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Dermatoglyphic study among sex and other crime convicts

An attempt was made to investigate dermatoglyphic variation between four sex-crimes (SC) and four sex and other crime (SOC) convicts. These were compared with 10 endogamous and 11 penal populations. The results indicate that the two closely related sex crime cases IPC-363 and IPC 366 («kidnap» and «abducting») show wide differences in dermatoglyphic characters. A comparison of sex crimes with sex and other crime cases showed least differences in the case of IPC-363, IPC-363 KC and in IPC 366 and IPC-366 AC but wide differences in IPC-354 («molestation») cases. The dendrograms suggest that the eight sex crime cases cluster together and are different from other endogamous and penal populations. The significant low mean finger ridge count observed in the case of IPC-366 is in agreement with other studies, suggesting a strong association between crime (sex) and dermatoglyphics.

Introduction

Studies among monozygotic and dizygotic twins indicate that the liability to commit (repeated) crimes, seem to be strongly genetically controlled (VOGEL & MOTULSKY, 1986). There is strong evidence that chromosomal abnormalities also often show marked differences in dermatoglyphic characters (PENROSE, 1967). Since tendency to commit crime and dermatoglyphics are both genetically controlled, it seems reasonable to investigate the association between crime and dermatoglyphics. Such an association has been investigated in earlier studies. For example, Bugge and Poll study showed a lower frequency of whorls in Danish and German criminal populations than in non criminals. Abel found defects of ridge formation in some criminals and Ascraelli found a higher frequency of radial loops among prostitutes (CUMMINS & MIDLO, 1976). BISWAS (1945-46) however, observed no marked differences in finger dermatoglyphic patterns of juvenile convicts. But a higher Arch/Whorl index has been reported in two series of jail convicts than in criminal tribe by Sen, (1955), and in jail convicts when compared to other criminals from Lucknow and Moradabad of U.P. (SINGH, 1959). In the case of quantitative dermatoglyphic study, significant decrease in mean finger ridge count (TFRC) when compared to non-criminal populations in Anglo-Saxon (WELCH, 1971) and Spanish populations (QUINTANA-CASTILLA, 1979) has been reported.

In this paper data on four different types of sex crime convicts were studied to investigate whether sex specific crimes show significant difference in finger dermatoglyphic pattern types and in mean finger ridge-count.

Data and methods

The data on finger print patterns related to sex and other crimes were drawn from files maintained by the Central Finger Print Bureau, Calcutta. It consisted of 347 male finger prints, obtained from people, convicted for sex-crimes and sex-and-other-crimes during the years 1956 to 1970. About 80 per cent of the individuals belong to the age group 17 to 35 years, and the mean age (years) is 28.4 ± 0.46, S.D.: 8.56.

They come from 18 different states of India and belong to different endogamous groups of Hindu and Muslim relegions.

The prints were collected by usual ink and roll method by the Finger Print Bureau Officials during 1956 to 1970.

Out of 347 cases, (1) 218 individuals were convicted once for either of the four different types of sex crimes identified under Indian Penal Code (IPC) sections: 363, 366, 376 and 354; (2) 34 cases, convicted twice/thrice for the four sex crime types, (3) 13 cases were offenders for two of the above four sex-crimes as well as for other crimes; (4) 81 individuals were convicted once for either of the four sex crimes as well as for several other crimes. For the present purpose the first and the last categories were considered. The other crimes (OC) include, for example, IPC 373, 375, 347, 368, 294, 451, 381, 379, 342, 109, 148 etc. The details of two categories are given in Table 1.

The finger print patterns were classified into four types: Whorl (W), Ulnar Loop (UL), Radial Loop (RL), and Arch (A) (Tented and Plain). The maximum ridge count on each finger and total finger ridge count on each hand and for individual were counted according to CUMMINS & MIDLO (1976), and HOLT (1968).

The analyses of the data were done in three parts: (i) 218 cases of four types of sex crime convicts were analysed for significant variation in pattern type and ridge-count (TFRC); (2) 299 cases (218 of category A and 81 of category B) of four types of sex were compared with other crimes. (3) The above two series of data were compared with other available data on penal populations as well as with other noncriminal populations.

The comparison of the above four types of sex crime cases with the noncriminal populations was especially difficult. The following method was followed. A scrutiny of the data indicated that, on the average, more than 80 per cent of the sex crime convicts come from four out of 18 states: Uttar Pradesh (UP), Madhya Pradesh (MP), Maharashtra and Gujrat (76 percent of IPC-363, 89.3 per cent of cases of IPC-366, 84.5 per cent cases of IPC-376 and 85 per cent of IPC-354). In each state individuals represent several endogamous groups, including Brahmins, and other castes and Muslims. Therefore, the published dermatoglyphic studies (SINGH & BHASIN, 1979) on three different endogamous groups from each of the above three states and on one endogamous group from the Gujarat were considered as noncriminal population records.

The two series of data were analysed for inter group variation in (a) pattern frequency, (b) pattern combination and (c) ridge count variation. These were tested by χ^2-test, Student's t-test and Analysis of variance test for possible significance, in case of between sex crime cases and between other populations.

Modified mean square distance (MSD) was used (WHITE, 1979) to compare within variation of the two categories of sex-crime data by using seven qualitative and one quantitative dermatoglyphic characters, viz. ulnar loops, radial loops, whorls, arches, pattern combination of two and three types, pattern intensity index and mean finger ridge count. MSD was also calculated for comparing the present data with endogamous and penal populations by using four characters: whorls, loops, arches and pattern intensity index. Further dendrograms were drawn following minimum distance clustering method.

Results

1. Sex-crime convicts

Pattern types

A. Pattern Frequency The per cent frequency of four types of finger patterns of the four cases of sex-crime convicts were given in *Table 2*. A high frequency of whorls in IPC-363 (40.4 per cent) and a high frequency of ulnar loops in the case of IPC-366 (60.8 per cent) were observed. IPC-366 convicts show a high frequency of Arches (3.5 per cent), which is twice the frequency of IPC-376 and is about four times in the case of IPC-363 (6.72 per cent).

The overall pattern frequency between the four IPC sex-crime cases, when tested by x^2-test ($x^2 = 24.6$, df = 9, $p < 0.01$), while IPC-376 cases did not show any significant differences in pattern frequency. Furthermore, a comparison of IPC-363 with the combined sample of IPC-376 and IPC-354 was found to be more significant ($x^2 = 20.61$, d.f. 4, $p < 0.01$) than IPC-366 with the combined sample of IPC-376 and IPC-354 ($x^2 = 12.32$, d.f. 4, $p < 0.05$). This suggests a marked pattern frequency variation in the case of IPC-363.

When inside variation of pattern frequency was considered, IPC-363 and IPC-366 showed significant differences and IPC-376 and IPC-354 were found to be not significant. But the IPC-366 showed wider inside pattern variation ($x^2 = 12.67$, d.f. 3, $p < 0.01$) than IPC-363 convicts ($x^2 = 8.73$, d.f. 3, $p < 0.05$).

The frequencies of whorls, ulnar and radial loops, when tested by x^2-contingency table, did not show significant differences in the 4 sex-crime cases, but the frequency of arches did ($\chi^2 = 15.38$, d.f. 3, $p < 0.01$).

The data were also analysed for digit wise pattern variation and for bilateral variation between the sex crime convicts. But the results were not statistically significant.

B. Pattern Combination An attempt was made to see whether the four sex-crime cases could be discriminated in the frequency of pattern combination types. The results show that the frequencies of 6 types of whorl -loop (W-L) combination on left and right side and 11 types of combinations of whorl-loop pattern on both left and right side (*Table 3*) did not show overall significant (statistical) differences between sex crime convicts. Bur a high frequency of 1W-9L and 6W-4L, in cases of IPC-366, IPC-376 and 6W-4L and 7W-3L combination in IPC-354 can be noticed. IPC-363 shows the highest frequency in 2W-8L, 3W-7L; IPC-366, in 6W-4L; IPC-376 in 1W-9L and IPC-354 in 6W-4L combinations of pattern types. The other dimorphic pattern combination types (e.g., UL - A, UL-RL) are absent. The results were also not significant in the occurrence of number of combination of three pattern types (Whorl loop-Arch) and also between the total frequency of two, three and four pattern combination types (*Table 4*).

Indices

The three indices: Arch/Whorl (A/w), Whorl/loop (W/l) and pattern intensity index (PII) among the four sex-crime cases are shown in *Table 5*. The A/w index show marked differences: the highest in the case of IPC-366 (10.4), the lowest in IPC-363 (1.65). As it can be expected, W/l index showed the opposite trend; it is the lowest in the case of IPC-366 (52.6) and the highest in the case of IPC-363 (68.7). In the case of IPC - 376 and IPC-354, the indices do not show wide differences. Such wide differences are also observed in three pattern combination indices of M.I.,

TABLE 1 - *Details of the finger print data of the two categories of sex crime convicts.*

Category		A : SC		B : SOC		
IPC SECTION	CODE	Description	No.	IPC SECTION	CODE	No.
363	K	Kidnap	90	363 + OC	KC	22
366	A	Abducting	52	366 + 0C	AC	23
376	R	Rape	53	376 + OC	RC	5
354	M	Molestation	23	354 + OC	MC	31
			218			81

Category A: Sex crime convicts, category B: sex and other crime convicts, * OC: include crimes (OC) other than sex-crime. (Convicted for as many as 11 crimes).

TABLE 2 - *Per cent frequency of finger pattern types among sex crime convicts.*

			LOOPS		
IPC SECTION	No.	WHORL	ULNAR	RADIAL	ARCH
363 K	90	40.4	55.6	3.3	0.7
366 A	52	33.3	60.8	2.5	3.5
376 R	53	36.9	58.3	3.0	1.7
354 M	23	38.3	54.3	4.8	2.6

TABLE 3 - *Per cent frequency of pattern combination of whorls, loops among the sex crime convicts.*

COMBINATION OF	IPC SECTION			
WHORL-LOOP	363 K	366 A	376 R	354 M
n	84	44	49	19
OW-10L	10.0	15.4	9.4	4.3
IW-9L	10.0	13.5	13.2	8.7
2W-8L	13.3	7.7	9.4	8.7
3W-7L	13.3	7.7	13.2	4.3
4W-6L	5.6	5.8	5.7	4.3
5W-5L	6.7	3.8	7.5	8.7
6W-4L	10.0	17.3	11.3	21.7
7W-3L	11.1	1.9	7.5	17.4
8W-2L	7.8	3.8	7.5	4.3
9W-1L	2.2	7.7	3.8	0.0
10W-0L	3.3	0.0	0.0	0.0

TABLE 4 - *Per cent occurrence of types of finger pattern combinations among sex crime (Sc) convicts.*

Pattern Type Combination	IPC Section 363 K 90	366 A 52	376 R 53	354 M 23
Single type or Monomorphic	13.3	15.4	9.4	4.4
Double type or Dimorphic	53.4	48.1	58.5	56.5
Triple type or Trimorphic	30.0	34.6	28.3	26.1
Quadraple or Tetramorphic	3.3	1.9	3.8	13.0

TABLE 5 - *Mean pattern intensity index (PII), Arch-whorl, whorl-loop indices among the sex-crime convicts*

IPC SECTION	n	MEAN	PII SD	MEDIAN	A/W INDEX	W/L INDEX
363 K	90	13.93	2.8	13.85	1.65	68.7
366 A	52	13.15	3.1	13.00	10.40	52.6
376 R	53	13.51	2.7	13.56	4.59	60.3
354 M	23	14.00	2.5	15.75	6.82	64.7

TABLE 6 - *Mean, SD of total finger ridge count among sex-crime convicts.*

SECTION	RIGHT n	MEAN	SD	LEFT n	MEAN	SD	RIGHT + LEFT n	MEAN	SD
363 K	90	74.05	17.9	89	70.5	18.2	89	141.6	34.9
366 A	51	65.48	17.0	50	62.7	16.9	49	126.3	30.5
376 R	52	68.54	18.5	53	67.7	17.4	52	137.0	34.9
354 M	23	71.89	17.8	23	71.0	17.2	23	141.9	34.7

TABLE 7 - *Per cent frequency of finger pattern types among sex-crime and other crime cases*

IPC SECTION	WHORL	LOOP ULNAR	RADIAL	ARCHE
363 KC	39.1	56.9	3.3	0.6
366 AC	34.1	60.3	2.8	2.8
376 RC	41.0	54.3	3.1	1.6
354 MC	45.6	49.3	3.3	1.9

TABLE 8 - *Per cent frequency of pattern combination (Whorl, loop) among the sex and other crime convicts*

W-L	IPC Section 363 KC n = 104	366 AC n = 64	376 RC n = 62	354 MC n = 44
OW-10L	11.5	17.2	9.6	8.5
1W-9L	10.6	21.9	13.5	8.5
2W-8L	14.4	7.8	9.6	8.5
3W-7L	12.5	7.8	13.5	6.4
4W-6L	5.8	6.3	5.8	4.3
5W-5L	5.8	6.3	7.7	8.5
6W-4L	9.6	14.1	11.5	21.3
7W-3L	12.5	1.5	11.5	19.1
8W-2L	7.7	7.8	9.6	8.5
9W-1L	3.8	7.8	3.8	2.1
10W-0L	2.9	1.5	3.8	4.3

TABLE 9 - *Per cent occurrence of types of finger pattern combinations among sex and other crime (Soc) convicts*

Pattern type combination	IPC Section 363 KC 112	366 AC 75	376 RC 58	354 MC 54
Single type or Monomorphic	13.4	16.0	12.1	11.1
Double type or Dimorphic	52.7	45.4	55.2	55.6
Triple type or Trimorphic	31.3	37.3	29.3	25.9
Quadraple or Tetramorphic	2.6	1.3	3.4	7.4

TABLE 10 - *Arch-whorl, whorl-loop and pattern intensity indices (PII) among four sex and other crime convicts*

IPC SECTION	INDEX A/W	W/L	PATTERN INTENSITY INDEX n	MEAN	S.D.
363 KC	1.59	64.9	112	13.8	2.85
366 AC	8.20	54.1	75	13.2	3.15
376 RC	3.78	71.5	57	14.0	2.96
354 MC	4.06	86.6	53	14.6	2.86

TABLE 11 - *Mean, SD of total finger ridge count (TFRC) among sex and other crime convicts (Soc).*

IPC Section	RIGHT			LEFT			RIGHT + LEFT		
	n	Mean	SD	n	Mean	SD	n	Mean	SD
363 KC	112	73.7	17.1	111	70.3	17.5	111	141.8	33.3
366 AC	74	65.0	16.3	73	62.9	16.6	72	126.6	29.4
376 RC	57	69.9	18.4	58	68.9	17.4	57	140.3	32.9
354 MC	52	73.5	17.6	52	72.4	16.5	52	145.5	32.2

TABLE 12 - *Mean square distance (MSD) between eight sex and other crime convicts*

IPC SECTION	SEX CRIME CONVICTS				SEX AND OTHER CRIME CONVICTS			
	K	A	R	M	KC	AC	RC	MC
363K	-	3.857	0.426	2.899	0.036	3.002	0.359	1.599
366A	0.791	-	2.037	2.675	3.535	0.091	2.555	4.558
376R	0.113	0.326	-	2.736	0.315	1.487	0.516	2.430
354M	0.377	0.584	0.409	-	2.828	2.236	1.601	1.570
363 KC					-	2.724	0.581	1.867
366 AC					0.639	-	1.943	3.915
376 RC					0.104	0.355	-	0.687
354 MC					0.388	0.658	0.132	-

Right triangular matrix: MSD between eight sex and sex and other crime convicts
Left upper triangular matrix: MSD between sex crime convicts
Left lower triangular matrix: MSD between sex and other crime convicts

TABLE 13 - *Per cent frequency of finger dermatoglyphics patterns and indices in endogamous groups and in sex crime convicts.*

STATE	POPULATION	FINGER PATTERN				INDEX			REFERENCES*
		n	W	L	A	A/W	W/L	PII	
UP	Brahmins	100	41.3	55.0	3.5	8.5	75.1	13.8	Oswal, 1957
	Misc	181	46.6	51.1	2.4	5.2	91.2	14.4	Singh, 1961
	Chamar	100	37.4	58.4	4.2	11.2	62.3	13.3	Srivastava, 1969
MP	Binjhwar	90	53.3	43.2	3.5	6.4	123.4	15.0	Sen, 1976
	Rajgond	50	40.8	53.4	4.0	10.0	76.4	3.3	-do-
	Muslim	53	38.5	59.0	2.5	6.5	65.3	13.6	Wadhwa 1972
Maharashtra	Mahar	115	23.8	63.3	3.8	16.0	38.2	13.0	Mukherjee, 1962
	Korou	100	51.2	45.2	1.8	3.4	109.0	15.0	Basu 1969
	Patil	72	39.8	53.8	6.8	17.0	74.5	13.3	Malhotra et. al, 1974
Gujarat	Vaishas	45	42.7	55.8	1.6	3.7	76.5	14.3	Ahluwalia, 1969
IPC363K		90	40.4	58.9	0.7	1.6	68.7	13.9	Present Study
IPC 366A		52	33.3	63.3	3.5	10.4	52.6	13.2	-do-
IPC 376R		53	36.9	61.3	1.7	4.6	60.3	13.5	-do-
IPC 354M		23	38.3	59.1	2.6	6.8	64.7	14.0	-do-
POOLED		218	37.7	60.6	1.7	4.7	62.2	13.6	-do-
IPC 363KC		111	39.1	60.2	0.6	1.6	64.9	13.9	-do-
IPC 366AC		75	34.1	63.1	2.8	8.2	54.1	13.2	-do-
IPC 376AC		58	41.0	57.4	1.6	3.8	71.5	14.0	-do-
IPC 354MC		54	45.6	52.6	1.9	4.1	86.6	14.6	-do-
POOLED		298	39.4	59.0	1.6	3.9	66.8	13.8	-do-

*from Singh and Bhasin, 1979

TABLE 14 - *Mean total finger count of Indian endogamous populations, sex criminal populations and world pen populations*

POPULATION		n	MEAN	SD	CV	REFERENCE
ENDOGAMOUS POPULATIONS						
INDIAN DATA						
Maharashtra	Maratha	78	153.6	32.4	21.1	Chakraborty and Malhotra, 198
	Kurmar	60	130.3	42.3	32.5	Malhotra et al., 1974
	Brahmin	65	157.9	41.4	26.2	Malhotra et al., 1978
UP	Brahmin	203	145.3	39.2	27.0	Singh, 1961
	Muslim	100	149.7	31.5	19.6	-do-
	Chamar	172	144.1	46.6	32.3	
MP	Brahmin	410	144.9			
	Rajamuria	106	163.3	35.4	21.6	Pachori, 1986
SEX CRIMINAL POPULATION						
Calcutta IPC 363K		89	141.57	34.8	24.6	
IPC 366A		49	126.34	30.5	24.1	present study
IPC 376R		52	137.00	34.9	25.5	
IPC 354M		23	141.89	34.7	24.5	
POOLED		213	136.98	34.1	24.9	
SEX AND OTHER CRIMES						
IPC 363KC		111	141.79	33.3	23.5	
IPC 366AC		72	126.58	29.4	23.2	
IPC 376RC		57	140.28	32.9	23.4	-do-
IPC 354MC		52	145.46	32.2	22.1	
POOLED		292	138.40	32.6	23.6	
CRIMINAL POPULATION						
Spain	Prisoners	138	131.91	51.4	38.9	Quintana Castilla, 1979
	Male Control	50	150.10	54.7	36.4	-do-
	Female Control	100	127.11	50.1	39.4	-do-

D.I. and T.I. among SOC (VASULU *et al.*, 1991).

The mean and variance of pattern intensity index do not show wide difference between th sex crime, though IPC-366 shows the lowest mean (13.15), median (13.00) and the highe variance (9.61). Both the mean differences and the variance, when tested by ANOVA and Bartlet test respectively, were found to be not significant.

The frequency distributions of PII in all the four cases are not normal. A trend of bimodalit is seen in the case of IPC-363 and IPC-366 convicts. The x^2-test of significance for the occurrenc of different values of PII in the range 10-18 between the four cases was found to be not differen

TABLE 15 - *Per cent frequency of finger dermatoglyphic patterns and indices in Indian and other countries' penal populations*

No.	PENAL POPULATION	n	FINGER DERMATOGLYPHICS PATTERN W	L	A	INDEX A/W	W/L	PII	REFERENCE
1.	Calcutta	500	34.8	60.2	5.0	14.4	57.8	12.9	Biswas 1945-46
2.	Lucknow	205	51.3	45.9	4.5	9.1	111.8	14.8	Sen 1955
3.	Criminal tribe (M)	77	50.1	45.1	4.5	9.0	111.2	14.5	-do-
4.	Criminal tribe (F)	61	48.0	48.7	3.1	6.4	88.4	14.5	-do-
5.	UP Jail	808	43.7	52.9	3.3	7.6	82.7	14.0	Singh, 1959
6.	Calcutta	100	31.6	67.0	1.3	4.7	41.2	13.6	Dikshutulu et al, 1984
7.	Present Study	218	37.7	60.6	1.7	4.7	62.2	13.6	P.S.
8.	-do-	298	39.4	59.0	1.6	3.9	66.8	13.8	P.S.
9.	Chinese		51.5	46.4	2.0	3.9	110.9	14.9	Biswas 1945-46
10.	-do-		50.6	47.7	1.4	2.8	106.1	14.2	-do-
11.	Korean		45.2	51.8	2.6	5.8	87.3	14.3	-do-
12.	Eitoto		45.7	52.0	1.9	4.2	87.9	14.3	-do-
13.	Ichigage		45.2	52.7	1.8	3.9	85.8	14.3	-do-
14.	Jap. Lugaro		45.2	51.8	2.6	5.8	87.3	14.2	-do-
15.	Norway		25.6	66.9	7.4	28.9	38.3	11.8	-do-
16.	Hatian		36.4	58.4	4.7	12.9	62.3	13.1	-do-
17.	German		33.7	60.9	5.3	15.7	55.3	12.8	-do-
18.	Spain		28.0	67.0	4.0	14.3	41.8	12.3	Q. Castilla, 1979

P.S. Present study

Ridge-Count

The mean finger ridge count (FRC) in right and left hands of the four sex crime cases are shown in *Table 6*. The wide mean differences are seen in both hands. A two way analysis of variance showed no significant bilateral difference, but significant mean ridge count differences between the four cases ($F = 14.26$, d.f. (3.3), $p < 0.05$). Furthermore, when mean ridge-count differences in left, right, right and left combined were separately analysed, the ANOVA results showed significant mean ridge count differences ($F = 2.78$; d.f. 3, 212; $p < 0.05$) in the case of the right hand side of the above four cases only. Further analysis showed that on the right hand IPC-363 significantly differs from with IPC-366 ($t = 2.82$, d.f. 139, $p < 0.01$) and from IPC-376 ($t = 1.78$, d.f. 140, $p < 0.05$).

The frequency distribution of TFRC are of normal type, except a slight skewed distribution in the case of IPC-366.

The relation between the four sex-crime cases together in eight dermatoglyphic charachters was calculated by mean square distance (*Table 12*) and represented by dendrogram (*Figure 1*). The figure indicates that IPC-363, IPC-376 and IPC-376, IPC-354 are closely related.

2. Sex and Other crime convicts

Pattern types

A. Pattern Frequency The pattern frequencies of finger prints of the four types of sex crime and sex-crime with other crime convicted cases are shown in *Table 7*: IPC-366 AC convicts show the least frequency of whorls (34 per cent), the highest frequency of ulnar loops (60.3 per cent) and arches (2.81 per cent), when compared with other three IPC cases. The frequency of radial loops are nearly the same in IPC-363KC, IPC-376RC and IPC-354MC.

The overall pattern frequency in the four IPC cases is statistically significant ($x^2 = 34.47$, df. 9, $p < 0.01$). A pair wise x^2 - contingency test for the pattern frequency differences between any two of the 6 possible combinations, indicate that only one pair combination (IPC-363KC with IPC-376RC) is not significant, while other pair combinations show wide differences in pattern frequencies. Nearly all the four IPC cases show wide differences in their finger dermatoglyphic patterns.

When inside within variation pattern frequency is compared, IPC-366AC category show significant differences in the case of left hand ($x^2 = 15.36$, df. 3, $p < 0.01$). Similarly, IPC-354MC also show significant differences in left and right combined data ($x^2 = 9.74$, df. 3, $p < 0.05$).

Patternwise frequency variation between the four IPC cases were considered for analysis. χ^2-test of homogeneity analysis indicate that frequency of Whorls ($x^2 = 10.89$, df. 3, $p < 0.05$) and frequency of Arches ($x^2 = 13.82$, df. 3, $p < 0.01$) were found to show marked differences. Radial loops and Ulnar loops are not significantly different. When data are considered for left hand and right hand separately, the whorls are found to differ significantly in the left hand ($x^2 = 10.91$, df. 3, $p < 0.01$) and the frequency of arches differs significantly on the right hand of the above four cases.

B. Pattern combination The data on the occurrence of pattern combination in the four IPC cases were also considered for analysis. A high frequency of 1W-9L and 6W-4L combinations in the case of 366AC and 6W-4L and 7W-3L combination in the case of 354MC is observed. The x^2-test suggests that the frequencies of 6 combinations of Whorl-Loop pattern in the left hand and in right hand, and 11 types of combination of Whorl-loop pattern did not show any significant difference between the sex and other crime convicts (*Table 8*). The six possible associations of the

four IPC cases in the frequencies of eleven pattern combinations, when tested by Spearman's rank correlation, were all significant ($t = 2.4$ to 7.4; $p < 0.05$ (2), $p < 0.01$ (4)). The results were not significant in the total occurrence of combination of two and three pattern types in the four IPC cases (*Table 9*). A striking feature is the complete absence of UL-A and UL-RL pattern combinations.

Indices

The three indices: Arch/Whorl (A/w), Whorl by loop (W/L), and pattern intensity index (PII) are reported in *Table 10*. Both A/w and W/L indices show wide variation in the four sex crime cases, but W/L index show significant difference ($x^2 = 9.18$, df. 3, $p < 0.05$), it is markedly different in IPC-366AC and in IPC-354MC, highest A/w index (8.20) and highest W/L index (86.6) respectively.

The mean and variance of pattern intensity index is the lowest in IPC-366AC and IPC-363KC respectively. ANOVA test for homogeneity of mean PII indicates significant mean differences ($F = 2.62$; df. 3,293; $p < 0.05$) between the four IPC cases. Further analysis suggest that both IPC-366AC and IPC 354MC show significant mean PII difference ($t = 2.72$, df. 126, $p < 0.01$) when compared to other five combinations. The variance of PII between the four IPC cases is not significant.

The frequency distributions of PII in the four IPC cases show non normal distribution. A tendency of bimodal distribution can be seen in the case of IPC-363KC, IPC-366AC and IPC-354MC cases. The distribution of PII values between the range 10 to 18, when tested by x^2-test, was found to be not significant.

Ridge-Count

The mean finger ridge count in right, left and combined data of left and right (*Table 11*) show significant mean differences between the four IPC cases. Further analysis of pairwise mean FRC in the four IPC cases were considered, the t-values show that IPC-366AC widely differs in mean FRC when compared with IPC-354MC. In the case of left hand and right hand, IPC-366AC shows wide mean ridge count differences with IPC-363KC and with IPC-354MC.

The frequency distributions of TRC show more or less normal distribution. The relation between four sex-and-other-crime cases in overall dermatoglyphic characters was calculated by mean square distance (*Table 12*) and represented by dendrogram (*Figure 1*). The figure and the table indicate that IPC-366AC is different from the other three IPC cases.

3. Comparison with non-criminal and other criminal populations

Non-criminal populations

The two series of sex crime and sex-with-other-crime data were compared with the dermatogliphics data available for three different endogamous (non-criminal) groups each from the three states of India and one endogamous group from Gujarat (*Table 13*). The results show no particular difference in finger pattern frequency nor in two index values except a very low frequency of arches (1.6) in IPC-363 convicts. The PII values are nearly equal in criminal and non-criminal populations.

The mean finger ridge count in criminal and other endogamous groups does not show wide difference, except in the case of IPC-366 convicts (*Table 14*).

Criminal populations

The combined sex-crime and other crimes data were compared with the available data on other criminal populations in India and in other countries (*Table 15*). In the pattern frequency, the present data show nearly equal values with Calcutta Juvenile data and with two other countries (Haiti and Germany) in whorl and loop frequency. The frequency of Arches show the lowest values and is nearly equal to Chinese, Eitoto and Inchigage data. No wide difference in PII can be noticed between Indian and other countries.

For the finger ridge count, the two series of crime data were compared with the crime data from Spanish population (*Table 14*). The IPC-366 case show lower ridge count and other three IPC cases show higher values. But the pooled sample of sex-crime and sex-and-other-crime data show equal range of mean ridge count with the Spanish penal population.

Based on the four dermatoglyphic patterns, mean square distances were calculated between 8 sex crime cases and 10 endogamous population from four states (India) in order to see whether sex-crime cases can be discriminated from non-criminal populations. The dendrogram based on the distance matrix suggests that, except for three populations (6-Muslims of UP, 10-Vaishyas of Gujarat and 2-Miscellaneous data from UP), the seven endogamous populations show wide deviations (*Figure 2*). The sex-crime cases cluster together and IPC-363 and 363KC, IPC-366 and 366AC show the least differences.

When the eight sex crime cases were compared along with eleven penal populations by mean square distance, the dendrogram shows close clustering of all the sex crime cases except

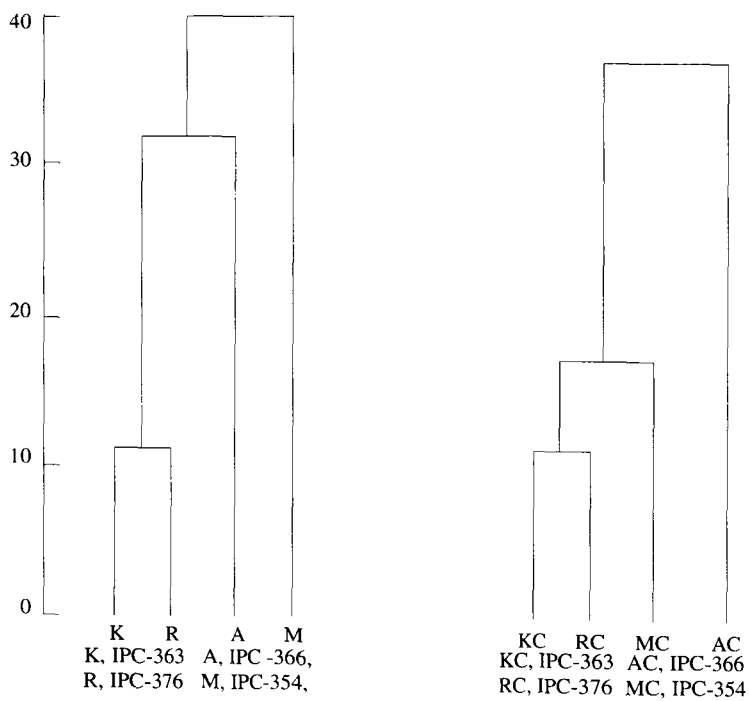

Figure 1 - Dendrograms showing the relationship between sex-crime cases and sex- and other crime cases

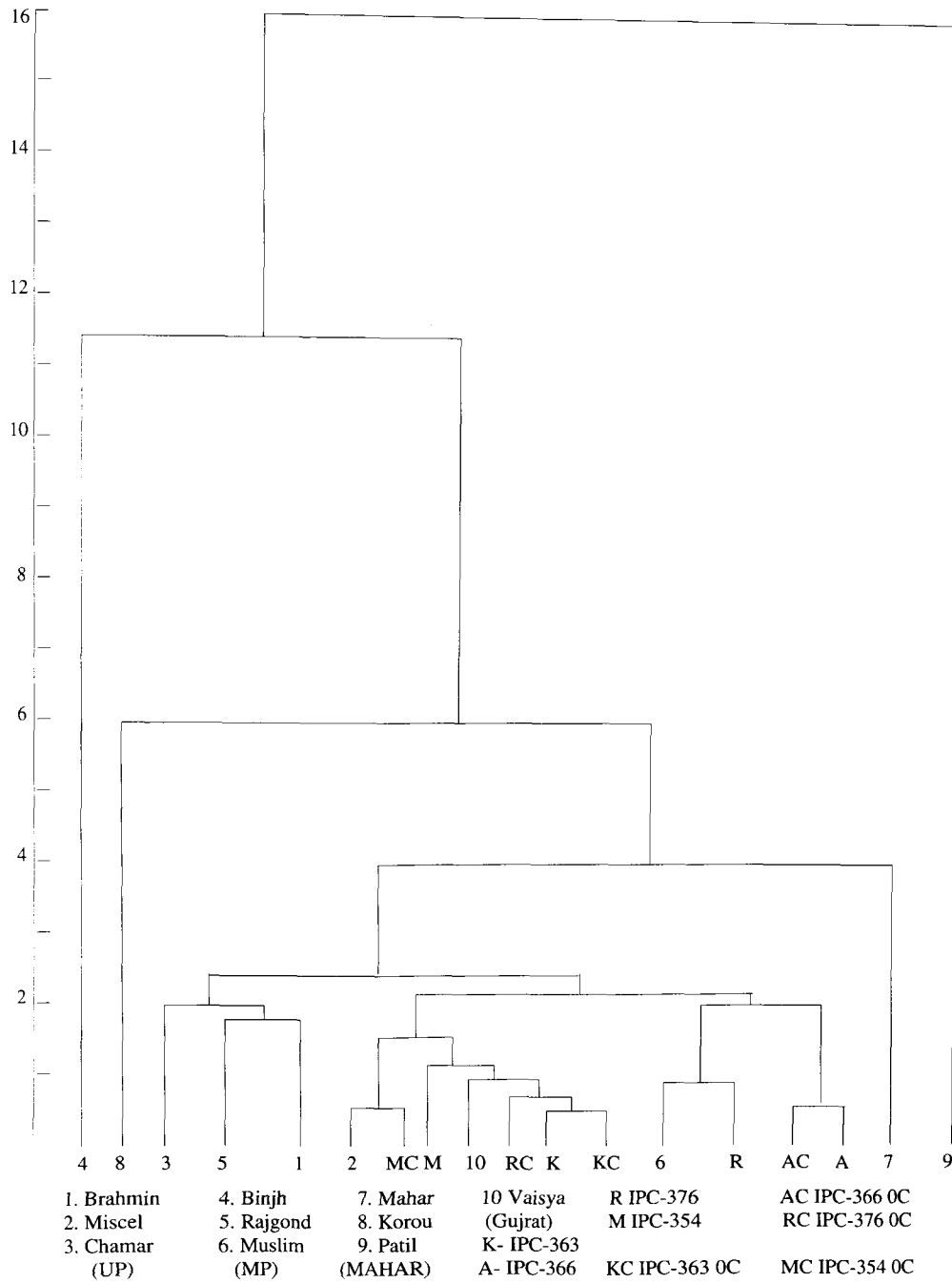

Figure 2 - Dendrogram of the four sex-crime, four sex and other crime cases and ten endogamous populations based on dermatoglyphic characters.

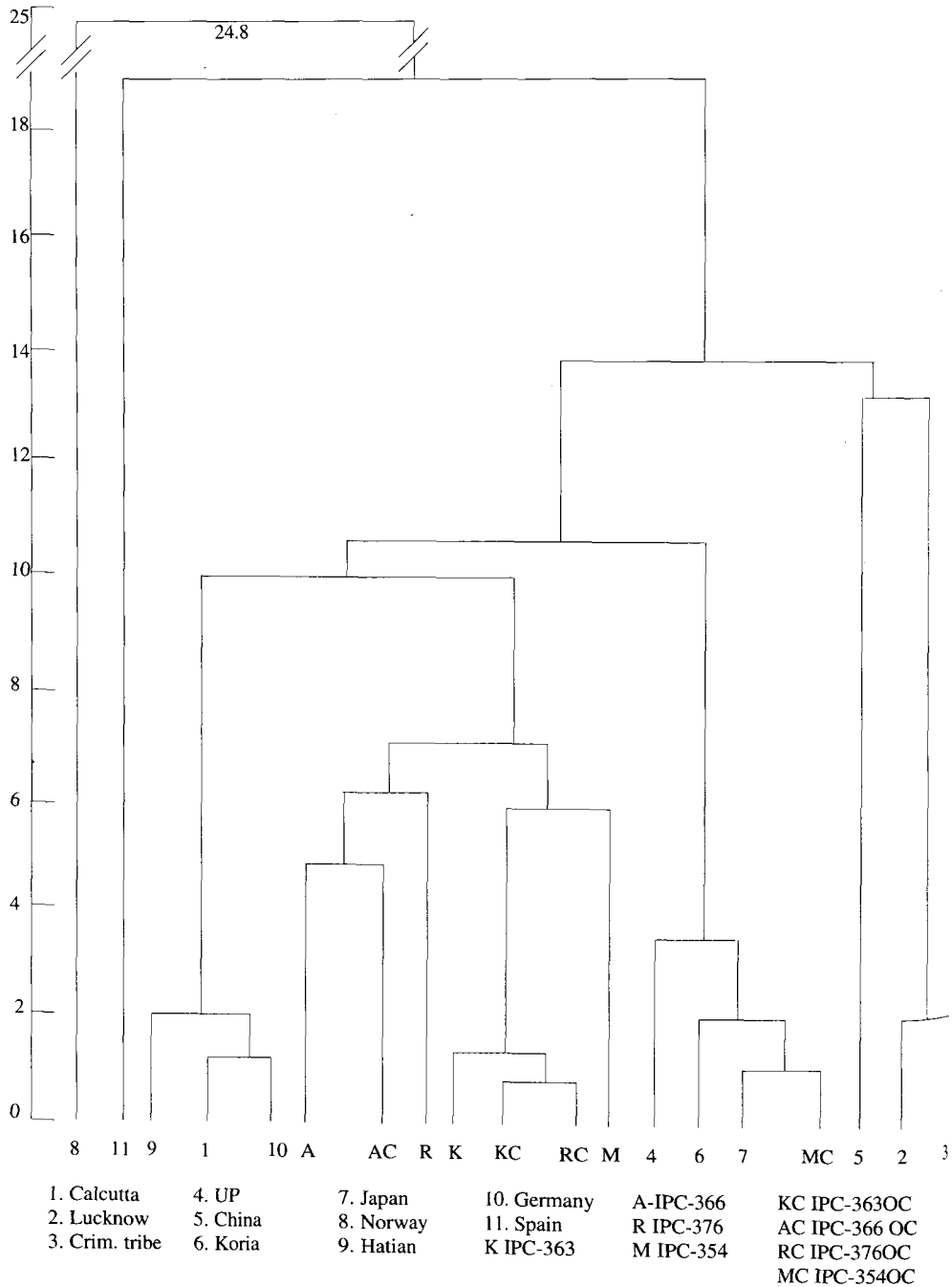

Figure 3 - Dendrogram of the 11 penal populations and 8 sex-and other crime cases based on dermatoglyphic characters

IPC-354MC (*Figure 3*). Within the sex-crime cases, K (IPC-363), KC (IPC-363KC) and RC (IPC-376RC) show the least differences. Except a few cases (1- Calcutta jail, 10-German criminal and 4-UP jail), the other penal populations show large deviations. Mean square distance were also compared in the pooled sex data (SC, SOC) with endogamous and penal populations. The dendrograms show almost the same clustering.

Discussion

The wide differences in frequency of whorls, high index of W-L in case of IPC-363 in contrast to IPC-366, suggest that the two related sex crimes are different in dermatoglyphic patterns. The dendrogram (*Figure 1*) also indicate that the two pairs of sex related crimes show wide differences in dermatoglyphic patterns. This suggests that related sex crimes do not necessarily show similar dermatoglyphic features.

Even among the sex crimes the greatest difference is among «kidnap» and «abducting» and the difference diminishes when sex crimes and other crimes are considered (*Figure 4*) except in the case of IPC-354M and IPC-354MC. The influence of other crimes appears to be more discriminating than the sex crimes, considering that both «kidnap» and «abducting» are indirect offenses of sex crimes, in the sense that they refer to «kidnapping» or «abducting» a girl for rape or prostitution, and are therefore not entirely sexual, whereas both «molestation» and «rape» are specifically sex offenses. *Figure 4* suggests that discrimination among the eight sex and sex and other crime cases is apparently more related to other crimes than to different sex crimes. This possibly explains the minor differences between IPC-363 and IPC-366.

Figure 3 shows to what extent the dermatoglyphic characters between sex-specific crimes can be discriminated from other crimes. The clustering A, AC and R (366, 376) and also K, KC, RC and M (363, 366 and 354) except MC are the same as in *Figure 4*, but when compared to other penal populations, they show wide deviations. This could be due to the heterogeneous nature of the sample and variation due to racial origins or geographical clines, as should be also taken into consideration. Possibly a detailed study with a focus on specific crimes and a wide control in monozygotic and dizygotic twins and other series could confirm some of the pending issues observed between crime and dermatoglyphics.

How far the sex crime cases different from non-criminal populations? Despite the difficulty of finding a suitable control sample for comparison the ten endogamous populations from four states of India, utilised as possible controls, (*Figure 2*) on the overall (except for three cases) suggests dermatoglyphic similarity among sex crime cases and wide differences with other populations. To compare, possibly, the heterogeneity of the sample in case of sex crime due to different gene pools may lead to the observed deviation, which is possibly equally true in case of endogamous populations. The wide deviation could be attributed to differences between endogamous groups or their historical origin, irrespective of their regional or state location. In the endogamous groups there is no systematic pattern with regard to either caste or regional allocation (Sing & Bhasin, 1979).

It is interesting to underline that when comparison is made between penal populations or endogamous populations or among sex crime convicts separately, the pattern of clustering of eight cases of sex and other crime convicts basically remains the same. This evidence can suggest a strong association with dermatoglyphic features. For example, the dimorphic pattern combination types of UL-A and UL-RL are completely absent in the present study, a significant difference from other normal endogamous, e.g. Yanadis and non-normal (Downs, Schizophrenic) populations (Vasulu *et al.*, 1991).

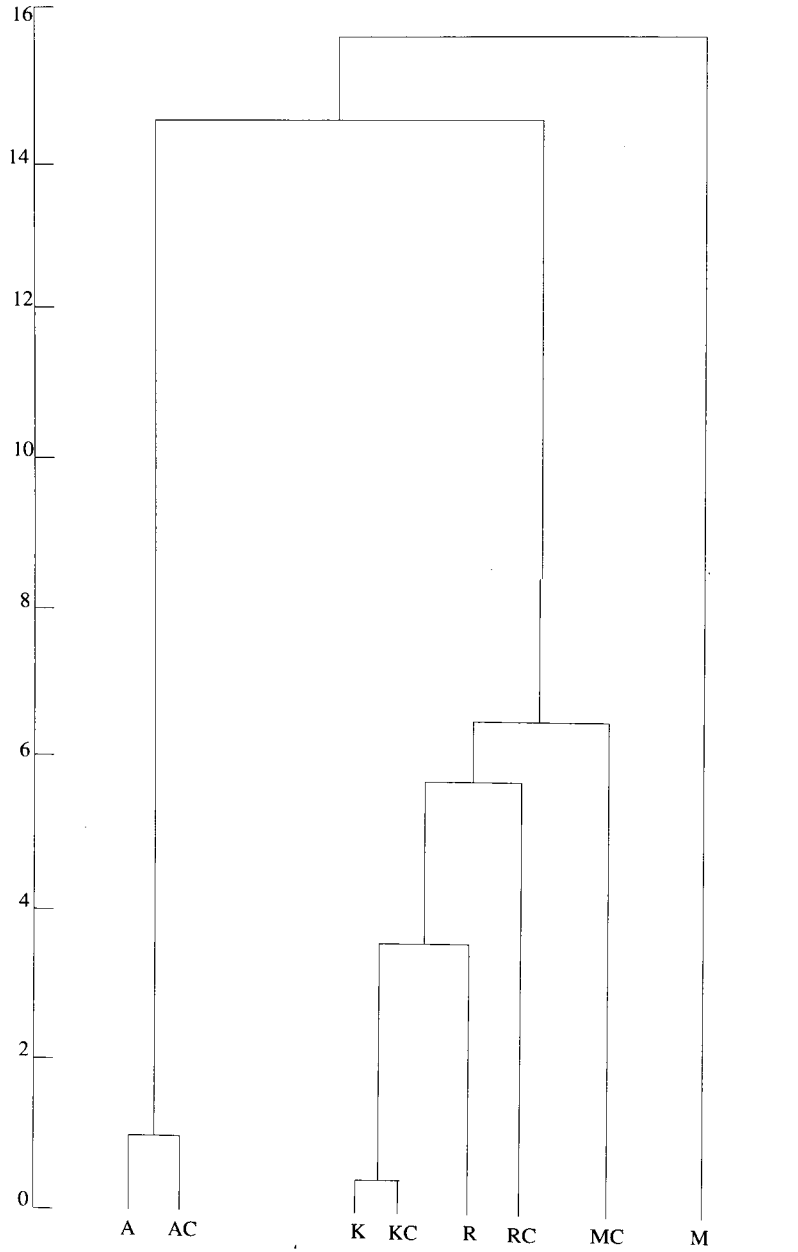

Figure 4 - Dendrogram of the four IPC sex-crime cases and four IPC Sex and other crime cases for dermatoglyphic characters

The lack of agreement between sex-related crimes and dermatoglyphic characters, and the wide deviation of IPC-354M from other IPC cases are other interesting aspects, whose validity cannot be ascertained due to non-availability of similar such studies. However, one significant finding is that the low mean ridge count (TFRC) observed in both IPC-366A and AC, is in agreement with the other two similar studies on penal populations from Spain and America. In both studies the differences in the mean ridge count are around 18. The possible dermatoglyphic association of low mean ridge count with crime (suggested by WELSH & CASTELLA 1971, 1979) is strongly supported by the present investigation among IPC-366A and IPC-366AC offenders for abducting and other crime.

Since a chromosomal analysis or other more confirmatory biological evidence were not compared, due to paucity of such data (because some extra chromosomal variations, like in Klinefelter's syndrome lead to decrease in digital ridge count), it can be said that the present results are only suggestive of strong association between crime and dermatoglyphics. In case of specific sex crimes, there is a trend that IPC-354M case for «Molestation» may show significant departure when compared, especially, to IPC-376R for «Rape». It is possible to speculate that certain dermatoglyphic features are observable among criminals with respect to noncriminals and this may testify in favour of a natural propensity towards criminal behaviour. But a full investigation remains to be carried out by a careful study of age group of both sexes and by enivronmental control for possible clues of genetic disposition that could be identifiable through dermatoglyphic characters, at least, at population level, in terms of statistical probabilities of risk estimation. However, as VOGEL & MOTELSKY (1986) observe from three different studies (Section based 8.2.1.5. based monozygotic-dizygotic in different condition of adoption etc.) strong genetic influences and also unfavourable environmental conditions, which act as a trigger mechanism to crime, are both important. Whether these conditions can be extended to sex crime and dermatoglyphics is to be confirmed. The present results seem to encourage further studies.

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