachari, or from the

Table 27. ABO blood groups in Dimasa and Semsa.

Populations	No.	ABO blood groups							Reference
		Phenotypic frequency				Gene Frequency			
		O	A	B	AB	p	q	r	
Dimasa	100	32	16	41	11	0.1446	0.3050	0.5508	Phukan, 1975
Semsa	106	49	23	29	5	0.1424	0.1760	0.6816	Present study

χ^2 = 8.7672, d.f = 3, $P < 0.05$. Significant.

Table 28. Comparison of frequencies of χ-linked colour-blindness between the Semsa and other populations of Assam and Meghalaya.

Populations	No. Tested	Normal		Colour-blind		Authors
		No.	%	No.	%	
Semsa	119	110	92.44	9	7.56	Present study.
Garo	102	97	95.10	5	4.90	Rizvi, 1974.
Khasi	495	476	96.16	19	3.84	Mukherjee, 1963.
Ahom	167	160	95.81	7	4.19	Das *et al*., 1986.
Mikir	125	125	100.00	0	0.00	Mukherjee, 1963.
Boro-Cachari	201	186	92.54	15	7.46	Mukherjee and Guha, 1990.
Miri	37	37	100.00	0	0.00	Srivastava, 1969.
Hajong	183	176	96.18	7	3.82	Barua, 1985.

χ^2 (between all populations) = 6.4820, df = 5, $P > 0.05$, Insignificant.
χ^2 (between Semsa and Garo) = 0.6541, df = 1, $P > 0.05$, Insignificant.
χ^2 (between Semsa and Khasi) = 3.0510, df = 1, $P > 0.05$, Insignificant.
χ^2 (between Semsa and Ahom) = 1.4919, df = 1, $P > 0.05$, Insignificant.
χ^2 (between Semsa and Boro-Cachari) = 0.0114, df = 1, $P > 0.05$, Insignificant.
χ^2 (between Semsa and Hajong) = 2.0154, df = 1, $P > 0.05$, Insignificant.

Hajong in respect of this trait (χ^2 values have been given at the bottom of the Table 28).

Table 29 shows the gene frequencies of ABO, Rh and PTC taste-blindness among the Koch, Rabha, Garo, Chutia, Lalung, Khasi, Ahom, Mikir and Khamyang. It may be noted that data on PTC taste-blindness among the Khamyang are not available. However, this table is self explanatory. On the basis of these data, along with those of Semsa, distance matrix has been calculated and the results are given in Tables 30 and 31.

Table 30 shows the distance matrix, calculated on the basis of ABO and Rh blood groups and PTC taste-blindness for the populations, viz., the Koch, Rabha, Garo, Chutia, Lalung, Khasi, Ahom, Mikir and Semsa. It may be noted that we have taken the Khasi sample, given by Das in 1969. However, Das (1978) has also published data on ABO blood groups separately for each of the Khasi subgroups, but he has not given data on Rh blood group and PTC taste-blindness. So, we have not been able to consider each of the Khasi subgroups separately. From Table 30, it is seen that the minimum distance takes place between the Semsa and Lalung (0.002). It is then followed by a distance between the Chutia and Semsa (0.003), between the Ahom and Semsa

Table 29. Gene frequencies of ABO, Rh and PTC by populations.

Population	ABO				Rh			PTC			Reference
	No.	p(A)	q(B)	r(O)	No.	D(+)	d(-)	No.	T	t	
Semsa	106	0.1424	0.1760	0.6816	106	0.9030	0.0970	156	0.4120	0.5880	Present study
Koch	104	0.2294	0.2420	0.5286	104	0.9020	0.0980	121	0.4546	0.5454	Sengupta, 1991
Rabha	600	0.2570	0.238	0.505	126*	0.9111	0.0889	108	0.5920	0.4080	Das, 1960; *Das *et al.* 1980a
Garo	143	0.1780	0.2990	10.5230	144	1.000	0.0000	125	0.5350	0.4650	Das *et al.*, 1980.
Chutia	184	0.2000	0.1120	0.6880	64	0.8751	0.1249	190	0.4520	0.5480	Das *et al.*, 1985
Lalung	114	0.1940	0.2280	0.5780	114	0.9062	0.0938	94	0.4640	0.5360	Das *et al.*, 1980
Khasi	821	0.1930	0.1110	0.6860	315	1.0000	0.0000	838	0.6080	0.3920	Das, 1968
Ahom	348	0.1640	0.1390	0.6790	123	0.8724	0.1276	204*	0.4620	0.538	Das *et al.* 1980; *Das *et al.* 1985
Mikir	245	0.2460	0.2030	0.5510	106	0.8779	0.1221	209	0.5960	0.4040	Das and Deka, 1985
Khamyang	248	0.1060	0.2260	0.6740	248	0.9368	0.0632	-	-	-	Singh and Phukan, 1990

Table 30. Genetic distances* for nine populations of Assam and Meghalaya.

	Semsa	Koch	Rabha	Garo	Chutia	Lalung	Khasi	Ahom	Mikir
Semsa	0.000								
Koch	0.005	0.000							
Rabha	0.011	0.003	0.000						
Garo	0.024	0.019	0.018	0.000					
Chutia	0.003	0.006	0.011	0.032	0.000				
Lalung	0.002	0.000	0.004	0.018	0.005	0.000			
Khasi	0.027	0.029	0.024	0.012	0.027	0.025	0.000		
Ahom	0.004	0.008	0.013	0.033	0.004	0.006	0.031	0.000	
Mikir	0.010	0.004	0.001	0.024	0.007	0.004	0.027	0.010	0.000

* Based on ABO, Rh and P.T.C.-taste blindness.

(0.004) and between the Koch and Semsa (0.005). But the Semsa stand apart from the Khasi (0.027) as well as from the Garo (0.024). On the basis of this distance matrix, calculated by the method of Sokal and Sneath (1963), the dendrogram, showing the relationships among these populations, has been drawn and given in Fig. 6. The dedrogram shows that the Semsa are nearer to the Lalung and Koch but stand apart from the Khasi, Garo, Ahom and others. It may be recalled that the dendrogram, drawn on the basis of anthropometric measurements, shows a different picture in which the Semsa is found to be nearer to the three Khasi subgroups, viz., Khynriam, War and Pnar and stand apart from the Lalung and Koch.

Table 31 shows the distance matrix, based on ABO and Rh blood group systems, among the Semsa, Koch, Rabha, Garo, Chutia, Lalung, Khasi, Ahom, Mikir and Khamyang. This distance matrix has been calculated according to the method of Sokal and Sneath (1963). It shows that the Semsa stand very close to the Khamyang (0.001), followed by the Lalung (0.003), Chutia (0.004), Koch, Ahom and Mikir (0.006). The Semsa stand apart from the Garo (0.032) and Khasi (0.030). The dendrogram, drawn on the basis of this genetic distance matrix, has been given in Fig. 7, which shows that the Semsa and Khamyang come very close to each other. However,

Table 31. Genetic distances* for ten populations of Assam and Meghalaya.

	Semsa	Koch	Rabha	Garo	Chutia	Lalung	Khasi	Ahom	Mikir	Khamyang
Semsa	0.000									
Koch	0.006	0.000								
Rabha	0.009	0.000	0.000							
Garo	0.032	0.027	0.025	0.000						
Chutia	0.004	0.010	0.011	0.047	0.000					
Lalung	0.003	0.001	0.002	0.026	0.007	0.000				
Khasi	0.030	0.037	0.036	0.017	0.035	0.033	0.000			
Ahom	0.006	0.012	0.015	0.048	0.005	0.009	0.041	0.000		
Mikir	0.006	0.001	0.001	0.035	0.006	0.002	0.040	0.010	0.000	
Khamyang	0.001	0.008	0.010	0.021	0.010	0.004	0.025	0.010	0.010	0.000

*Based on ABO and Rh blood groups.

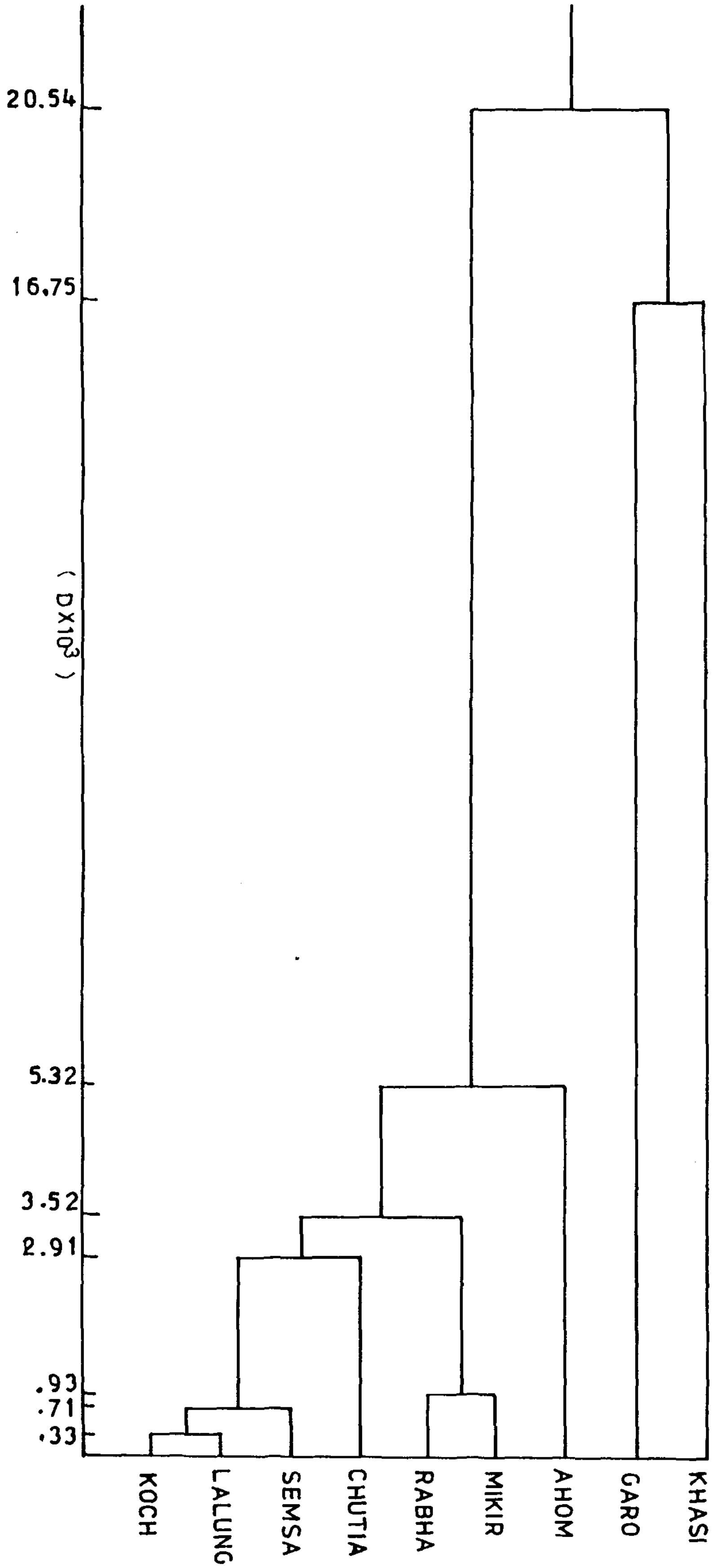


FIG.6. DENDROGRAM FOR NINE POPULATIONS OF ASSAM AND MEGHALAYA BASED ON ABO AND RH BLOOD GROUPS AND P.T.C. TASTE SENSITIVITY.

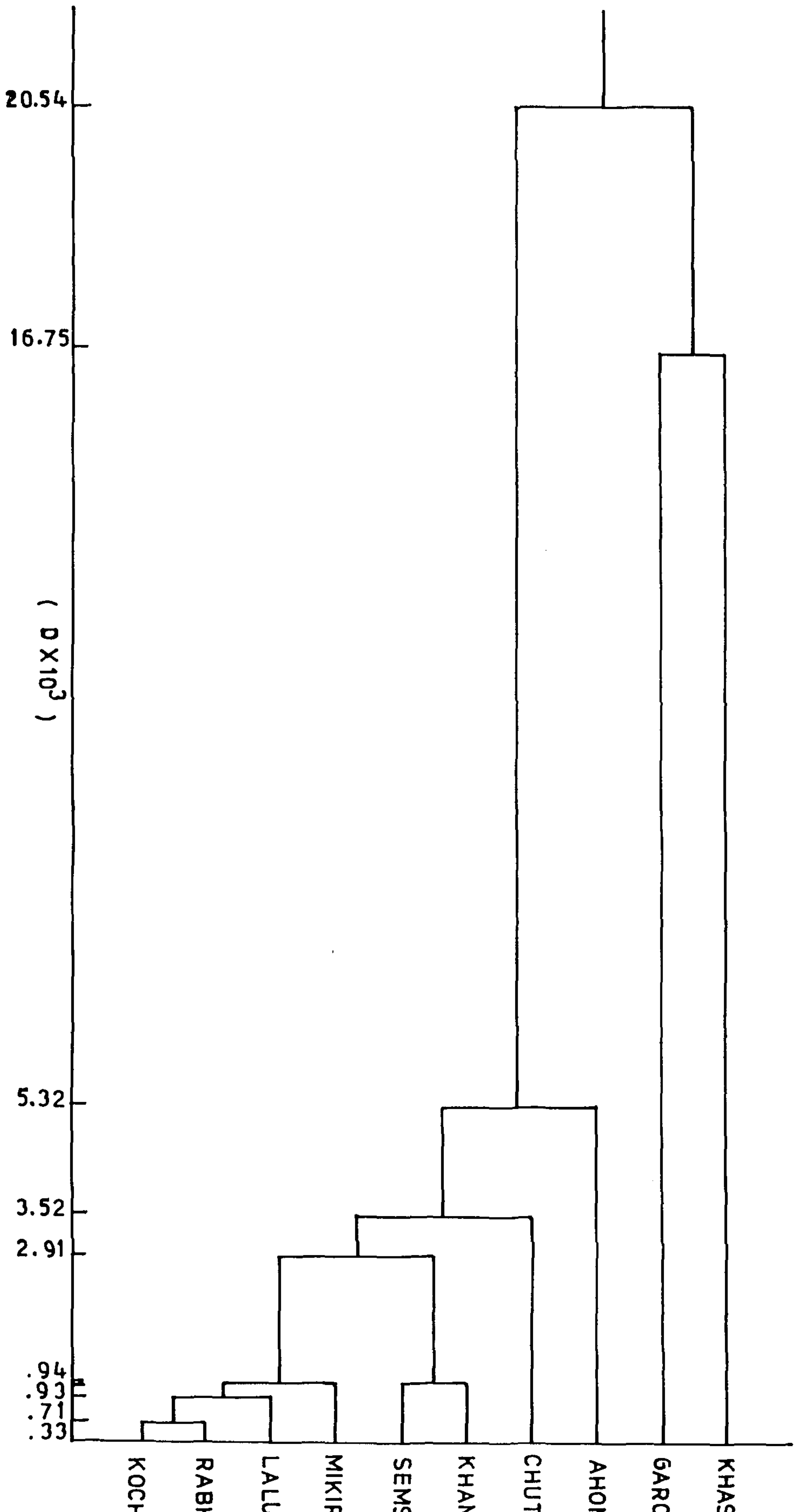


FIG. 7. DENDROGRAM FOR TEN POPULATIONS OF ASSAM AND MEGHALAYA (BASED ON ABO AND RH BLOOD GROUPS)

such relationships have not been observed on the basis of anthropometric characters (Fig. 4).

From all these comparisons it is extremely difficult to assess correctly the Semsa's genetic relationship with other populations of Assam and Meghalaya. However, the point to be noted is that, on the basis of ABO blood groups as well as anthropometric measurements, the Semsa do not show any resemblance with the Dimasa, though it is presumed that the Semsa is an offshoot of the Dimasa (Danda and Ghatak, 1985). We shall discuss this point further at an appropriate place.

CHAPTER VI

DERMATOGLYPHICS

In this chpater we shall discuss about the dermatoglyphic characteristics of the Semsa and compare the Semsa with the other mongoloid populations of Assam and Meghalaya.

Table 32 shows the finger pattern types among the Semsa males. The most common pattern in the digits of both right and left hands is ulnar loop, which is followed by whorl. The maximum number of ulnar loops occurs in III and V digits of both hands. In general, the percentage of ulnar loop increases in the following way - Right hand: 1 - IV → II → V → III and Left Hand: I → IV → II → III → V. While combining all digits together, it is found that in right hand the frequency of ulnar loop is 50.77%, followed by whorl (39.12%). The frequencies of radial loop and arch are 2.20% and 7.91%, respectively. For left hand the order is almost the same. The frequencies of ulnar loop, whorl, arch and radial loop are 56.70%, 33.19%, 7.69% and 2.42%, respectively. Combining both hands together, it is found that the frequencies of ulnar loop, whorl, arch and radial

Table 32. Finger patterns in Semsa (male), N = 91.

Digit	Side	Whorl		Loop				Arch	
				Ulnar		Radial			
		No.	%	No.	%	No.	%	No.	%
I	R	59	64.84	23	25.27	1	1.10	8	8.79
	L	47	51.65	34	37.36	0	0.00	10	10.99
II	R	27	29.67	42	46.15	7	7.69	15	16.48
	L	20	21.98	48	52.75	11	12.09	12	13.19
III	R	16	17.58	66	72.53	1	1.10	8	8.79
	L	23	25.27	61	67.03	0	0.00	7	7.69
IV	R	50	54.95	36	39.56	1	1.10	4	4.40
	L	44	48.35	42	46.15	0	0.00	5	5.49
V	R	26	28.57	64	70.33	0	0.00	1	1.10
	L	17	18.68	73	80.22	0	0.00	1	1.10
Total	R	178	39.12	231	50.77	10	2.20	36	7.91
	L	151	33.19	258	56.70	11	2.42	35	7.69
	R + L	329	36.15	489	53.74	21	2.31	71	7.80

loops are 53.74%, 36.15%, 7.80% and 2.31% respectively. Combining ulnar and radial loops together, it is found that the frequency of loops is more than 56%, whereas that of whorls is 36.15% and that of arches 7.80%.

The highest frequency of whorls is found on digit I, followed by digit IV. The percentage of whorl increases in the following way: Right hand: III → V → II → IV → I; Left hand: V → II → III → IV → I.

Arches are very few in number. The highest percentage of arches is found on digit II, followed by digit I. It gradually decreases from digit II to V in both hands. The frequency of radial loop, in general, is very low. The highest percentage is seen on IInd digit of left hand (12.09%) and right hand (7.69%).

Table 33 shows the finger types among the Semsa females. The most common pattern on digits of both right and left hands is ulnar loop, followed by whorl. Generally, the percentage of ulnar loop decreases in the following way: Right hand: V → III → II → IV → I and Left hand: V → III → II → IV → I. Combining all digits together, it is found that in right hand the frequency of ulnar loop is 49.74%, which is followed by 43.08% of whorl. The percentages of radial loop and arch are 1.03% and 6.15% respec-

Table 33. Finger patterns among the Semsa (female), N = 39.

Digit	Side	Whorl		Loop				Arch	
				Ulnar		Radial			
		No.	%	No.	%	No.	%	No.	%
I	R	26	66.67	10	25.64	0	0.00	3	7.69
	L	23	58.97	14	35.90	1	2.56	1	2.56
II	R	11	28.21	20	51.28	2	5.13	6	15.38
	L	12	30.77	18	46.15	1	2.56	8	20.51
III	R	13	33.33	24	61.54	0	0.00	2	5.13
	L	9	23.08	25	64.10	0	0.00	5	12.82
IV	R	25	64.10	14	35.90	0	0.00	0	0.00
	L	20	51.28	16	41.03	0	0.00	3	7.69
V	R	9	23.08	29	74.36	0	0.00	1	2.56
	L	10	25.64	29	74.36	0	0.00	0	0.00
Total	R	84	43.00	97	49.74	2	1.03	12	6.15
	L	74	37.94	102	52.31	2	1.03	17	8.72
	R + L	158	40.50	199	51.03	4	1.03	29	7.44

tively. For left hand the order is the same. The frequencies of ulnar loop, whorl, arch and radial loop are 52.31%, 37.94%, 8.72% and 1.03% respectively. Combining both hands together, it is found that the frequencies of ulnar loop, whorl, arch and radial loop are 51.03%, 40.50%, 7.44% and 1.03% respectively.

The highest frequency of whorl is found on digit I, followed by digit IV, in both hands. In general the percentage of whorl decreases in the following way: Right hand: I → IV → III → II → V; Left hand: I → IV → II → V → III.

Arches are found to be very few in number. The highest frequency is found on digit II of left hand, which is followed by digit II of right hand.

The frequency of radial loop is still fewer in number. The IInd digit of right hand shows the highest frequency (5.13%). The first and second digits of left hand show radial loop in the frequency of 2.56% each.

Figure 8 shows bimanuar with percent frequencies of finger pattern combinations in the Semsa males. There are 4.39%, 2.20% and 1.10% of all individuals, who are monomorphic i.e., only with whorls, or loops, or arches in all the

WHORLS											
10	4.39										
9	1.10										
8	5.49										
7	10.99										
6	6.59	1.10									
5	3 30										
4	8.79				1.10						
3	12.09	4.39									
2	7.69	5.49	1.10								
1	5.49	1.10			1.10		1.10				
0	2.20	4.39	3.30	3.30	2.20			1.10			1.10
	0	1	2	3	4	5	6	7	8	9	10

ARCHES

FIG. 8. A BIMANUAR WITH THE PERCENT FREQUENCIES OF FINGER PRINT PATTERN COMBINATIONS IN THE SEMSA MALE INDIVIDUALS

fingers. 12.09% of all males have three whorls and seven loops, whereas 10.99% have seven whorls and three loops and 8.79% have four whorls with six loops.

There are 1.10% of all males, who have equal number of whorls and arches (i.e., 4 each) and two loops. Almost equal percentage of individuals (1.10%) have one whorl, one arch and eight loops. About 1.10% of all males have four arches, one whorl and five loops, while equal number of individuals have six arches, three loops and one whorl.

Fig. 9 shows that there are 10.26%, and 2.56% of all Semsa females, who are monomorphic i.e., having only whorls or loops, respectively.

There are 10.26% of the Semsa females, who have six whorls and four loops. Almost equal percent of individuals have one whorl and nine loops.

It further shows that there are 5.13% of all females, who are having equal number of whorls and loops only. It is found that 7.69% of all females have four whorls and six loops and almost equal number females have two whorls and eight loops.

Fig. 9 further shows that there are 2.56% of all Semsa females, who are having nine whorls and one loop and

Whorls \ Arches	0	1	2	3	4	5	6	7	8	9	10
10	10.26										
9	2.56										
8	7.69										
7	5.13										
6	10.26										
5	5.13										
4	7.69										
3	7.69	2.56									
2	7.69	2.56			2.56						
1	10.26										
0	2.56		2.56	5.13		7.69					

FIG. 9. A BIMANUAR WITH THE PERCENT FREQUENCIES OF FINGER PRINT PATTERN COMBINATIONS IN THE SEMSA FEMALE INDIVIDUALS.

equal percent of females have two whorls, one arch and seven loops; three whorls, one arch and six loops; two whorls, four arches and six loops; and eight loops and two arches.

There are 5.13% of all females, who have equal number (i.e., 5) of whorls and loops and the same percent of females are having three arches and seven loops. It also reveals that there are 7.69% of females having equal number of arches and loops (i.e., 5).

Table 34 shows all digital indices. The Furuhata's index is 64.51 in male and 77.83 in female. The Dankmeijer's index is found to be 21.58 in male and 18.35 in female. The Pattern Intensity Index in male and female is 12.84 and 13.31 respectively. In general, these indices are higher in female than in male, excepting the Dankmeijer's index, which is higher in male.

Table 35 shows the mainline formulae in the Semsa. Only three mainline formulae, 11-9-7, 9-7-5 and 7-5-5 have been discussed since the other mainline formulae have appeared in this population in very low frequencies. It is seen that the mainline formula 9-7-5 appears in the highest frequency on both hands of male and on right hand of female. The frequency of the mainline formula 7-5-5 is

Table 34. Indices

Indices	Male	Female
Furuhata's index	64.51	77.83
Dankmeijer's index	21.58	18.35
Pattern Intensity index	12.84	13.31

Table 35. Mainline formulae in Semsa.

Mainline formulae	Right hand				Left hand				Total Right & Left			
	Male		Female		Male		Female		Male		Female	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
11-9-7	28	30.77	10	25.64	6	6.59	2	5.13	34	18.64	12	15.38
9-7-5	31	34.07	13	33.33	27	29.67	10	25.64	58	31.87	23	29.49
7-5-5	9	9.89	6	15.38	23	25.27	11	28.21	32	17.58	17	21.79

highest on left hand of female. It is found that the mainline formula 11-9-7 has appeared in considerably higher frequency on right hand of both sexes. The frequency of the mainline formula 7-5-5 is more on left hand of both sexes than on right hand. Combining both hands together, it is found that the frequencies of the mainline formulae 11-9-7, 9-7-5 and 7-5-5 are 18.64%, 31.87%, and 17.58% respectively in male and 15.38%, 29.49% and 21.79% respectively in female. However, it is seen that the frequency of the mainline formula 9-7-5 is highest in both sexes. The frequency of the mainline formula 7-5-5 is the second highest in females, whereas that of the mainline formula 11-9-7 is the second highest in males.

Table 36 shows the position of axial triradius on palm in the Semsa. It is found that the axial triradius t appears in highest frequency on both hands of both sexes. Next to t comes the axial triradius t', which appears in higher frequency on both hands of both sexes in comparison to the other two axial triradii, t" and tt". The axial triradii tt" appear only once on the left hand of a male individual. However, combining both hands together, it is seen that the frequencies of the axial triradii t, t' and t" are 80.22%, 15.93% and 3.30% respectively in male and

Table 36. Position of axial triradius.

Triradius	MALE						FEMALE					
	Right hand		Left hand		Right+Left		Right hand		Left hand		Right+Left	
	No	%	No.	%	No.	%	No.	%	No.	%	No.	%
t	79	86.81	67	73.63	146	80.22	25	64.10	29	74.36	54	69.23
t'	9	9.89	20	21.98	29	15.93	9	23.08	10	25.64	19	24.36
t"	3	3.30	3	3.30	6	3.30	5	12.82	0	0.00	5	6.41
tt"	0	0.00	1	1.10	1	0.55	0	0.00	0	0.00	0	0.00
Total	91	100.00	91	100.01	182	100.00	39	100.00	39	100.00	78	100.00

69.23%, 24.36% and 6.41% respectively in female. It may be noted that the frequency of dual formation triradii tt" is 0.55% in male, but no such dual formation is noticed in female.

Table 37 shows the frequencies of model type of 'C' line termination in the Semsa. The occurrence of ulnar termination is most common on both hands of both sexes. It is followed by radial termination in both sexes. The frequency of proximal termination is higher in male than in female. The termination of 'C' line is missing more in female (7.69%) than in male (3.85%). Combining both hands together, it is seen that the frequencies of ulnar, radial and proximal termination of 'C' line in male are 60.44%, 29.12% and 6.59% respectively and in female 64.10%, 25.64%, and 2.56% respectively.

Table 38 shows the mean 'atd' angle in the Semsa. The mean ± s.e. in right and left hands of male is 41.11 ± 0.43 and 41.08 ± 0.51 respectively and in female 44.49 ± 0.86 and 44.26 ± 0.93 respectively.

Table 39 and 40 show the digital patterns and Pattern Intensity Index of male and female respectively of 14 mongoloid populations of Assam and Meghalaya. It may be noted that data on dermatoglyphics for the Koch males are

Table 37. C-line termination among the Semsa.

Sex	Side	Termination type - C									
		Ulnar		Radial		Proximal		Absent		Total	
		No	%	No.	%	No.	%	No	%	No.	%
Male	R	44	48.35	38	41.76	6	6.59	3	3.30	91	100.00
	L	66	72.53	15	16.48	6	6.59	4	4.40	91	100.00
	R+L	110	60.44	53	29.12	12	6.59	7	3.85	182	100.00
Female	R	22	56.41	14	35.90	1	2.56	2	5.13	39	100.00
	L	28	71.79	6	15.38	1	2.56	4	10.26	39	99.99
	R+L	50	64.10	20	25.64	2	2.56	6	7.69	78	99.99

Table 38. atd angle among the Semsa.

Male (N = 91)		Female (N = 39)	
Right hand	Left hand	Right hand	Left hand
Mean ± s.e.	Mean ± s.e.	Mean ± s.e.	Mean ± s.e.
41.11 ± 0.43	41.08 ± 0.51	44.49 ± 0.86	44.26 ± 0.93

Table 39. Finger patterns and Pattern Intensity Index of 15 mongoloid (male) populations of Assam and Meghalaya.

Populations	No. tested	Whorls		Loops		Arches		P.I.I.	Reference
		No.	%	No.	%	No.	%		
Deuri	57	311	54.36	248	43.51	11	1.93	15.51	Das _et al_., 1980b
Mishing	57	214	37.54	343	60.18	13	2.28	13.35	Das _et al_., 1980b
Chutia	62	305	49.19	293	47.26	22	3.55	14.79	Das _et al_., 1980b
Mikir	100	384	38.40	559	55.90	57	5.70	13.27	Deka and Bora, 1973
Lalung	106	541	51.04	503	47.45	216	1.51	14.96	Chakravartti and Mukherjee, 1961
Rabha	132	502	38.06	728	55.12	90	6.82	13.12	Chakravartti and Mukherjee, 1961
Ahom	56	261	46.61	287	51.25	12	2.14	14.48	Das _et al_., 1980b
Garo	134	562	41.90	744	55.50	34	2.50	13.94	Chakravartti and Mukherjee, 1961
Khynriam	67	278	41.49	390	58.21	2	0.30	14.12	Das, 1978
Pnar	95	407	42.87	521	54.81	22	2.32	14.05	Das, 1978
War	98	400	40.82	565	57.65	15	1.53	13.82	Das, 1978
Bhoi	32	179	55.94	137	42.80	4	1.25	15.46	Das, 1978
Moran	55	265	48.18	278	50.55	7	1.24	14.69	Das _et al_., 1980b
Khamyang	56	202	35.98	342	61.13	16	2.88	13.09	Das and Bhagabati, 1962
Semsa	91	329	36.15	510	56.04	71	7.80	12.84	Present Study

Table 40. Finger patterns and Pattern Intensity Index of 15 mongoloid (female) populations of Assam and Meghalaya.

Populations	No. tested	Whorls		Loops		Arches		P.I.I.	Reference
		No.	%	No.	%	No.	%		
Deuri	58	314	54.14	245	42.24	21	3.62	15.08	Das _et al_., 1980b
Mishing	54	193	35.74	302	55.93	45	8.33	12.72	Das _et al_., 1980b
Chutia	58	241	41.55	335	57.76	4	0.69	14.09	Das _et al_., 1980b
Mikir	100	349	34.90	592	59.20	59	5.90	12.90	Deka and Bora 1973
Lalung	132	514	38.94	764	57.88	41	3.18	13.58	Chakravartti and Mukherjee, 1961
Rabha	50	194	38.80	296	59.20	10	2.00	13.68	Chakravartti and Mukherjee, 1961
Ahom	52	171	32.88	325	62.50	24	4.62	13.28	Das _et al_., 1980b
Garo	104	500	48.10	522	50.20	18	1.70	14.63	Chakravartti and Murkherjee, 1961
Khynriam	97	335	34.53	591	60.93	44	4.53	13.00	Das, 1978
Pnar	92	318	34.51	580	63.05	22	2.39	13.20	Das, 1978
War	67	242	36.17	396	59.05	32	4.78	13.13	Das, 1978
Bhoi	39	145	37.18	242	62.06	3	0.75	13.64	Das, 1978
Moran	52	264	50.77	251	48.27	5	0.96	14.98	Das _et al_., 1980b
Khamyang	61	236	38.62	350	57.30	24	3.94	13.48	Das and Bhagabati, 1962
Semsa	39	158	40.51	203	52.05	29	7.44	13.31	Present study

only available but these are not available for females. So we have excluded the Koch from this study. It may be further noted that no dermatoglyphic data on the Dimasa are available for comparison. However, the above mentioned two Tables are self explanatory.

Table 41 shows the distance matrix, after combining both sexes together, calculated by the method, given by Sanghvi (1953). It shows that the Semsa stand closer to the Mikir (0.13057), Mishing (0.19699), and Rabha (0.31568), whereas the Semsa stand apart from the Moran (2.19576) and Deuri (2.14491). The other populations come in between.

The dendrogram (Fig. 10) has been constructed by unweighted pair group method of Sokal and Sneath (1963). It shows that the Ahom, Khamyang, War, Pnar and Khynriam come closer to one another, whereas the Semsa stand separated from all other populations, though the Rabha, Mikir and Mishing show slightly closer relationship with the Semsa. However, the dendrogram, constructed on the basis of finger patterns and Pattern Intensity Index, shows different relationships among these populations from the dendrograms, constructed on the basis of anthropometric traits and genetic markers.

Lastly, it may be pointed out that Chamla (1962-63) has published the range of various dermatoglyphic traits

Table 41. Distance matrix based on finger patterns and pattern intensity index among 15 mongoloid populations of Assam and Meghalaya.

	DR	MH	CH	MK	LL	RB	AH	GR	KR	PR	WR	BH	MR	KM	SM
DR	-	2.21374	1.87000	2.25552	0.64570	1.73935	1.44171	0.74315	1.89839	1.75208	1.72222	0.79636	0.47350	1.99150	2.14491
MH		-	0.87420	0.00791	0.76840	0.04622	0.19330	0.84551	0.376096	0.40057	0.19856	1.21809	1.82592	0.14285	0.19699
CH			-	0.97365	0.005083	0.53700	0.282886	0.00114	0.38020	0.31164	0.36766	0.13889	0.19892	0.51281	1.26065
MK				_	0.93371	0.07835	0.26439	0.94481	0.48621	0.51081	0.27869	1.61680	1.95189	0.21781	0.13057
LL					-	0.42997	0.22551	0.00445	0.34295	0.27938	0.31030	0.20688	0.26075	0.44165	1.12576
RB						-	0.05594	0.51177	0.21183	0.21749	0.07371	1.05890	1.33345	0.06101	0.31658
AH							-	0.25788	0.08858	0.07926	0.01713	0.67326	0.92481	0.04519	0.58461
GR								-	0.34364	0.27850	0.33852	0.12971	0.21486	0.47700	1.23956
KR									-	0.00341	0.03791	0.64744	0.99825	0.05946	0.98967
PR										-	0.03974	0.60929	0.88828	0.07370	0.99714
WR											-	0.74606	1.05400	0.01202	0.67712
BH												-	0.06184	1.03264	1.99418
MR													-	1.28346	2.19576
KM														-	0.62037
SM															-

DR - Deuri; MH - Mishing; CH - Chutia; MK - Mikir'; LL - Lalung; RB - Rabha; AH - Ahom; GR - Garo; KR - Khynriam; PR - Pnar; WR - War; BH - Bhoi; MR - Moran; KM - Khamyang; SM - Semsa.

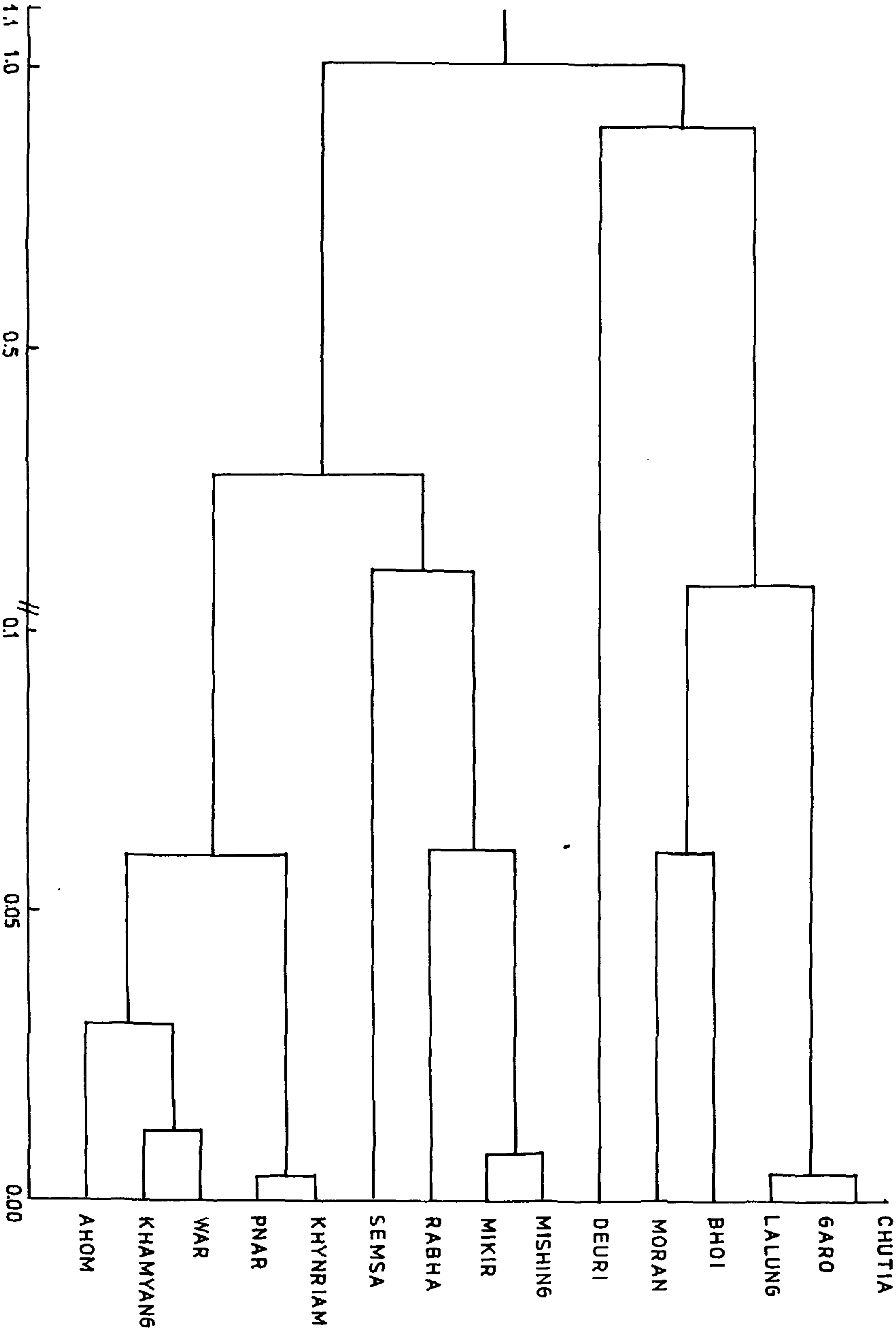


FIG.10. DENDROGRAM BASED ON FINGER PATTERNS AND PATTERN INTENSITY INDEX OF 15 TRIBAL POPULATIONS (MALES AND FEMALES COMBINED) OF ASSAM AND MEGHALAYA

among the mongoloid populations of the world. It shows that the frequency of whorl varies between 43% and 59%, that of loop between 38% and 59%, and that of arch between 0.0% and 5.5%. The Pattern Intensity Index varies from 13.45 and 15.90, whereas the Dankmeijer's Index is generally below 10. When the Semsa is compared with the world range for the mongoloid populations, it is found that the Semsa (both male and female) have lower value for whorl but higher value for arch and Dankmeiker's Index, but the frequencies of both loop and Pattern Intensity Index fall within the world range. So it seems that the Semsa do not exactly show resemblance with the other mongoloid populations, in spite of the fact that the Semsa happen to be one of the mongoloid populations of North-East India.

CHAPTER VII

MORPHOLOGICAL AND BEHAVIOURAL TRAITS

In this chapter, we shall deal with various morphological and behavioural traits that we have studied in the Semsa of Semkhor village. The traits, which have been employed for the present study, are as follows: 1. arm-folding; 2. hand-clasping; 3. tongue-rolling; 4. ear-lobe attachment, and 5. mid-phalangeal hair. It is generally believed that such morphological and behavioural traits are not as valuable as the genetic markers like blood groups, PTC-taste blindness, haemoglobin types, etc. from genetic point of view. But Salzeno (1961) has pointed out that such traits may be utilized for several reasons in population genetical studies. With this view in mind, we have utilized such morphological and behavioural traits for the present study.

Arm-folding

Arm-folding has been classified into two groups - L>R and R>L (as given in Chapter II). Table 42 shows the frequencies of L>R and R>L in both sexes. It is found that the frequency of L>R is 63.04% in females and that in males

Table 42. Arm-folding by sex among the Semsa.

Sex	Arm-folding				Total
	L > R		R > L		
	No.	%	No.	%	
Male	50	46.30	58	53.70	108
Female	29	63.04	17	36.96	46
Total	79	51.30	75	48.70	154

$\chi^2 = 3.6386$, df = 1, $P > 0.05$

is 46.30%. But, the χ^2 value (3.6386, d.f. = 1, P > 0.05) shows that there is no significant difference between two sexes in respect of this morphological trait. Pooling data on both sexes together, it is found that the frequencies of L>R and R>L are 51.30% and 48.70%, respectively.

The entire data on arm-folding have been classified into three age-groups i.e., - 23, 24-46 and 47 + years. Each of these age-groups corresponds to a generation, as explained in Chapter III with respect to demographic parameters. It is seen from Table 43 that the frequencies of L>R and R>L in the III generation are 46.67% and 53.33%, respectively, and in the II generation (i.e., age group 24-46 years) these frequencies are 55.13% and 44.87% respectively. In the I generation (i.e., age-group 47 + years) each of these two types has a frequency of 50%. However, the χ^2 value (χ^2 = 0.9854, d.f. = 2, P > 0.05) shows that there is no significant difference between generations in respect of this morphological trait. Table 43 also shows the value of χ^2 between any two generations, which are not statistically significant.

Hand-clasping

Table 44 shows the frequencies of different types of hand clasping in the Semsa. It is seen that the frequency of R>L (55.56%) in males is higher than that in

Table 43. Arm-folding by age-group.

Generations	Age groups (in years)	Arm-folding				Total
		L>R		R>L		
		No.	%	No.	%	
III	- 23	28	46.67	32	53.33	60
II	24 - 46	43	55.13	35	44.87	78
I	47 +	8	50.00	8	50.00	16

χ^2 (between all generations) = 0.9854, df = 2, $P > 0.05$.

χ^2 (between I and II) = 0.1404, df = 1, $P > 0.05$

χ^2 (between II and III) = 0.9724, df = 1, $P > 0.05$

χ^2 (between I and III) = 0.0563, df = 1, $P > 0.05$

Table 44. Hand-clasping by sex.

Sex	Hand clasping				Total
	L>R		R>L		
	No.	%	No.	%	
Male	48	44.44	60	55.56	108
Female	23	50.00	23	50.00	46
Total	71	46.10	83	53.90	154

$\chi^2 = 0.4014$, df = 1, $P > 0.05$

females (50.00%), whereas the frequency of L>R (44.44%) is lower in males than in females ((50.00%). However, the χ^2 value (χ^2 = 0.4014, d.f. = 1, P > 0.05) shows that, in respect of this morphological trait, there is no significant difference between two sexes. Pooling data on both sexes together, it is found that the frequencies of L>R and R>L are 46.10% and 53.90% respectively.

Table 45 shows the distribution of different types of hand-clasping according to generation. It is found that in the third generation (i.e., in the age group - 23 years) the frequencies of L > R and R > L are 48.33% and 51.67% respectively. In the middle generation (i.e., 24-46 years), these frequencies are 43.59% and 56.41% respectively, whereas in the first generation (i.e., age group 47 + years), these two types are present in equal frequencies i.e., 50% each. However, the χ^2 value (χ^2 = 0.4153, d.f. = 1, P > 0.05) shows that there is no significant difference in respect of hand clasping between these generations. Similarly, the χ^2 value does not show any significant difference between any two generations.

Ear-lobe

In Table 46 the frequencies of free and attached ear-lobe have been set out by sex. It is found that the frequency of free ear-lobe is predominantly higher (71.74%)

Table 45. Hand-clasping by age group.

Generations	Age groups (in years)	Hand clasping L>R No.	Hand clasping L>R %	Hand clasping R>L No.	Hand clasping R>L %	Total
III	- 23	29	48.33	31	51.67	60
II	24 - 46	34	43.59	44	56.41	78
I	47 +	8	50.00	8	50.00	16

χ^2 (between all generations) = 0.4153, df = 2, $P > 0.05$

χ^2 (between I and II) = 0.22, df = 1, $P > 0.05$

χ^2 (between II and III) = 0.308, df = 1, $P > 0.05$

χ^2 (between I and III) = 0.0140, df = 1, $P > 0.05$

Table 46. Ear-lobe attachment by sex.

Sex	Ear-lobe attachment				Total
	Free		Attached		
	No.	%	No.	%	
Male	65	60.19	43	39.81	108
Female	33	71.74	13	28.26	46
Total	98	63.64	56	36.36	154

$\chi^2 = 3.7173$, df = 1, $P > 0.05$

Attached ear-lobe due to recessive gene:
Gene frequency = 0.6030.

Free ear-lobe due to recessive gene:
Gene frequency = 0.7979.

in females than in males (60.19%), whereas the frequency of attached ear-lobe in males (39.81%) is higher than that in females (28.26%). However, the χ^2 value (χ^2 = 3.7173, d.f. = 1, $P > 0.05$) shows that in respect of this morphological trait, there is no significant difference between two sexes. Pooling data on both sexes together, it is found that in the Semsa the frequency of free ear-lobe is found to be 63.64% and that of attached ear-lobe 36.36%. It is well known that the mode of inheritance of ear-lobe does not follow the simple Mendelian laws. So, many people have suggested different modes of inheritance. Hilden (1922) and Powell and Whitney (1937) have suggested that the free ear-lobe is a dominant character, which means that attached ear-lobe is recessive in nature. On the other hand, Carriere (1922) has held an absolutely opposite view. According to him, free ear-lobe is a recessive character, whereas attached ear-lobe is a dominant one. We have tried to calculate gene frequencies, taking into consideration both the views. Considering the attached ear-lobe as a recessive trait, its gene frequency is found to be 0.6030 among the Semsa. But when a free ear-lobe is considered as a recessive character, the gene frequency of free ear-lobe becomes 0.7979.

When ear-lobe attachment is examined according to generation (Table 47), it is found that the frequencies of free and attached ear-lobes in the third generation (i.e., - 23 years) are 62.07% and 37.93% respectively. In the second generation (i.e., 24-46 years), the frequencies of free and attached ear-lobe are 62.82% and 37.18% respectively, while in the first generation (i.e., 47 + years) the frequencies of free ear-lobe (72.22%) is higher than that of the attached one (27.78%). However, the χ^2 value (χ^2 = 1.7700, d.f. = 2, P > 0.05) indicates that there is no significant difference in the frequencies of ear-lobe attachment among these generations. Table 47 also shows the absence of statistical difference between any two generations.

In the present study, it is noticed that there is no bilateral assymetry in respect of ear-lobe attachment. It holds good for both sexes and for all three generations. So, the symmetry is 100% in the Semsa in respect of this morphological trait.

Tongue rolling

Table 48 shows the types of tongue rolling in the Semsa. It is seen that 62.96% of males can roll their tongues, whereas 37.04% of them cannot do so. But in the case of females the frequency of the former is 47.83% and

Table 47. Ear-lobe attachment by age group.

Generations	Age groups (in years)	Ear-lobe attachment				Total
		Free		Attached		
		No.	%	No.	%	
III	- 23	36	62.07	22	37.93	58
II	24 - 46	49	62.82	29	37.18	78
I	47 +	13	72.22	5	27.78	18
Total		98	63.64	56	36.36	154

χ^2 (between all generations) = 0.4810, df = 2, $P > 0.05$

χ^2 (between I and II) = 0.5651, df = 1, $P > 0.05$

χ^2 (between II and III) = 0.0080, df = 1, $P > 0.05$

χ^2 (between I and III) = 0.6183, df = 1, $P > 0.05$

Table 48. Tongue-rolling by sex.

Sex	Tongue-rolling				Total
	Present		Absent		
	No	%	No	%	
Male	68	62.96	40	37.04	108
Female	22	47.83	24	52.17	46
Total	90	58.44	64	41.56	154

$\chi^2 = 3.0393$, d.f = 1, $P > 0.05$

that of the latter is 52.17%. However, the difference between two sexes is insignificant in respect of this morphological trait (χ^2 = 3.0393, d.f. = 1, $P > 0.05$).

Considering both males and females together, it is found that 58.44% of the individuals can roll their tongues, whereas 41.56% of them cannot do so.

Table 49 shows the frequency of tongue rolling by generation. In the third generation (i.e., upto 23 years), the frequencies of presence and absence are 60.34% and 39.66% respectively, whereas in the second generation (i.e., 24-46 years) these frequencies are 56.96% and 43.04% respectively and in the first generation (i.e., 47 + years) these are 58.82% and 41.18% respectively. However, the χ^2 value (χ^2 = 0.1584, d.f. = 2, $P > 0.05$) between all generations, in respect of this morphological trait, shows that there is no significant difference. Table 49 further shows that in respect of this trait no significant difference exists between any two generations.

Mid-Phalangeal hair

Table 50 shows the frequencies of the affected fingers with mid-phalangeal hair in males and females. It is found that the fourth finger is mostly affected and the second finger is least affected in both sexes. The decreasing order of the affected fingers is IV - III - V - II.

Table 49. Tongue-rolling by age group.

Generations	Age groups (in years)	Tongue-rolling: Present No	Present %	Tongue-rolling: Absent No	Absent %	Total
III	- 23	35	60.34	23	39.66	58
II	24 - 46	45	56.96	34	43.04	79
I	47 +	10	58.82	7	41.18	17
Total		90	58.44	64	41.56	154

χ^2 (between all generations) = 0.1584, df = 2, $P > 0.05$

χ^2 (between I and II) = 0.0197, df = 1, $P > 0.05$

χ^2 (between II and III) = 0.1571, df = 1, $P > 0.05$

χ^2 (between I and III) = 0.0127, df = 1, $P > 0.05$

Table 50. Frequencies of the affected fingers with the mid-phalangeal hair in both the sexes.

Finger number	Sex	Right hand		Left hand		Right and Left hand combined	
		No. of fingers affected	%	No. of fingers affected	%	No. of fingers affected	%
II	M	2	3.92	2	4.00	4	3.96
	F	1	6.67	0	0.00	1	3.70
III	M	18	35.29	16	32.00	34	33.66
	F	5	33.33	5	41.67	10	37.04
IV	M	24	47.06	24	48.00	48	47.52
	F	7	46.67	6	50.00	13	48.15
V	M	7	13.73	8	16.00	15	14.85
	F	2	13.33	1	8.33	3	11.11
Total	M	51	100.00	50	100.00	101	99.99
	F	15	100.00	12	100.00	27	100.00

Table 51 shows that 87.96% of all males and 91.30% of all females are symmetrically affected with mid-phalangeal hair. It shows that the males are less symmetrically affected than females.

Table 51 has shown the frequency of affected fingers and various combinations of fingers affected with mid-phalangeal hair for both sexes. Extracting from the above table, Table 52 shows the frequency of affected and non-affected individuals by sex. It is found that males and females are almost equally affected with mid-phalangeal hair, though males are slightly more affected than females. However, there is no significant difference, in respect of this morphological trait, between two sexes.

Table 53 has shown the frequency of affected and not affected individuals by generation. As done earlier, the entire population has been classified into three generations. It is found that the frequency of affected individuals decreases as generation advances. However, the χ^2 value (0.5452, d.f. = 2, $P > 0.05$) shows that there is no significant difference among these three generations in respect of this morphological trait. Similarly, the difference between any two generations is not statistically significant in respect of this trait (Table 53).

Table 51. Symmetry of left and right hands with respect to combination of fingers with mid-phalangeal hair.

Finger combinations identical on both hands of an individual	No. of individuals			
	Male		Female	
	No	%	No	%
0	84	77.78	39	84.78
IV	2	1.85	0	0.00
III-IV	6	5.56	2	4.35
III-IV-V	3	2.78	1	2.17
II-III-IV-V	0	0.00	0	0.00
Total symmetrical combinations	95	87.96	42	91.30
Total asymmetrical combinations	13	12.04	4	8.70
Grand Total	108	100.00	46	100.00

Table 52. Affected and not-affected Semsa individuals by sex.

Sex	Affected		Not-affected		Total
	N	%	N	%	
Male	24	22.22	84	77.78	108
Female	7	15.22	39	84.78	46
Total	31	20.13	123	79.87	154

$\chi^2 = 2.6036$, df = 1, $P > 0.05$

Table 53. Affected and not-affected individuals by generation.

Generation	Age groups (in years)	Affected		Not affected		Total
		N	%	N	%	
III	- 23	11	18.64	48	81.36	59
II	24 - 46	15	19.74	61	80.26	76
I	47 +	5	26.31	14	73.64	19
Total		31	20.13	123	79.87	154

χ^2 (between generations) = 0.5452, df = 2, $P > 0.05$

χ^2 (between I and II generations) = 0.3959, df = 1, $P > 0.05$

χ^2 (between II and III generations) = 0.0227, df = 1, $P > 0.05$

χ^2 (between I and III generations) = 0.5188, df = 1, $P > 0.05$

In Tables 54 to 58, we have presented data on these five morphological and behavioural traits (viz., arm-folding, hand-clasping, ear-lobe attachment, tongue-rolling and mid-phalangeal hair) from other mongoloid populations. These tables are self explanatory. On the basis of these data, we have compared each of these mongoloid populations with the Semsa in respect of these five traits. The χ^2 values have been given in Table 59. It shows that, in respect of these morphological traits, the Semsa differ from all these populations, despite the absence of significant difference in respect of one or two characters. For example, in respect of ear-lobe attachment the Semsa do not differ with the Ahom, Deuri and Koch; in the case of arm-folding, no significant difference is noticed between the Semsa and Khasi and also between the Semsa and Lalung. In respect of hand-clasping, the Semsa do not differ from the Chutia; in respect of tongue-rolling, no significant difference is noticed between the Semsa and Deuri; in respect of mid-phalangeal hair, the Semsa differ significantly from all these populations, excepting the Boro-Cachari, Bhoi Khasi and War Khasi. So, it shows that the Semsa, by and large, do not resemble any of the neighbouring mongoloid populations in respect of all these morphological and behavioural traits.

Table 54. **Arm-folding among seven mongoloid populations of Assam and Meghalaya.**

Populations	No.	R > L		L > R		Authors
		No.	%	No.	%	
Ahom	204	64	31.40	140	68.60	Das et al., 1985
Deuri	201	44	21.90	157	78.10	Das et al., 1985
Mishing	201	64	31.80	137	68.20	Das et al., 1985
Chutia	190	49	25.80	141	74.20	Das et al., 1985
Moran	206	35	17.00	171	83.00	Das et al., 1985
Khasi	76	29	37.85	47	62.15	Das & Baruah, 1974
Lalung	94	53	56.38	41	43.62	Das et al., 1980

Table 55. Hand-clasping among seven mongoloid populations of Assam and Meghalaya.

Populations	No.	R > L		L > R		Authors
		No.	%	No.	%	
Ahom	204	176	86.30	28	13.70	Das *et al.*, 1985
Deuri	201	185	92.00	16	8.00	Das *et al.*, 1985
Mishing	201	176	87.60	25	12.40	Das *et al.*, 1985
Chutia	190	118	62.30	72	37.70	Das *et al.*, 1985
Moran	206	154	74.80	52	25.20	Das *et al.*, 1985
Khasi	201	139	69.16	62	30.84	Das & Baruah, 1974
Lalung	94	93	98.94	1	1.06	Das *et al.*, 1980

Table 56. Ear-lobe attachment among the mongoloid populations of Assam and Meghalaya.

Populations	No.	Free		Attached		Authors
		No.	%	No.	%	
Ahom	380	245	64.47	135	35.53	Sengupta, 1987
Deuri	291	202	69.36	89	30.64	Sengupta, 1987
Mishing	302	139	46.03	163	53.97	Sengupta, 1987
Rabha	300	54	18.00	246	82.00	Das, 1967
Garo	200	54	27.00	146	73.00	Das, 1967
Kachari	50	10	20.00	40	80.00	Huq, 1975
Hajong	298	134	44.97	164	55.03	Barua, 1985
Boro-Cachari	300	76	25.33	224	74.66	Mukherjee and Guha, 1990
Lalung	52	16	30.80	36	69.20	Huq, 1975
Koch	40	22	55.00	18	45.00	Huq, 1975

Table 57. Tongue-rolling among six mongoloid populations of Assam.

Populations	No.	Present		Absent		Authors
		No.	%	No.	%	
Ahom	204 (M+F)	157	76.80	47	23.20	Das _et_ _al_., 1985
Deuri	201	106	52.40	95	47.60	Das _et_ _al_., 1985
Chutia	190	77	40.50	113	59.50	Das _et_ _al_., 1985
Mishing	201	87	43.30	114	56.70	Das _et_ _al_., 1985
Moran	206	87	42.30	119	57.70	Das _et_ _al_., 1985
Lalung	94	68	72.34	26	27.66	Das _et_ _al_., 1980

Table 58. Mid-phalangeal hair among five mongoloid populations of Assam and Meghalaya.

Populations	No. tested	Present		Absent		Authors
		No.	%	No.	%	
Boro-Cachari	300	53	17.75	247	82.25	Mukherjee and Guha, 1990
Khynriam Khasi	400	151	37.75	249	62.25	Mukherjee, 1964
Pnar Khasi	100	36	36.00	64	64.00	Mukherjee, 1964
War Khasi	50	15	30.65	35	69.35	Mukherjee, 1964
Bhoi Khasi	52	15	28.85	37	71.45	Mukherjee, 1964

Table 59. χ^2 values in respect of five morphological and behavioural traits.

Populations	Arm-folding	Hand-clasping	Ear-lobe attachment	Tongue-rolling	Mid-phalangeal hair
Semsa vs Ahom	11.0994*	45.9727*	1.5164	14.0664*	
Semsa vs Deuri	28.1295*	68.5772*	1.5311	1.1456	
Semsa vs Mishing	10.4024*	50.0732*	12.6703*	8.0175*	
Semsa vs Chutia	19.3700*	2.3582	-	10.9316*	
Semsa vs Khasi	2.2879	8.6589*	-	-	
Semsa vs Lalung	1.4243	57.4622*	17.0003*	4.8736*	
Semsa vs Moran	41.7490*	17.0434*	-	9.2588*	
Semsa vs Rabha	-	-	95.1609*	-	
Semsa vs Garo	-	-	47.6763*	-	
Semsa vs Cachari	-	-	28.8464*	-	
Semsa vs Hajong	-	-	14.1724*	-	
Semsa vs Boro Cachari	-	-	63.1691*	-	0.4106
Semsa vs Koch	-	-	0.6897	-	-
Semsa vs Khynriam	-	-	-	-	15.6493*
Semsa vs Pnar	-	-	-	-	16.6635*
Semsa vs War	-	-	-	-	2.1110
Semsa vs Bhoi	-	-	-	-	1.7046

* Significant at 5% level of probability.

In the present chapter, we have presented data on five different morphological and behavioural traits among the Semsa, and we have tried to find out the differences between generations in respect of these traits, with a view to making out the effect of drift, following the method suggested by Glass (1956). However, it is found that, on the basis of these traits, there is no statistical differences between generations. The other point to be noted here is that the Semsa mostly do not resemble any of the other neighbouring mongoloid populations of Assam and Meghalaya in respect of these traits.

CHAPTER VIII

DISCUSSION

In physical anthropology emphasis is being shifted gradually from human taxonomic research to population genetical research since the middle of the present century. So the physical anthropologists are becoming more and more interested in understanding the nature and extent of human variations and in finding out the processes of microevolution and the impact of various natural forces like selection, drift, etc. on human populations.

From this point of view, India occupies a unique position. The reason is that many culturally isolated groups have been living in various parts of this country since time immemorial. The North-Eastern part of the country is specially remarkable because plenty of small populations have been residing here and many of them have not yet been studied from anthropological point of view - physical or cultural.

The scientific groups of the World Health Organization (WHO, 1964, 1968) have suggested that there is an urgent need to study culturally isolated population groups. They say that some of these groups are likely soon to become extinct and many, if not all, are undergoing rapid and substantial cultural change due to constant contact with more advanced societies, and such changes would have had far reaching biological consequences. They have further suggested that "such groups present both in their size and level of economy the closest approximation one can find to the conditions under which man has lived for the greater part of his existence. It is probable that much of the genetic endowment of modern man has been shaped by the action of natural selection and other evolutionary processes at these cultural levels." Keith (1950) has referred to such breeding isolated groups as "evolutionary units", the study of which may reveal various important facts, regarding the mechanism and processes of human evolution.

With this end in view we have undertaken a study on the Semsa of Semkhor village in the North Cachar Hills district of Assam. The purposes of the present study are to describe the demographic and genetic structure of the population, to find out the effects of evolutionary forces, acting on it and to assess its relationship with other neighbouring mongoloid populations.

The Semsa is a small isolated population, restricted in one village, known as Semkhor. Danda and Ghatak (1985) have suggested that the Semsa is an offshoot of the Dimasa and they have been maintaining their cultural isolation for more than two hundred years. Regarding the origin of the Semkhor village there are two distinct versions - A. The Dimasa people from nearby villages came to Semkhor and by accident of their luck they came across five saline-pits and finally settled there, and B. A section of the Dimasa people took shelter in this village during the Kachari King's encounter with the Ahom King (Danda and Ghatak, 1985). However, Ghosh and Dasgupta (1991) say that the Semsa people broke up all their relations with their parental group i.e., the Dimasa, in order to protect their ecological interest i.e. they never wanted to share those saline pits in the Semkhor village with anyone, thereby leading to complete fission. In this connection, it may be noted that, on the basis of demographic structure with patterns of subsistence, ecological adoption and social organisation, Salzano (1972) and Perez Diez and Salzano (1978) have classified the American Indian tribes into three stages of evolution: "Stage A would be represented by hunters and gatherers with incipient agriculture: Stage B by more advanced agriculturalists and fishers; and stage C by pastoralists and populations living in densely inhabited areas, as well as industrialized centres". According to this classification of Perez Diez and Salzano it seems that the Semsa as a community belong to the stage B, since the Semsa are agriculturists and relatively small isolated groups. Such relative isolation of the group must have encouraged local endogamy to a full extent. Whatever may be the reason(s) for the Semsa to get themselves separated from their parental group, Dimasa, it is true that at present the Semsa is, in all possible sense, a culturally isolated group. So, it seems likely that the structure of this population could be better described by using the island model of Wright (1943) as suggested by Salzano (1972) in the case of those populations belonging to stage B.

In the preceding chapters we have presented our findings on the Semsa. In the present chapter we shall examine all the findings on the Semsa in the light of the data available on other populations.

The demographic structure of the Semsa has been discussed in Chapter III. It is seen that this population appears to be of progessive type according to the Sunbarg's classification of population. In this population overall sex ratio is found to be very near to the ideal sex ratio of 1:1, though it is slightly tilted in favour of females.

However, it is also observed that male mortality is higher than female mortality in the early age groups, though the average longevity is more in the case of males than in the case of females. The sex ratio in Assam is 923 females per 1000 males and in Meghalaya it is slightly more i.e., 955 females per 1000 males. The overall sex ratio in India is 927 females per 1000 males (North Eastern Council, 1995). The data on sex ratio for the neighbouring populations of the Semsa are not available. However, it shows that sex ratio among the Semsa is certainly near to the ideal one than what has been reported for various populations and states in India.

Marriage among the Semsa is found to be very stable by and large. It is seen that only 12.04% of all married individuals have changed their mates. This frequency is slightly more among the males than among the females. In comparison to the Kota of Nilgiri Hills (Ghosh, 1976) in which the frequency of 'more than once married individuals' is 29% and to the Pahira of Ajodhya hills (Basu, 1969) in which the frequencies of "more than once married individuals" are 19.61% in the North Pahira, 23.01% in the South Pahira I and 23.88% in the South Pahira II, it shows that among the Semsa the marriage is very stable. In this connection, it may be recalled what Danda and Ghatak (1985) have said about the Semsa. They say, "Possibility of remarriage of widow and widower is not much. Normally a widower marries a widow .... But it mostly happens that widows always do not get chance of remarriage because of non-availability of suitable widower who may be compatible to her age...." They also say, "when there are so many restrictions regarding marriage it may seem that there would be much difficulty in getting mate for a single individual. But in reality no one remains unmarried in the society."

Among the Semsa the marriage rule is strictly guided by the principle of the double descent system and village endogamy. Danda and Ghatak (1985) have reported that cross-cousin marriage is allowed among the Semsa, though it is not being practised. However, during the present field work, we have collected extensive genealogies, covering all individuals, among the Semsa, and have detected nine case of consanguineous marriages (details are given in Chapter III). It is true that the degree of consanguinity varies from case to case. It is observed that in such cases of consanguineous marriage, the Semsa have even strictly followed the rule of the double descent system i.e., they have taken into full consideration both matriclan and patriclan at the time of marriage. During the time of the present field work a solitary instance of violation of the double descent system was brought to our notice. A Semsa person named Faithar Haflongbar (Disirik) married a Semsa woman named Dethandee Langthasa (Disirik). This man, though did not marry within his patriclan Haflongbar, married Dethandee Langthasa (Disirik), who belonged to his matriclan Disirik. Consequently, this couple was compelled to leave the village Semkhor; and they ran away to a nearby Hmar village, Semtilung. Incidentally this man never had any child through this wife. However, after a couple of years since they ran away, this couple came back to the Semkhor village, and they were formally separated. Since then they have not married again. It shows that how strictly the Semsa have been following their traditional double descent system.

The other point to be noted here is about village endogamy. In the present survey only two instances were brought to the notice that the rule of village endogamy was violated. Danda and Ghatak (1985) have already reported one instance of such violation in which a Semsa boy married a Dimasa girl and the Semsa boy was compelled to leave Semkhor. The boy is no more considered as a Semsa. The other instance, which the present field worker came to know, while working in Semkhor, is that a Semsa widow named

Belkhodee Phonglo (Nadigal), having no child through her deceased husband, married a Dimasa man and eventually left Semkhor to settle in some Dimasa village. The women Belkhodee Phonglo (Nadigal) is no more considered as a Semsa by the Semsa people of Semkhor. It shows that how strictly the Semsa are maintaining village endogamy (See Table 14).

Regarding fertility of the Semsa it is seen that there is not a single woman aged 44 + years, who is not having any child. So, by and large, the average fertility among the Semsa women is high. For example, the mean number of livebirths for the women, married once, is 4.24 ± 0.21 and that for the women, married more than once, is 4.62 ± 0.54. The completed family size among the Semsa is found to be 4.76 surviving children per mother and the average number of livebirths per mother is 7.52. The completed family size among the Kota is reported to be 3.67 livebirths per mother (Ghosh, 1976), whereas Basu (1969) has reported that the completed family size among the Pahira is 6.44 livebirths per mother in the North Pahira, 6.38 livebirths per mother in the South Pahira I and 6.18 live births per mother in the South Pahira II. So, it shows that, in comparison to both the Kota and three Pahira subpopulations, the fertility of the Semsa is considerably greater. Khongsdier (1992) has reported the completed family size among the Pnar of Jaintia Hills is 6.98 live births per mother and Deka (1989) has reported the completed fertility of the same population of a different village is 8.1 live births per mother. So, it shows that the completed family size among the Semsa is not as high as that found among the Pnar of Jaintia Hills. Khongsdier (1993) has reported the completed family size among the two sections of the War Khasi. It is found that among the Christian War Khasi the completed family size is 6.69 live births per mother and that among the non-Christian War Khasi 6.61 live births per mother. So, the completed family size among the Semsa is not as high as those found in two sections of the War Khasi. Nag (1965) has reported the completed family size among the Khasi, but he has not mentioned which of the Khasi sub-populations he had worked on. However, he has reported that the completed family size among the Christian Khasi is 4.1 live births per mother and that among the non-Christian Khasi 5.7 live births per mother. Barring the results among the Christian and non-Christian Khasi, reported by Nag (1965), the Semsa seem to have a very high fertility rate. It may also be noted that Roberts (1956) has reported that the completed fertility among the Dinka is about 5.38 children per family, which is certainly lower than that found among the Semsa. But Eaton and Mayor (1953) have reported that the completed family size among the Hutterites is as high as 10.7 children per family (This is the highest value so far reported). It is true that though the completed family size among the Semsa is high in comparison to most of the populations, it is not as high as that among the Hutterites.

The child-woman ratio (fertility ratio) among the Semsa is found to be 50.23, which is certainly lower in comparison to the Pahira of the Ajodhya hills (Basu, 1969) in which the North Pahira show 74.24, the South Pahira I 68.57 and the South Pahira II 74.40. The fertility ratio among the Kota (Ghosh, 1976) is found to be 62.17. Khongsider (1993) has reported that the fertility ratio, among the Christian and non-Christian War Khasi are 61.48 and 62.10 respectively. Khongsdier (1992) has reported that the fertility ratio among the Pnar of Jaintia Hills is as high as 86.96. Roberts (1956) has reported the fertility ratio among the Dinka is 78.0, whereas Eaton and Mayor (1953) have reported that the same among the Hutterites is 96.3 (highest in the world). So, it shows that in comparison with whatever data are available on child-woman ratio from different populations, the Semsa show lower value. The reason for such low value, as indicated by the child-woman ratio, is that among the Semsa the infant mortality rate before the age of 4 years is more than 20% (Table 11). However, the overall average live births per mother among the Semsa is found to be 4.28, which indicates that the fertility rate is fairly high in this population.

Among the Semsa, it is found that the overall mortality rate, based on all live births, is about 35.73% (Table 9), but the child-mortality rate (i.e., death before 15 years of age) is found to be about 31.60% (Table 11). It indicates that the child mortality rate is very high among the Semsa in comparison to that among the Pnar of Jaintia Hills (8.0%) (Khongsdier, 1992). Khongsdier (1991) has reported that the child-mortality rate among the Christian War Khasi is 10.57% and that among the Non-Christian War Khasi 12.19%. So in comparison to the War Khasi population, the Semsa have greater child mortality rate. Das and Das (1982) have reported that the child mortality rates among the Mongoloid, Muslim and Hindu populations of Assam are 11.43%, 14.24% and 15.49%, respectively. In comparison to all these Assamese populations, the child mortality rate among the Semsa is considerably high. Barua (1982) has reported that the child mortality rate among the Hajong of Meghalaya is 15.6%, which is less than half of the rate found among the Semsa. Ghosh (1976) has reported that the overall child mortality rate among the Kota of Nilgiri hills is 30.77%, which is lower than that found among the Semsa. Basu (1969) has reported that the child mortality rates are 44.3% in the North Pahira, 34.64% in the South Pahira I and 32.3% in the South Pahira II. So far the child mortality rate is concerned, the Semsa resemble both the South Pahira I and South Pahira II, but the North Pahira is having higher child mortality rate.

Among the Semsa, the frequency of reproductive wastage (still birth and abortion together), based on total number of pregnancies, is found to be 5.90%. Among the Kota of Nilgiri Hills, Ghosh (1976) has reported that the frequency of reproductive wastage is 8.34%, which is higher than that found among the Semsa. Khongsdier (1991) has reported that the frequency of reproductive wastage among the Christian War Khasi is 7.68% and that among the non-Christian War Khasi 8.09%. So it seems that the frequency of reproductive wastage in the Semsa is lower than those found among the two sections of the War Khasi. Barua (1982) has reported that the child mortality rate among the Hajong of Meghalaya is 15.6%, which is less than half of the rate found among the Semsa. Das and Das (1982) have found that the frequency of reproductive wastage is 2.87% among the Assamese Hindu castes, whereas it is 2.55% among the Mongoloid populations and 1.64% among the Muslim of Assam.

So it shows that among the populations of Assam the frequency of reproductive wastage is comparatively lower than that among the Semsa. Combining both child mortality and reproductive wastage rates together, it is found that among the Semsa the potential offspring loss is about 37.5%, which is considerably high in a small population like this. Danda and Ghatak (1985) have observed that the health condition of the Semsa is not generally good since they lack medical facilities in the village. So, the present finding of high rate of offspring loss in the Semsa clearly indicates the general health condition of the population and the extent of medical facilities they are lacking.

In short, it can be said that the Semsa is a small population, restricted only in one village. They strictly observe village endogamy, which means marriage outside the village is not allowed (Cases of such marriage have already been discussed). It is also true that the Semsa strictly follow the system of double descent. In spite of it,there is a demographic compulsion among them, which might have led to practise of some amount of consanguineous marriage. So the Semsa is not a random mating population since they marry not only within the village but also among the relations. Such non-random mating system is likely to have tremendous genetic effect on the population (Neel, 1967). Among the Semsa it is found that the admixture rate is zero since the Semsa never accept mate from any other populations. Consequently, the coefficient of breeding isolation in this population has become zero.

From an evolutionary point of view the change due to random drift is very important in "a population of relatively small size which is more or less isolated" (Brues, 1964). Wright (1940) has said that the differentiation due to drift for a gene frequency depends upon the coefficient of breeding isolation (Nem) i.e., the product of effective population size (Ne) and the admixture rate (m). Roberts (1956) says,"For a gene frequency in the total population of 0.5, there is very great differentiation of local gene frequencies where Nem is less than 0.5; there is important differentiation where Nem is less than 5, but differentiation is slight if Nem is greater than 50." In case of the Semsa, as mentioned earlier, the value of Nem is found to be zero, which indicates that differentiation in gene frequencies due to random genetic drift is appreciably great. To the best of our knowledge no one has so far reported about any population in India in which the coefficient of breeding isolation is zero. So it may be assumed that the random genetic drift, which causes change in the proportions of the hereditary trait, is particularly an important force in a small, isolated population like the Semsa.

The variance due to drift (σ^2_{dq}, where $q = 0.5$) among the Semsa is found to be 0.0006098. But the variance due to random genetic drift has been calculated on the basis of the assumption that there would be no mutation, selection and intermixture in the population. It is true that in the case of the Semsa there is no intermixture, but it is extremely difficult to rule out that either mutation or selection or both are not acting on this population. With all probability some of these natural forces must be active in this population. So, it is extremely difficult to make any critical estimate on this result.

Selection is a major evolutionary force, which can bring about changes in the genetic make up of a population. To understand how selection is operating in this population the index of opportunity for selection in the Semsa has been calculated according to the formula given by Crow (1958) as well as by the modified formula of Johnston and Kensinger (1971). According to Crow's formula of 1958 the index of total selection intensity (I) is 0.6165 with its mortality (I_m) and fertility (I_f) components 0.4717 and 0.0984 respectively. It shows that selection is operating more through differential mortality than through differential fertility. However, selection is operating with moderate intensity in the Semsa. Reddy and Chopra (1990) have compiled all the results, reported on 96 Indian populations on the indices of selection intensity, calculated according to the formula of Crow. It is found that the index of total selection intensity varies from 0.258 in a sub-group of the Yanadi tribe (Vasulu, 1987) to 2.250 in the Kota (Basu, 1972). Comparing with the Indian range it seems that the total selection intensity in the Semsa falls towards the lower half of the range. The index of selection due to fertility component varies between 0.018 in the Sao Teli (Rao and Choudhury, 1980) and 0.815 in the Kota (Basu 1972). Among the Semsa the index of selection due to fertility component (I_f) is lower in comparison to most of the Indian populations. The index of selection due to mortality component (I_m) varies between 0.053 in the Yanadi tribe (Vasulu, 1987) to 1.062 in the Mala (Rao and Murthy, 1984). So it shows that in the Semsa the index of selection due to mortality component is generally greater in comparison with most of the Indian populations.

Sengupta and Kalita (1996) have compiled all results of total selection intensity, calculated according to Crow's formula, on the so far studied populations of

North-East India. It is seen that the index of total selection intensity varies between 1.0700 among the Gallong of Arunachal (Chakravarty and Ahmed, 1989) and 0.1824 among the urban Ahom of Assam (Sengupta and Kalita, 1996). Considering the range for the Indian populations of North-East India, the Semsa stand in the middle. The fertility component varies between 0.3100 among the Bengali Muslim of Cachar (Chakravarty, 1976) and 0.1130 among the Khamti (Sarkar et al., 1994). Again taking into consideration the range of fertility component among the various populations of North-East India, it is seen that differential fertility contributes least to total selection intensity in the Semsa. The range of mortality component among the populations of North-East India is found to vary between 0.1057 among the Pnar (Banerji et al. 1994) and 0.7500 in the Gallong (Chakravarty and Ahmed, 1989). Among the Semsa the value of mortality component is found to be 0.4717, which appears to fall towards the upper half of the range, that is found for the people of North-East India. However, it is seen that the mortality component among the Semsa is very high, though it is not as high as that found in the Gallong. But it is well understood that selection is operating more through differential mortality than through differential fertility.

In the present study we have also calculated the total selection intensity among the Semsa according to the modified formula of Johnston and Kensinger (1971). The total selection intensity (I) is found to be 0.6779, which is slightly higher than that calculated by Crow's formula of 1958. The index of selection due to embryonic mortality (I_{mc}) in the Semsa is found to be 0.038, which is lower than that reported for the Pnar (Khongsdier, 1990) or the Hajong (Barua, 1982) or the Jaintia (Deka, 1989). So in comparison with the other populations of North-East India it shows that in the Semsa the contribution of embryonic component to total selection intensity is lower.

Anthropometry

In the present study we have considered 13 anthropometric measurements on the Semsa males (adult). On the basis of these anthropometric measurements, one can infer that the Semsa males are generally short statured people with dolicocephalic head and mesorrhine nose. They are medium chested with medium to very broad face.

On the basis of these measurements,we have seen the Semsa differ significantly from the Dimasa in respect of height vertex, sitting height vertex, nasal height and least frontal breadth. It is also observed that the Semsa mostly do not differ from any of the four subgroups of the

Khasi, excepting in case of least frontal breadth (differ from all four Khasi subgroups) and head circumference (only from the Bhoi). However, when the distances, on the basis of eight anthropometric measurements, calculated according to the method given by Rao (1952), it is found that the Semsa come closer to the three Khasi subgroups, Khynriam, War and Pnar, but stand quite apart from the Dimasa and others.

Genetic Markers

In the present study four genetic markers have been considered with a view to understanding the genetic composition of the Semsa and to finding out its genetic relationship with other mongoloid populations of Assam and Meghalaya. In respect of three genetic markers, i.e., ABO and Rh blood groups and P.T.C. taste blindness, the Semsa seem to be in genetic equilibrium. It is also seen that nearly 7.56% of all Semsa males are colour blind.

It is found that among the Semsa nearly 42.47% of all matings are incompatible in respect of the ABO blood groups. It may be noted that, generally, the frequency of Rh^- gene is absent or present in a very low dose among the Indian mongoloid populations (Bhattacharjee, 1968). It is seen that among the Semsa the frequency of Rh^- gene is less than 1%. So it can be presumed that among the Semsa there could be hardly any incompatibility in respect of the Rh-system. So, the way, that selection puts pressure, is through ABO incompatibility, which seems to be fairly high in this population. We have already seen that selection is active on this population and it acts mostly through differential mortality.

Glass (1956) has suggested that in any isolated population the differences in phenotypic frequencies between generations are due to the effect of genetic drift. Since the Semsa is a small isolated population, such effect of genetic drift is very much expected. It is seen that in the Semsa no significant differences are found in respect of genetic markers between generations. In this connection, one may recall what Basu (1969) has said. He has contradicted Glass' observation and suggested that such variation between generations need not necessarily be due to drift alone but it may be compatible with selection. Following Roberts' (1965) method, Basu (1969) has shown that some variations between generations, in respect of P.T.C. taste blindness, may be attributed to drift alone, while some others may be attributed to both drift and other evolutionary forces. In the light of the arguments, given by Roberts (1965) as well as Basu (1969), the observed variations between I and II, I and III and II and III generations, in respect of non-taster allele t, have been calculated, and it is observed that with the exception of the difference between I and II generations (which is more than twice the standard deviation) the observed variations between other generations are likely to be due to the effect of genetic drift. So, the operation of drift, in respect of genetic markers, just cannot be ruled out in the Semsa. It may be recalled that, on the basis of demographic data, it has been suggested that changes due to genetic drift in this population is expected to be very great. So, drift, along with other evolutionary forces like selection, etc. may play a very important role in regulating the gene frequencies in the present population.

As mentioned earlier, Danda and Ghatak (1985) have suggested that the Semsa is an offshoot of the Dimasa. So it is expected that the Semsa should resemble the Dimasa. When a comparison has been made between the Semsa and Dimasa in respect of ABO bloodgroups, it is found that there is significant difference between them. Unfortunately data on other genetic markers from the Dimasa are not available for further comparison. It may be recalled that in respect of various anthropometric traits the Semsa differ significantly from the Dimasa. Even the dendrogram (Fig. 4), showing relationship among various mongoloid populations of Meghalaya and Assam on the basis of anthropometric traits, shows that the Semsa stand apart from the Dimasa.

The three genetic markers (ABO, Rh and PTC) have been taken into consideration to find out the genetic relationship between the Semsa and other mongoloid populations. The dendrogram shows that the Semsa stand much closer to the Lalung and Koch than to other populations (Fig. 6). When only two blood groups i.e., ABO and Rh, have been taken into consideration, the dendrogram (Fig. 7) shows that the Khamyang and Semsa stand closer to each other, but the Semsa stand apart from the other populations. So, it may be suggested that on the basis of two or three genetic markers, the exact phylogenetic relationship among the populations is difficult to assess. However, on the basis of whatever data on genetic markers are available, one may infer that the Semsa do not resemble the Dimasa, in spite of the fact that according to various suggestions, based on some cultural traits, the Semsa happen to be an offshoot of the Dimasa.

Dermatoglyphics

We have discussed dermatoglyphic characteristics of the Semsa in Chapter VI. The finger patterns show that the frequency of loops is more than that of whorl in the Semsa. The present findings on the Semsa have been compared with those of 14 other mongoloid populations of Assam and Meghalaya.

It is seen that the Semsa show closer relationship with the Rabha, Mikir and Mishing and also it is found that the Ahom, Khamyang, War, Pnar and Khynriam come closer to one another. However, these two clusters stand close to each other. Since no data on dermatoglyphics are available from the Dimasa, no comparison between the Semsa and Dimasa is possible. The point to note here is that we have constructed four different dendrograms, based on anthropometric traits, genetic markers and dermatoglyphic characteristics, and each of these four dendrograms shows different types of relationships between the Semsa and the other mongoloid populations of Assam and Meghalaya.

The point to be noted here is that though the Semsa is a mongoloid group, most of the dermatoglyphic traits among them show different picture in comparison with the range for various dermatoglyphic traits suggested by Chamla (1962-1963).

Morphological and Behavioural traits

In the present study we have examined five different morphological and behavioural traits among the Semsa. It is true that such behavioural and morphological traits are of lesser value than the genetical traits in population genetical studies. But Salzano (1961), while working among the Caingang Indians, has suggested that such morphological and behavioural traits are of some value and can be utilized in any population genetical study. With this idea we have utilized these data on morphological and behavioural traits in the present study. It is found that among the Semsa, in case of arm folding, the frequencies of R>L and L>R are more or less of same value, though L>R is slightly more. In case of hand clasping R>L is predominantly more than L>R. In case of ear lobe attachment it is found that the frequency of free ear lobe is more than that of attached ear lobe. It is seen that majority of the Semsa can roll their tongue. It is also observed that among the Semsa both sexes are almost equally affected with mid-phalangeal hair.

We have utilised all these five morphological and behavioral traits in order to find out variations between generations. It is seen that in respect of all these five traits no significant difference is noticed between three generations. It shows that the effect of genetic drift, on the basis of these five morphological and behavioural traits, is not very clearly perceptable in the Semsa.

When compared with the other mongoloid populations of Assam and Meghalaya, it shows that the Semsa differ significantly with them in respect of most of these morphological and behavioural traits.

In the present study anthropometric, genetic, dermatoglyphic, and morphological and behavioural traits, besides demography, have been taken into consideration and it is found that the Semsa do not resemble any of the mongoloid populations of Assam and Meghalaya, not even the Dimasa.

We have seen that on the basis of ABO blood groups and anthropometric characters the Semsa do not resemble the Dimasa. It is further observed that both selection and drift are quite active in the Semsa. Demographic data suggest that the effect of genetic drift is expected to be great on the Semsa, and genetic markers also corroborate that the effect of drift on this population just cannot be ruled out. Through demographic data it is found that selection is acting moderately in the Semsa. This has been further elucidated through the findings of incompatible matings in respect of ABO blood groups. On the basis of all morphological, behavioural and dermatoglyphic traits it may be said that the Semsa do not resemble the other mongoloid populations of Assam and Meghalaya.

Now the question is why the Semsa is different from the Dimasa (as anthropometric and serological data indicate?).

Danda and Ghatak (1985) have suggested that the Semsa is an offshoot of the Dimasa on the basis of the some resemblance between the Semsa and Dimasa in respect of language, double descent system and various other cultural traits and the popular sayings about the origin of the Semkhor village. If such suggestion is accepted, then one can reasonably presume that only a group of the Dimasa people came and settled in the Semkhor village for one reason or the other, and that group finally got separated from their parental group. So the group, which initially settled in the Semkhor village, cannot be taken for granted that it was a random sample of the parental Dimasa. Consequently, in whatever proportions of the genes the original settlers of the Semkhor village initially carried with them, are still being maintained more or less in the same frequencies since for last more than two hundred years there was not a single case of admixture with Dimasa or any other populations. But on the other hand, it may be presumed that the present day Dimasa, being a fairly large population, may have some admixture with the other populations, particularly with the neighbouring ones. It can also reasonably be presumed that selection pressure must be different for different populations. So, the Semsa and the Dimasa are having different selection pressure on them and selection happens to be one of the most powerful forces, which brings about changes in a population. So to our mind the most reasonable way to explain the present population genetic structure of the Semsa in the light of the Founder Principle (Mayr, 1963). As mentioned earlier and one can reasonably presume, when a group of people (at present known as the Semsa) got separated from their original parental stock (i.e., the Dimasa), in no way the separated group could possibly represent a random sampling of their parental stock. The other point to note here is that over 200 years the separated group (i.e., the Semsa) never had any marital relation not only with their parental stock (the Dimasa), but also with any other neighbouring populations for one reason or the other. So, it is quite possible that the present population genetic structure of the present day Semsa must have evolved from the population genetic structure of the original splinter group, and whatever changes have occurred must have been due to the effect of selection and/or due to the effect of genetic drift since drift is a strong possibility in any isolated population like the Semsa (Brues, 1964).

In the present study we have used a very limited number of traits through which it is really difficult to assess the genetic relationship of the Semsa with the Dimasa in particular and with the other neighbouring mongoloid populations in general. Since we have limited facilities, even if we wish to do, we have not been able to establish fully the genetic relationship between the Semsa and the Dimasa and also between the Semsa and the other neighbouring mongoloid populations. As and when our infra-structural facilities will increase we shall be in a better position to collect data on various other genetic markers like serum proteins, red cell enzymes, haemoglobin, etc. on the Semsa, Dimasa and other neighbouring mongoloid populations to examine this problem of genetic relationship. But at present with our limited data we may say that the Semsa is a separate endogamous group, which forms a genetic isolate, having no relationship with the Dimasa or any other population and the present genetic structure of the Semsa must have been shaped due to the effect of Founder Principle.

CHAPTER IX

SUMMARY

Since the middle of the present century, the physical anthropologists have been changing their emphasis from taxonomic research to population genetic research. Consequently, micro-evolutionary studies in physical anthropology are gaining interest with a view to finding out the impact of various natural forces like selection, drift, etc. on human populations.

The scientific groups of World Health Organisation (1964, 1968) have suggested that there is an urgent need to study the culturally isolated population groups since most of these groups are constantly under the threat of cultural disintegration owing to constant contact with more advanced societies. They have further suggested that such changes will have far reaching biological consequences.

Keith (1950) has referred to such isolated group as "evolutionary units" since the genetic endowment of man has been shaped by the action of various evolutionary forces at this cultural level. So, a study of such small culturally isolated groups may reveal various important facts, regarding the mechanisms and processes of human evolution.

With this end in view we have undertaken a study on the Semsa of Semkhor village in the North Cachar Hills district of Assam. The purposes of the present study are as follows:

1. To describe the demographic and genetic structure of the population ;
2. To find out the effects of evolutionary forces, acting on it;
3. To assess its relationship with other neighbouring mongoloid populations.

The Semsa is a small culturally isolated population, restricted in one village, known as Semkhor. Danda and Ghatak (1985) have suggested that though the Semsa is an offshoot of the Dimasa, they have been maintaining their cultural isolation for more than two hundred years.

Regarding the origin of the Semsa, there are two different versions:

1. Some of the Dimasa people from the nearby village came to Semkhor and by accident of their luck, they came across five saline pits and finally settled there.

2. A section of the Dimasa people took shelter in this village during the Cachari King's encounter with the Ahom King and finally settled there.

Ghosh and Dasgupta (1991), however, have suggested that the Semsa people gave up all their relations with their parental group i.e., the Dimasa, in order to protect their ecological interest. They never wanted to share those saline pits with any other person and that eventually led to complete fission.

Whatever may be the reasons for the Semsa to get themselves separated from their patental group Dimasa, it is true that at present the Semsa is a culturally isolated endogamous group, restricted in a single village.

The marriage rule among the Semsa is strictly guided by the principle of double descent system and village endogamy (Danda and Ghatak, 1985). Among the Semsa, initially, they had seven patriclans but now they are having only five patriclans, along with sixteen matriclans.

The Semsa, though having no marital relation with the Dimasa, are still having traditional cultural traits of the Dimasa tribe, including the language, which belongs to the Tibeto-Burman linguistic family (Danda, 1978).

The Semsa people mostly practise shifting and settled cultivation. They also earn their livelihood through various types of other activities like weaving, basket making, etc. In fact, the Semsa are largely dependent on forest for their survival.

As per the classification of populations by Perez-Diez and Salzano (1978), the Semsa belong to the stage B, which is represented by more advanced agriculturalists and fishers.

The structure of any population in stage B could be better described by using the 'island model' of Wright (1943). So in the present study we have relied on Wright's island model.

The findings of the present study may be briefly summarized as follows:

1. According to the Sunberg's classification of population, the Semsa is of progressive type.
2. It is seen that nearly 20.41% of males and 19.33% of females belong to the age group 0-14 years whereas about 24.70% of males and 26.13% of females belong to the reproductive age group 15-49 years. In the post-reproductive age

group, i.e., 50+ years, 4.77% and 4.65% are males and females respectively.

3. The sex ratio among the Semsa is found to be 1:1.005. It shows that the number of females is slightly more than that of males. However, the sex ratio is very near to the ideal sex ratio of 1:1.

4. It is found that in the prereproductive age group i.e., 0-14 years, the sex-ratio is 1:0.95, which means that the number of males is slightly more than that of females. But in the reproductive age group (i.e., 15-49 years), the sex ratio (1:1.06) is tilted in favour of females, whereas in the post reproductive age group (i.e., 50+ years), the sex ratio (1:0.98) is again tilted in favour of males. It shows that the average longevity is slightly higher in males than in females.

5. The population pyramid shows the distribution of population by age groups. It depicts that in recent time, the base is quite shrunken. It may be due to the high infant mortality rate since the Semsa, till today, have not adopted any family planning method.

6. The mean age at marriage for males and females is found to be 22.11 ± 0.18 years and 18.42 ± 0.17 years, respectively.
7. The mean age at first child birth in the case of females is 20.58 ± 0.24 years and that in the case of males 24.59 ± 0.29 years. So, the mean age at first child birth, taking both males and females together, is 22.59 years.
8. Following the method, suggested by Glass (1956), we have taken 23 years as a generation length for the Semsa.
9. It is found that the frequency of multiple marriages in the third generation i.e., upto 23 years, is 5.56% for males and 2.94% for females, whereas in the second generation (i.e., 24-46 years), 12.29% of males and 8.77% of females have married more than once. In the first generation i.e., 47 + years, 19.23% of males and 20% of females have married more than once. So it shows that males have greater tendency to change their mates than their female counterparts.
10. The completed fertility size in the Semsa is found to be 7.52. The average number of surviving offspring per mother, aged 45 + years, is 4.76.
11. The child-woman ratio in the Semsa is found to be 50.23.

12. The overall average number of livebirths per mother is found to be 4.28.

13. It is found that the age-specific fertility rate in the Semsa increases from 0.3939 for the mothers, aged 15-19 years, to 1.3206 for the mothers, aged 30-34 years. Thereafter, it decreases from 1.0374 in the age group 35-39 years to 0.1228 in the age group 45 + years. The total fertility rate (TFR) is 6.0293, which is fairly high.

14. The overall child mortality rate(i.e., those who died before 15 years of age) is found to be 31.60% : 7.55% of the offspring died before completing one year, 13.09% of them died between 1 and 4 years, 8.96% of them died between 5 and 9 years and 2% of them died between 10 and 14 years. Probably this is the reason for the shrinking of the population base.

15. Among the Semsa, it is found that 3.52% of all marriages are consanguineous. Of these marriages, there is one case of marriage between half first cousins, three cases between first cousins, two cases between second cousins, two cases between second cousin once removed and one case between fourth cousins. The average coefficient of inbreeding (F) in this population is found to be 0.0296166.

16. Among the Semsa, the breeding size, effective population size, coefficient of breeding isolation and variance due to drift have been calculated on the basis of all these demographic information.

16(a). It is found that out of total population of 838 individuals, only 316 males (i.e., 37.71%) of them actually constitute the breeding size.

16(b). The effective population size is 205. It means that 24.46% of the total population, or 64.87% of the breeding size, constitute the effective population size.

16(c). It is found that among the Semsa there is no case of admixture with any other population. Consequently, the admixture rate has become zero.

16(d). According to Wright (1938, 1940, 1943) the differentiation due to drift depends upon the product of effective population size and the migration rate (Nem, where Ne = effective population size and m = migration). Among the Semsa, it is found that the coefficient of breeding isolation is zero. It indicates that changes due to genetic drift is very great.

16(e). According to the formula given by Wright (1940), the variance due to random genetic drift per generation is found to be 0.0006098 with an initial gene frequency of 0.05.

17. Selection is one of the most powerful evolutionary forces, which brings about changes in the genetic make up of the population. The total selection intensity in the Semsa has been estimated by using the formula of Crow (1958) as well as the modified formula of Johnston and Kensinger (1971).

18(a). According to Crow's formula the total selection intensity (I) is 0.6165 and its fertility component (I_f) and mortality component (I_m) are 0.0984 and 0.4717 respectively. So it shows that selection is operating more through differential mortality than through differential fertility. However, selection acts with moderate intensity, taking into consideration the range for Indian populations (Reddy and Chopra, 1990).

18(b). According to the Johnston and Kensignger's modified formula, the total selection intensity (I) is 0.6779. Its fertility and mortality components (I_f and I_m) are the same as found earlier. But its embryonic component (I_{me}) is 0.0380. However, it still shows the selection is acting moderately on this population.

Anthropometry

1. Altogether 13 anthropometric measurements have been taken on the adult Semsa males, aged between 21 years and 63 years. The detailed results of all these measurements and the indices have been given in the Chapter IV. On the basis of these anthropometric measurements, it is found that the Semsa males are generally short statured people with dolicocephalic head and mesorrhine nose. They are medium chested with medium to very broad face.
2. On the basis of 8, out of 13 anthropometric measurements, the distances among the populations have been calculated, according to the method suggested by Rao (1952). It is found that the Semsa stand quite apart from the Dimasa and other tribes, though they come little closer to the three Khasi subgroups, namely, Khynriam, War and Pnar.

Genetic markers

In the present study, we have used four genetic markers viz., ABO and Rh blood groups, PTC-taste blindness and colour blindness.

1. It is found that in the Semsa the frequencies of A, B,

AB and O blood groups are 21.70%, 27.36%, 4.72% and 46.23%, respectively. The gene frequencies of p, q and r are 0.1424, 0.1760 and 0.6816 respectively. Both D/σ and χ^2 values indicate that this population is in equilibrium.

2. The frequencies of Rh^+ and Rh^- individuals among the Semsa are 99.06% and 0.94% respectively. The frequencies of D and d genes are 0.9030 and 0.0970 respectively. The χ^2 value indicates that this population is in equilibrium.

3. The frequencies of tasters and non-tasters in this population are found to be 65.38% and 34.62% respectively. The frequencies of T and t genes are 0.412 and 0.588 respectively. The χ^2 value indicates that the population is in equilibrium.

4. It is found that nearly 7.56% of all males are colour blind. Of all the colour blind individuals, 55.56% are protan, 33.33% deutan and 11.11% total colour blind. The frequency of colour blind gene among the Semsa males is 0.0756.

5. It is found that on the basis of ABO blood groups, about 42.47% of all matings are incompatible, which indicates the important role of selection in this population.

6. Since the frequency of Rh^- gene is less than 1%, incompatible matings in respect of Rh system, is insignificant in this population.

7. As per suggestion of Glass (1956) the intergeneration differences, in respect of both ABO blood groups and PTC taste blindness, have been worked out among the Semsa. It is found that there is no significant difference between generations. Under such circumstances, Glass (1956) has suggested that drift in a given population might have occurred more than three generations ago. It may, however, be noted that Roberts (1965) and Basu (1969) have contradicted the Glass's method, suggesting that any significant difference between any two generations cannot be attributed to drift alone. Other evolutionary forces should also be taken into consideration, while interpreting such variations between generations. Following Roberts' method (1965), as done by Basu (1969), it is found that in the Semsa the observed variations, excepting in case of between I and II generations in which difference is more than twice standard deviation, may be due to the operation of genetic drift. So, the action of drift in the Semsa cannot be ruled out.

8. Taking into consideration the three traits i.e., ABO

and Rh blood groups and PTC taste blindness, the Semsa has been compared with 8 other mongoloid populations of Assam and Meghalaya. The dendrogram, drawn according to the method of Sokal and Sneath (1963), shows that the Semsa come nearer to the Lalung and Koch, but stand quite apart from the Khasi, Garo and others.

9. Taking only ABO and Rh blood groups into consideration, the findings among the Semsa have been compared with those for the 9 mongoloid populations of Assam and Meghalaya. The dendrogram shows that the Semsa come closer to the Khamyang, Lalung, Chutia, Koch, Ahom and Mikir, but they stand apart from the Garo and Khasi.

10. It may be noted that with the exception of ABO blood groups no data are available for the Dimasa. In respect of ABO blood groups, it is found that the Semsa differ significantly from the Dimasa.

Dermatoglyphics

1. Combining both hands together, it is found that the frequencies of loop, whorl and arch are 56.05%, 36.15% and 7.80% in males and 52.06%, 40.50% and 7.44% in females respectively.

2. In the Semsa the Furuhata's index, Dankmeijer's index and pattern intensity index are found to be 64.51, 21.58, 12.84 in males and 77.83, 18.35, 13.31 in females, respectively.
3. Combining both hands together, it is found that the frequencies of the mainline formulae 11-9-7, 9-7-5 and 7-5-5 are 18.64%, 13.87%, 17.58% in males and 15.38%, 29.49%, 21.79% in females respectively.
4. The axial triradius 't' is found to occur in the highest frequency on both hands of both sexes. It is followed by t', t" and tt". It is seen that tt" is absent in females.
5. The occurrence of ulnar termination of 'c' line is most common on both hands of both sexes.
6. The mean atd angle on right and left hands of males is 41.11 ± 0.43 and 41.08 ± 0.51 respectively and that in the case of females 44.49 ± 0.86 and 44.26 ± 0.93 respectively.
7. Combining both sexes together, the genetic distance matrix, calculated according to the method proposed by Sanghvi (1953), shows that the Semsa stand closer to the Mikir, Mishing and Rabha, but the Semsa stand apart from the Moran and Deuri and the other popula-

tions come in between. The dendrogram, drawn by the method of Sokal and Sneath (1963), shows that the Ahom, Khamyang, War, Pnar and Khynriam come closer to the Semsa, whereas the Semsa stand separated from all other populations.

Morphological and Behavioural Traits

Arm-folding

1. The frequencies of L>R and R>L among the Semsa are found to be 51.30% and 48.70% respectively.
2. There is no significant difference, in respect of this morphological trait, between generations.

Hand-Clasping

1. It is found that the frequencies of L>R and R>L are 46.10% and 53.90% respectively among the Semsa.
2. It is seen that there is no significant difference, in respect of hand clasping, between generations.

Ear-lobe

1. It is found that among the Semsa the frequency of free ear-lobe is 63.64% and that of attached ear-lobe 36.36%.
2. It is further observed that there is no significant difference, in respect of this morphological trait, between generations.

Tonge-rolling

1. It is found that among the Semsa 58.44% of all individuals can roll their tongues, whereas 41.56% cannot do so.
2. It is observed that there is no significant difference between generations.

Mid-phalangeal hair

1. The frequencies of affected and non-affected individuals with mid-phalangeal hair are 20.13% and 79.87% respectively.
2. It is seen that there is no significant difference between generations in respect of this morphological trait.

On the basis of all these morphological traits, it is found that the Semsa, by and large, differ from all other neighbouring mongoloid populations.

In the present study, we have described the population genetic structure of the Semsa of Semkhor village, taking into consideration the demographic parameters, anthropometric characters, genetic markers, dermatoglyphics, morphological and behavioural traits. It is found that the Semsa do not resemble any of the mongoloid populations of Assam and Meghalaya. Interestingly, the Semsa do not show any resemblance with the Dimasa, though the Semsa is thought to be an offshoot of the Dimasa.

Now questions are (i) how has the genetic structure of the Semsa been shaped? and (ii) why don't the Semsa show any resemblance with the Dimasa, in spite of the fact that the Semsa is an offshoot of the Dimasa?

To answer these two questions, we can reasonably presume that a group of Dimasa people, which initially settled in the Semkhor village, just could not be taken as a random sample of the then larger Dimasa population. Consequently, it can be well presumed that the initial settlers of Semkhor village might not have carried all genes with them in the same proportions that might have been present in the then Dimasa. So there is a possibility that the present day Semsa have been carrying those genes, by and large, in those proportions, which were present among the original splinter group, settled in Semkhor village. But if there is any change in those proportions, which might have occurred over the years, it might be mostly due to the effects of genetic drift and selection and due to non-random mating at village level as well as at consanguineous level. The reason is that for last two hundred years the Semsa have been living in isolation and have not contracted any marriage with any other population, not even with the Dimasa. So the present genetic structure of the Semsa can only be explained in the light of the Founder Principle (Mayr, 1963). Finally, we suggest that the population genetic structure of the present day Semsa must have evolved from the genetic structure of the original splinter group.

In the present study, we have used a very limited number of markers through which we have tried to assess the genetic relationship of the Semsa with the other neighbouring mongoloid populations, particularly with the Dimasa. We have seen that with such limited traits it is extremely difficult to find out the exact phylogenetic relationship of the Semsa with the other populations. To examine any genetic relationship between and among populations, one need to have sufficient infrastructural facilities to collect data on various genetic markers like red cell enzymes, serum protein, haemoglobin, etc., besides data on serological systems. Unfortunately, we don't have such infrastructural facilities at present. When such facilities will be made available, we shall be in a better position to examine further this problem of phylogenetic relationship. In fine, with our limited data on the Semsa we may say that the Semsa is a separate endogamous group, which has formed a genetic isolate since they, till today, are not having any relationship with the Dimasa or any other neighbouring populations. The present genetic structure of the Semsa must have been shaped due to the effect of founder principle along with other evolutionary forces like selection, etc.

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APPENDIX A

PEDIGREE SHOWING INBREEDING

LEGENDS

Square	- male
Circle	- female
Cross	- dead
Solid square/circle	- still born male/female
a.b.	- abortion
Double square/circle	- individuals married more than once.
n.i.	- no issue
"inf" below crossed sex symbol	- died before 15 years of age
Arabic numeral below sex symbol	- age
Arabic numeral above sex symbol	- serial number of the individual in a generation of Pedigree.
Roman number indicates	- generation
Capital alphabet indicates	- case of inbreeding
Mns	- months
λ	- twin

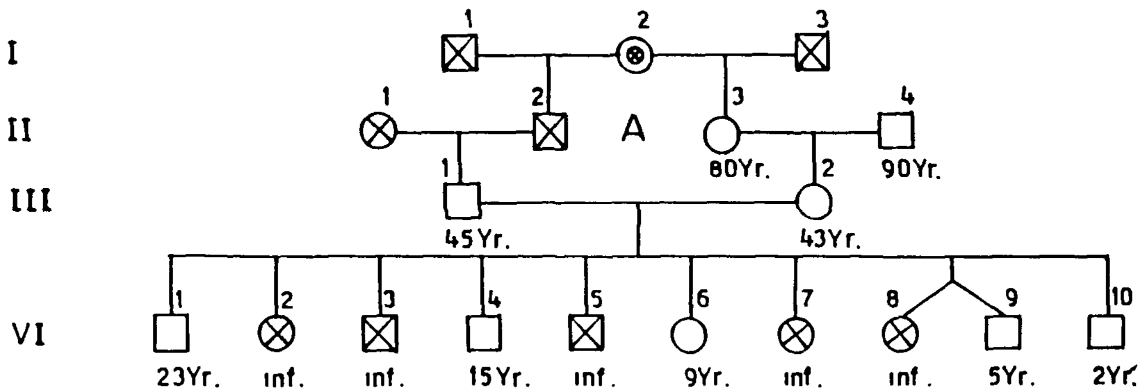

FIG.A. HALF FIRST COUSIN

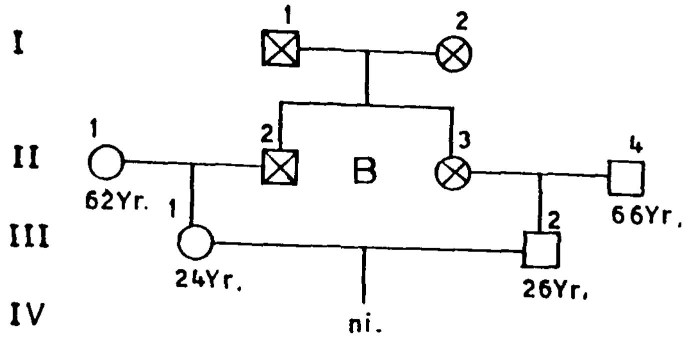

FIG.B. FIRST COUSIN

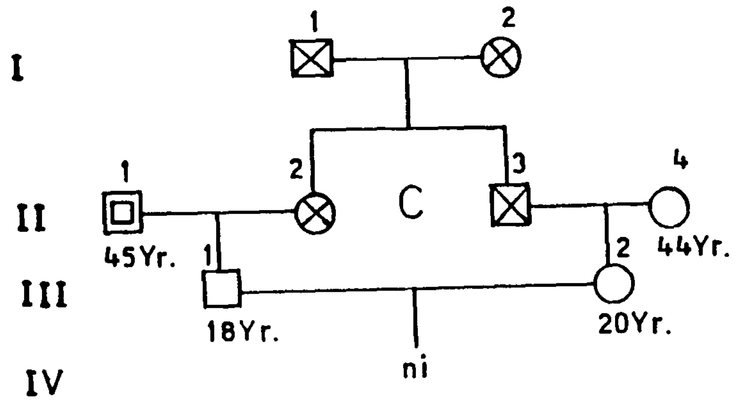

FIG. C. FIRST COUSIN

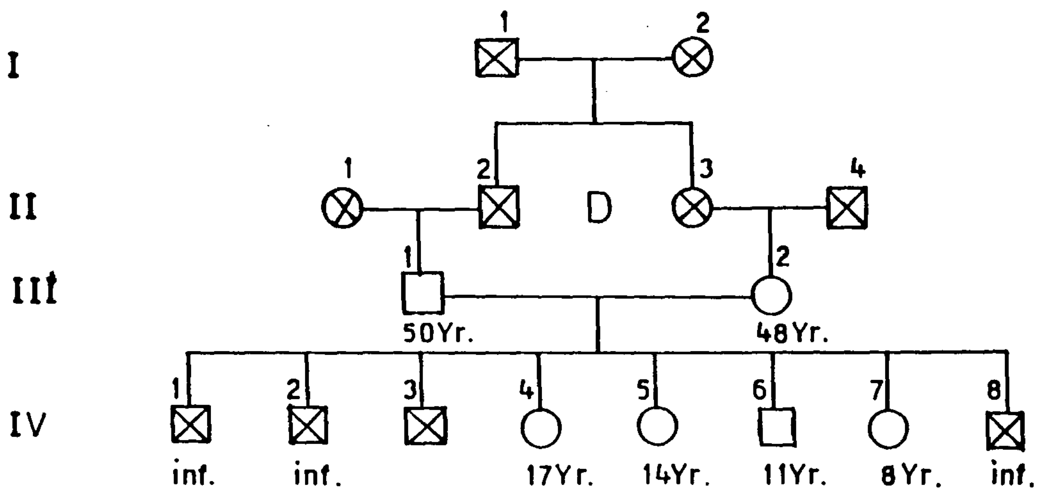

FIG. D. FIRST COUSIN

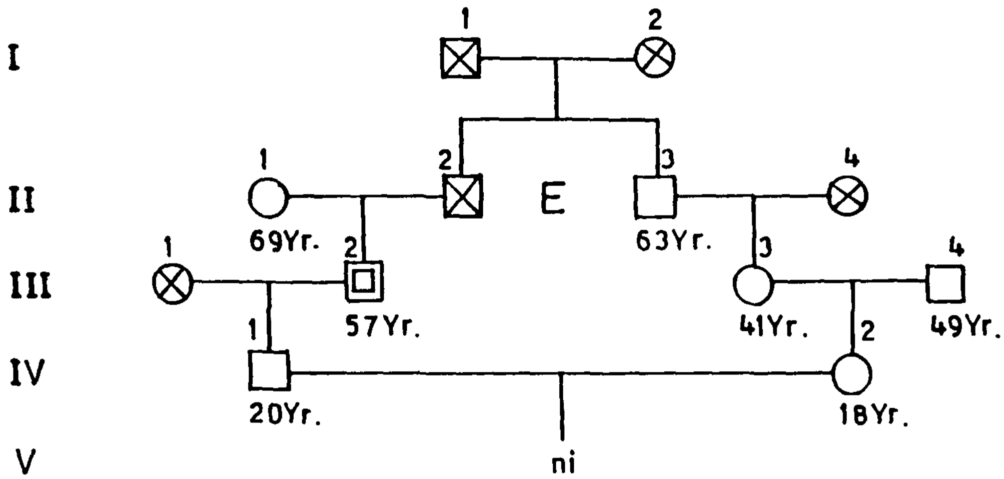

FIG.E.SECOND COUSIN

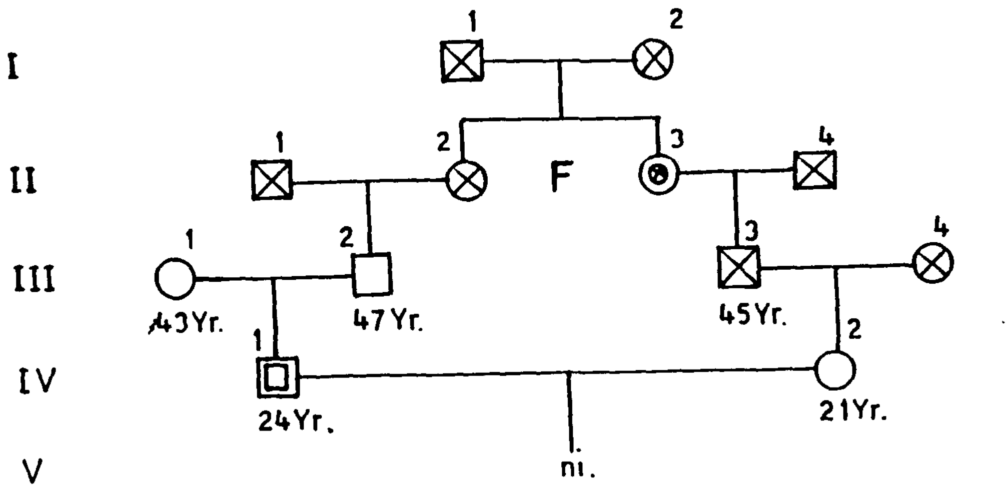

FIG.F.SECOND COUSIN

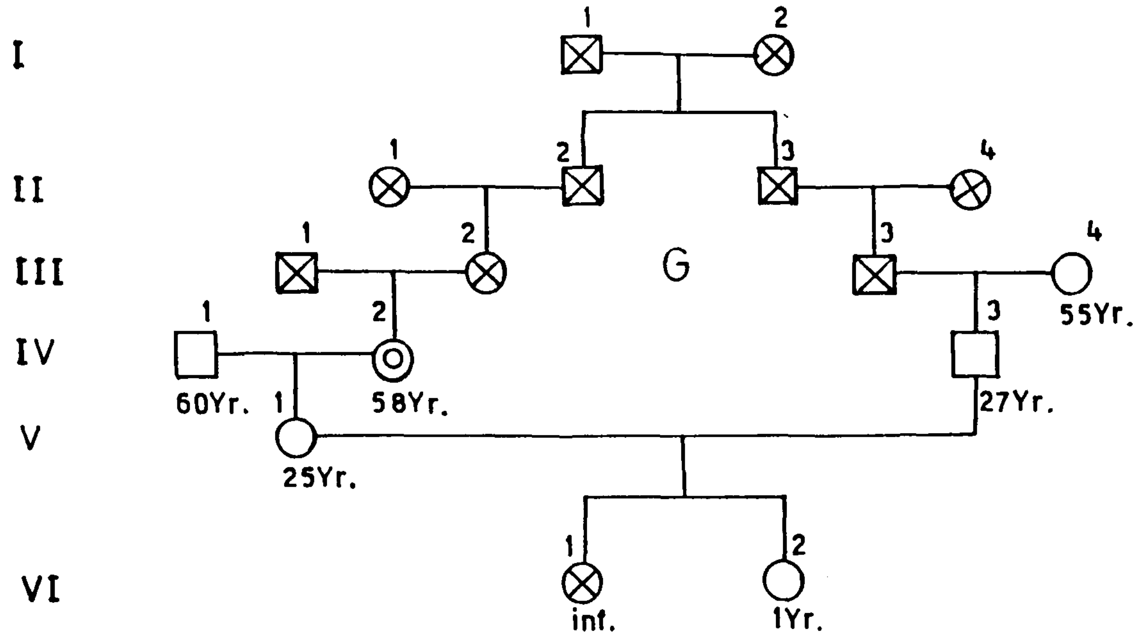

FIG. G. SECOND COUSIN ONCE REMOVED

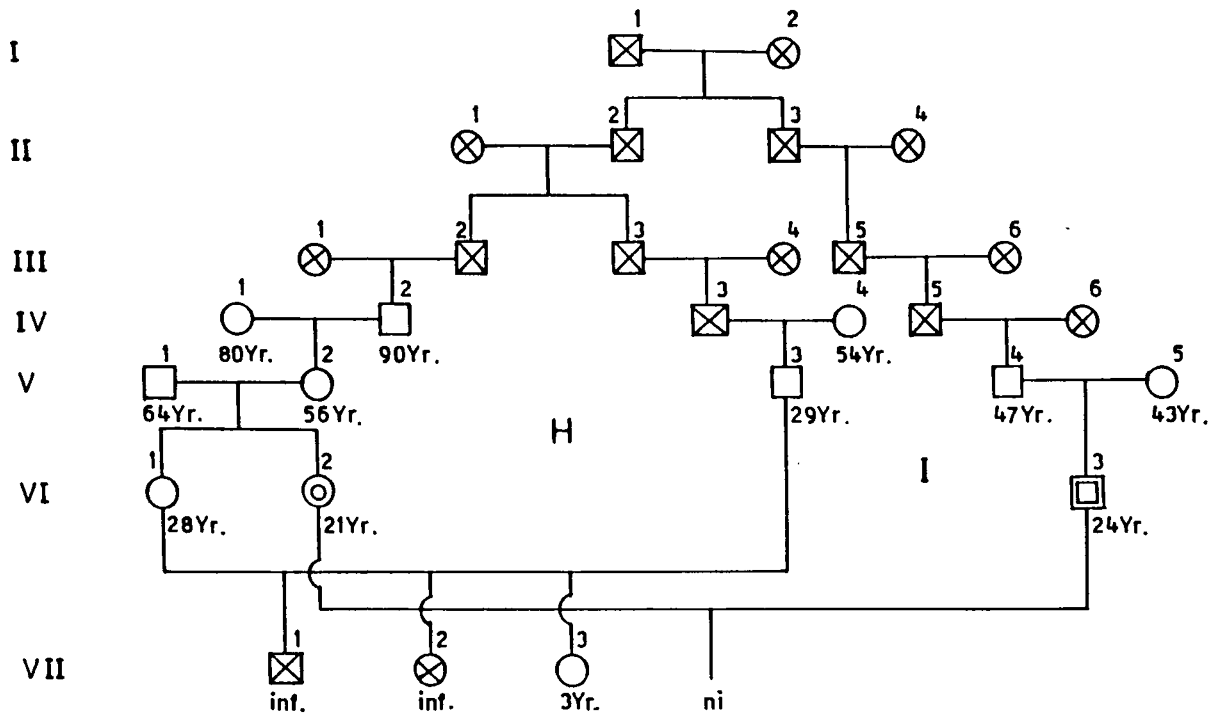

FIG H. SECOND COUSIN ONCE REMOVED

FIG I. FOURTH COUSIN

APPENDIX B

SCHEDULE

INTERVIEW SCHEDULE
For the doctoral dissertation on
"The Semsa - A Population Genetical Study"

Investigator ______________
Department of Anthropology
NEHU, Shillong

I. Identification

Village ____________ P/S ________ District ________ State ____________

Altitude (in mts) ____________ Aspect ____________

2. Demography

Sl. No.	Name	Caste/ Tribe	Rel.to Head	Sex	Age	Marital Status	Age at mar-riage	Age at death	Educa-tion	Occupa-tion	Place of occupa-tion	Place of birth	Salary/ wage/ income
1.													
2.													
3.													
4.													
5.													
6.													
7.													
8.													
9.													
10.													

STRICTLY CONFIDENTIAL	**THE SEMSA - A POPULATION GENETICAL STUDY** SCHEDULE 1.2 (DEMOGRAPHY-FERTILITY) DATE ____________	DEPARTMENT OF ANTHROPOLOGY, NEHU SHILLONG

1.2. IDENTIFICATION AND GENERAL PARTICULARS

1. ID NO[1]   2. NAME   3. EDUCATION

4. DATE OF/AGE AT MARRIAGE   5. OCCUPATION

2. FERTILITY RECORD

1. Have you ever had any children? Yes/No (If No skip to Q.5)
2. If yes, how many of your children are now alive?
3. Have you ever had any other children who were born alive to you but are not living now? Yes/No (If No skip to Q. 5).
4. If Yes, how many?
5. Have you ever had any pregnancies that ended in a miscarriage or still birth? Yes/No.
6. If Yes, how many miscarriages? And how many still births?
7. Now let me be sure that I have everything right. In all you have had children who are living ______ who have died ______ miscarriages ______ still births. Is that right? Yes/No (If Yes, skip to Q. 9)
8. If No, specify:
9. Now let me record all your pregnancies could you describe them in order of occurrence with a few other information?

PREGNANCY RECORD FORM

Sl. No.	Name	Live Births			Deceased Children			Foetal Death			
		Sex	Age	Date of birth	Sex	Age	Date of birth	Age at death	Date of loss	MC	SB
1.											
2.											
3											
4.											
5.											

10. Are you expecting a baby now? Yes/No/Don't know (If No/Don't know skip to Q.12).

11. If Yes? In what month of pregnancy are you?

12. Do you think you can have more children? Yes/No/Don't know (If Yes/don't know, conclude interview).

13. If No, Why not?

3. <u>Anthropometric Measurements</u>

4. <u>Morphological Characters</u>

Sl.	a	b	c	d	e	f	g	h	i	j	k	l	m	a	b	c	d		e					
No.																	R	L		I	II	III	IV	V
1.																			R L					
2.																			R L					
3.																			R L					
4.																			R L					
5.																			R L					
6.																			R L					
7.																			R L					

<u>Index</u>:

a) Height vertex
b) Sitting Height
c) Chest Girth
d) Head Length
e) Head Breadth
f) Bizygomatic Breadth
g) Nasal Height
h) Nasal Breadth
i) Weight
j) Least Frontal Breadth
k) Head Circumference
l) Bigonial Breadth
m) Mid-arm Circumference

<u>Index</u>:

a) Arm folding
b) Hand Clasping
c) Tongue Rolling
d) Ear Lobe
e) Mid Phalangeal hair

5. Colour Blindness

Sl. No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
1.																																						
2.																																						
3.																																						
4.																																						
5.																																						
6.																																						
7.																																						
8.																																						
9.																																						
10.																																						

6. Serology 7. Total Haemoglobin 8. P.T.C. Taste

Sl. No.	Blood + Anti-A	Blood + Anti-B	Blood + Anti-D	gm/dl	Threshold solution No.
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

BIO-DATA

Mr. Dhruba Kumar Limbu was born on 7th May 1963. He did his schooling from Government Higher Secondary School, Tezu, Arunachal Pradesh. This was followed with three years at St. Anthony's College, Shillong. He received his B.Sc. (Hons) in Zoology. He is a product of North-Eastern Hill University, Shillong, where he did his Master's Degree in Anthropology with specialization in Physical Anthropology in 1988, and obtained M. Phil degree from the same University in 1991.

He was a lecturer in Anthropology in Women's College, Shillong, from 1989 to 1995 and was also teaching in the Department of Anthropology, North-Eastern Hill University, Shillong, for a period of three years, i.e., from 1992 to 1995 as a guest lecturer. At present, he is a lecturer in D.H.S.K. College, Dibrugarh, Assam.