Paper 5.8: Haplogroup H Report.

Abstract: H1a-M69 represents almost all of the published data for Haplogroup H-M2713. Additionally, most of the published data come from Pakistan and India. One finds widespread consensus among the geneticists that identifies H-M69 as an "indigenous" South Asian mutation. Within this region, H-M69 is a significant mutations for deciphering the evolution of Indo-European, Dravidian and Austro-Asiatic languages. Outside of South Asia, H-M69 is found among some Turkic and Indo-European speaking populations of Central and East Asia. This is a potential genetic artifact of the Tocharians. In Europe, the H-M69 mutation attains a high frequency among the Romani and confirms what historians and linguists have long suspected, that they came from India. Surprisingly, the distantly related H2-P96 mutation is found on the Mediterranean island of Sardinia. This may represent a faint signal of the human settlement of Europe during the Paleolithic, the so-called Aurignacian archaeological transition.

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Paper 5.8. Haplogroup H-M2713.

The Genetic-Linguistic Interface.

Section 1. Overview.

In order to understand the phylogenetic history of the H-M2713 main haplogroup the reader should examine Figure 5.1.1 from Paper 5.1. As shown by the figure, HR-M578 and G-M201 are sister clades. H-M2713 evolved from HR-M578. According to Poznik et al. (2016: Supplementary Table 10), this occurred around forty-six thousand years ago. The reader is now directed to Figure 5.8.1, which outlines the internal phylogeny of H-M2713 and its informative variants. The internal structure contains two main divisions, H1-M3061 and H2-P96. According to Poznik (2016), both mutations evolved around thirty-seven thousand years ago.

In order to identify where the H-M2713 main haplogroup arose, several points need to be discussed. First, according to ISOGG 2017, H2-P96 represents a rare mutation found in Europe, mostly on Sardinia. A recent study of 1,194 Sardinians (Francalacci et al. 2015) found seven men with the mutation, a frequency of less than one percent. Second, almost all the published data for haplogroup H-M2713 comes from H1a-M69 and its downstream variants, which are commonly found in South Asian populations. Finally, H-M69 actually represented the main haplogroup H mutation until 2014. Since then, the mutation has been placed deeper in the haplogroup H phylogeny, first with H1-M69, and later H1a-M69. For the pre-2014 phylogeny of haplogroup H, the reader is directed to Figure 5.8.2.

Again, H1a-M69 represents almost all of the published haplogroup H data. Additionally, most of the published data come from men living in South Asia, and in particular, Pakistan and India. According to Sengupta et al. (2006) H-M69 attains a frequency of about twenty-six percent among Indians and among the Pakistanis the frequency is about six percent. Elsewhere H-M69 and its variants have been found in some populations of the Middle East, Central Asia and East Asia, where the overall frequency is very low. Additionally, the H-M69 mutation attains a high frequency among several Romani populations in Europe. For further information, the reader is directed to Table 5.8.1, which presents a survey of H-M69 populations.

Sengupta et al. (2006) suggest that H-M69 evolved around thirty thousand years ago. Given the age of this mutation and its moderate frequency among South Asian populations, one finds widespread consensus among the geneticists that identifies H-M69 as an "indigenous" South Asian mutation (e.g. Sahoo et al. 2006a; Sengupta et al. 2006; Trivedi et al. 2008; Debnath et al. 2011; Khurana et al. 2014). Because the phylogeny of H-M69 has been revised, with H-M69 downgraded from a main haplogroup to H1a, the question remains if the new higher level mutations, H-M2713 and H1-M3061, are also indigenous South Asian mutations.

Phylogenetic relationships and the archeological record, combined with dating estimates from Poznik et al. (2016), seem to place the origins of the main haplogroup H-M2713 mutation in Southwest Asia (or the Middle East). As the reader may recall from Paper 5.4, Hg. D, Section 2 and the working out-of-Africa hypothesis, the human tribe left Africa about 100 thousand years ago and settled in Southwest Asia. About 50 thousand years ago, with the onset of improved climatic conditions during Marine Isotope Stage 3, part of the human tribe migrated eastwards out of Southwest Asia and colonized South Asia, Australia and East Asia. Part of this expansion included men with the H-M2713 mutation. In South Asia, H1-M3061 diverged from H-M2713. Furthermore, during Marine Isotope Stage 3, part

of the human tribe, including those with H-M2713, migrated from Southwest Asia to Europe, the so-called Aurignacian culture. In Europe, H2-P96 diverged from H-M2713.

As noted previously, H-M69 appears to have evolved from H1-M3061 about 30 thousand years ago based on data from Poznik et al. (2016: Supplementary Table 10) and Sengupta et al. (2006: Table 11). Turning now to downstream variants of H1a-M69, three variants are commonly reported in the literature: H1a1-M52, H1a1a-M82, and H1a2a-Apt. Sengupta et al. (2006: Table 11) and Karmin et al. (2015: Table S7) suggest that that H1a1-M52 and H1a1a-M82 evolved during the Neolithic. Dating estimates for H1a2a-Apt, on the other hand, suggest that this mutation evolved during the Mesolithic (Sengupta et al. 2006).

Population reports are inconsistent in reporting internal variation for H-M69. Although H-M69 evolved during the Paleolithic, based on the available data for its internal phylogeny the main expansion of this marker occurred during the South Asian Neolithic. Thus, the frequency and distribution of H-M69 variation in South Asia may hold important clues for deciphering linguistic diversity in this region. At this point the reader is directed to Tables 5.8.2 and 5.8.3. Based on the tables, H-M69 appears frequently in South Asia among speakers of languages that fall within the Indo-European, Dravidian, and Austro-Asiatic language families. As previously mentioned in Paper 5.7, Hg. G., Section 3, the expansion of Indo-European and Dravidian across South Asia may have a connection with farmers from Southwest Asian who settled at Mehrgarh in the Balochistan region of Pakistan around nine thousand years ago. Over the course of several thousand years, this agricultural trajectory penetrated the Indus Valley of Pakistan and western India, and eventually migrated further eastwards into the Ganges Valley and southwards into southern India and Sri Lanka. Thus, the presence of haplogroup H-M69 among Dravidian and Indo-European-speaking populations may well be a genetic relic of the Southwest Asian Neolithic package that was adopted in northern and southern India. Austro-Asiatic, on the other hand, may have expanded into eastern India about four thousand years ago with the farmers who cultivated a domesticated variety of rice with origins in China (Diamond and Bellwood 2003; Bellwood 2005: 222-227). See, also, Paper 5.15, Hg. O, Section 11. Accordingly, haplogroup H-M69 may also represent the collision of Southwest Asian and East Asian agricultural expansions in eastern India and language shift from Dravidian or Indo-European to Austro-Asiatic.

Section 2. H-M69 and Language Variation in South Asia.

For the purposes of this present discussion, the term “South Asia” presents an overview of linguistic variation in Pakistan and India. Additionally, frequency data for H-M69 is combined with those who have the mutation itself and those who have downstream variants of the mutation: H1a-M52, H1a-M82 and H1a-Apt. This is necessary because many studies have not sequenced H-M69 for informative downstream variants. In the shorthand of the geneticists, I am reporting for H-M69*. Finally, this resource guide assumes that the distribution of H1a-M69* reflects demographic processes that began around nine thousand years with the onset of the South Asian Neolithic.

As previously mentioned in Paper 5.6, Hg. C, Section 3.2, India represents a country with remarkable linguistic diversity. Here, almost all of the spoken languages fall within one of the four language families: Dravidian, Indo-European, Austro-Asiatic or Sino-Tibetan. In neighboring Pakistan, on the other hand, Austro-Asiatic is absent, but one finds Indo-

European, Dravidian, and Sino-Tibetan. With respect to the Indo-European language family, one main difference between Indian and Pakistani linguistic diversity is that the Indo-European languages of India fall almost exclusively within the Indo-Aryan branch. Hindi, one of India's official languages, and a linguistic heavyweight with over 500 million speakers, provides an example (Ethnologue 2018). The Indo-European languages of Pakistan, on the other hand, are a mixture of Iranian and Indo-Aryan. Significant Indo-Aryan languages of this country include Urdu, the official language, and Punjabi, the most widely spoken language (CIA World Fact Book 2018). Within the Iranian branch, Pashto and Balochi are widely spoken.

Turning now to Dravidian languages, eighty-six languages fall within this classification. Brahui is Dravidian language found in Pakistan. The remaining Dravidian languages, such as Tamil, Telugu and Kannada, are spoken in India. Interestingly, the spatial distribution of Indo-European and Dravidian languages generally follows a geographic pattern in India. Indo-European is found in the North. Dravidian, on the other hand, tends to be present in the south.

Turning now to the Sino-Tibetan language family, the Sino-Tibetan languages of South Asia fall within the Tibetan-Burman branch. Within India, the distribution of Tibeto-Burman languages follows the border that this country shares with Nepal and China. It should be noted that an attempt was made to extrapolate the number of Tibeto-Burman languages spoken in India from the Ethnologue website. This proved very difficult, but the figure appears to be around one hundred and twenty-five languages. Examples include Mizo, a language spoken by around 675 thousand people (Ethnologue 2018). The only Sino-Tibetan language listed for Pakistan is Balti, a Tibeto-Burman language with around 327 thousand speakers.

According to Ethnologue (2018), the Austro-Asiatic language family consists of 167 languages. These languages stretch along a geographical expanse than begins in eastern India and end in Malaysia. Within this language family, the Munda branch represents the Austro-Asiatic languages of eastern India. Santhali and Mundari are among the more recognized Munda languages. The Mon-Khmer branch represents East Asian languages. Significant Mon-Khmer languages include Khmer and Vietnamese.

Two studies, Sengupta et al. (2006) and Trivedi et al. (2008), presented frequency data that facilitate analysis of the extent to which haplogroup H-M69 is an informative mutation among the four main language families of India. The problem with the studies is that the sample sizes are very small and as such, ascertainment bias may well be a problem. In order to overcome this problem, Tables 5.8.4 through 5.8.8 explore the correlation between linguistic and genetic diversity in South Asia by utilizing a large data set of over seven thousand samples gathered from previously published studies. The tables were prepared in order to assess the frequency of H-M69 in South Asians according to language family or language branch. The data were then compared against the results obtained by Sengupta et al. (2006) and Trivedi et al. (2008), which are summarized in Table 5.8.8.

In order to minimize ascertainment bias, Tables 5.8.4 through 5.8.7 excluded data from populations for which the sample size was less than twenty men. Frequency results for H-M69 and its downrange variants are as follows: Indo-European = 17% (Table 5.8.4); Dravidian = 28 % (Table 5.8.5); Austro-Asiatic = 25% (Table 5.8.6); Tibeto-Burman = 6%

(Table 5.8.7). It should be noted that the frequency for Tibeto-Burman is probably over-inflated because the H-M69 mutation was not detected in several of the reported Tibeto-Burman-speaking populations, and these populations are not included in the analysis. Indo-European, Dravidian and Austro-Asiatic populations, on the other hand, almost always have the H-M69 mutation. Consequently, the overall frequency data for these three language families are more accurate than that reported for Tibeto-Burman.

The H-M69 frequency data, as just described, supports the two conclusions. H-M69 is a very significant mutation for deciphering the prehistory of South Asian languages. Next, the frequency and distribution of H-M69 in South Asia help in the interpretation of data from other mutations found in the region, especially G-M201, J2-M172, L-M20, T-M184, O-M175, and R1a-Z93. For example, the previous discussion of G-M201 variation in South Asia, as presented in Paper 5.7, Hg. G, Section 3, suggested that this haplogroups may well be genetic signature of an expansion of the Indo-European language family from Southwest Asia into South Asia during the Neolithic. Additionally, the same mutation may signal the expansion of the Dravidian from Pakistan to southern India during the same period. Given this interpretation, an interesting question arises. Why does G-M201 decrease in frequency as one moves further east from Pakistan, whereas H-M69 has the opposite clinal pattern, and generally increases in frequency?

The reader is referred once again to Table 5.8.2, which provides a survey of H-M69 variation in Pakistan, and Table 5.8.3, which provides a survey of H-M69 variation in India. Perhaps what is particularly striking about the Pakistani data is that the mutation appears among the Indo-Aryan-speaking Kalash and Iranian-speaking Pathans. The mutation also appears among the Dravidian-speaking Brahui people and among the Burusho, speakers of a language isolate. Of course, the amount of Pakistani data is very small, but nevertheless H-M69 may well have been part of genetic inventory of hunter-gatherers who lived in the Balochistan region when Indo-European-speaking farmers arrived about nine thousand years ago. This suggests that the Neolithic expansion of Austro-Asiatic, Indo-European and Dravidian languages involved complex demographic processes that resulted from the admixture of Southwest Asian farmers and South Asian hunter-gatherers. Taking this a step further, it appears that language shift played a huge role in the evolution of linguistic diversity in South Asia. This is consistent with the available data (see Tables 5.8.4 – 5.8.7 and Paper 5.7, Hg. G, Section 3).

Again, the Neolithic expansion of H-M69 and its variants provide important background information that facilitates analysis of other genetic mutations in South Asia. The ultimate goal of this undertaking is to address several important and longstanding controversies surrounding language variation in the region. One interesting question involves the origins of Dravidian language. Similarly, another question concerns the origins of Austro-Asiatic languages. Another mystery involves Indo-Aryan language and if they arrived in South Asia as the result of a Bronze Age invasion of Central Asian nomads.

Section 3. H-M69 and Language Variation in Central Asia.

H1a-M69 variation in South Asia potentially offers useful data for assessing the purported Central Asian origins of Indo-Iranian languages and the evolution of the Iranian and Indo-Aryan branches. Such a discussion requires the presentation of important background information about the origins of the so-called Central Asian steppe nomad hypothesis. It should be noted that at the beginning of the twentieth century, with the discovery of clay tablets at Boğazkale in modern-day Turkey, Hittite became the oldest attested Indo-European language. However, during the nineteenth century Sanskrit was considered the oldest attested Indo-European language. Thus many linguists, such as Max Müller, took a keen interest in this ancient Indo-Aryan language and the Rigveda liturgical texts. From their interpretation (or perhaps misinterpretation) of these texts evolved the idea that the Aryan people were the original speakers of an Indo-European language. During the twentieth century Nazi Germany re-worked the Aryan hypothesis to support their racial and ethnic ideology. The archaeologist Marija Gimbutas then reworked the Aryan hypothesis in a series of articles published between 1952 and 1993. Instead of Aryans she proposed that the first Indo-Europeans were the prehistoric Kurgan people of the Russian steppes. Today the Kurgans have become Central Asian steppe nomads. One most recognized proponents of this current approach to Indo-European origins is the anthropologist David Anthony. As previously noted in Paper 5.7, Hg. G. Section 1, this version of Indo-European origins is controversial. It defies a trend observed elsewhere outside of Indo-European. Worldwide, several large language families co-expanded with early agriculture. Why, then, would Indo-European be an exception to the rule?

Several studies have discussed Central Asian steppe nomad hypothesis and have assessed their potential contribution to the contemporary Indian gene pool (e.g. Kivisild et al. 2003; Cordaux et al. 2004a; Sahoo et al. 2006a; Sengupta et al. 2006; Trivedi et al. 2008). Again, this follows the idea that a Bronze Age invasion from Central Asia brought Indo-Aryan languages to South Asia. While final analysis of the Central Asian steppe nomad hypothesis must wait until Paper 5.17, Hg. R, Section 9 and the discussion of the R1a-Z93 mutation, it is necessary at this time to present H-M69 data that are potentially useful for future analysis.

The H-M69 mutation has been detected in several populations of the Middle East, Central Asia and even East Asia (see Table 5.8.9 for additional information). These populations include those that speak Iranian languages, such as Tajiks in Afghanistan and Tajikistan, as well as Pashtuns in Afghanistan. The mutation has also been detected in Turkic-speaking populations, such as the Uygur of the Xingjian region of China and Uzbeks in Uzbekistan. Thus, these data raise an interesting possibility that prehistoric geneflow between South and Central Asia has been unidirectional, from South to North. Perhaps the geneflow originated during the Neolithic. The data seem to suggest that the Central Asian Neolithic may have been an expansion of the South Asian Neolithic, which evolved at Mehrgarh in Pakistan roughly nine thousand years ago (see Paper 5.7, Hg. G, Sections 3 and 4 for additional information). Taking this a step further, perhaps the prehistoric Tocharian people of the Tarim Basin in the Xingjian region and their Indo-European language stand as a linguistic relic of this migration.

Section 4. H-M69 and the Romani Languages.

Haplogroup H has also surfaced as a useful marker for understanding the population history of the Romani people, who are often identified as Roma, and sometimes as Gypsies, a term that is considered derogatory. This population is found throughout Europe. For years scholars have asked whether India is the putative homeland of this group. Language typology certainly points to India as the original homeland of the Romani people. *Ethnologue* classifies the Romani language as part of the Indo-Iranian and Indo-Aryan branches of the Indo-European language family. The historical record also seems to support India as the putative homeland of the Romani (e.g., Tcherenkov and Laederich 2004). Finally, geneticists discovered that haplogroup H-M69 and its variants are a common Y chromosome mutation among Romani groups in Europe. For example, about seventeen percent of Iberian Romani (Gusmão et al. 2008) and thirty-two percent of Hungarian Romani (Pamjav et al. 2011) have the mutation (see Table 5.8.10 for additional information)**.** A 2012 study published by Rai et al. 2012 analyzed haplogroup H-M69 data that was taken from ten thousand global samples. Based on their analysis, they identified northeast India as the putative homeland of the Romani people.

Section 5. Haplogroup F-M89.

It should be noted that haplogroup H frequencies for South Asia might be underreported in the literature. ISOGG 2017 states that when H-M69 was the main haplogroup mutation, potential H-M2713 and H1-M3061 mutations for South Asia were identified as unspecified variants of haplogroup F-M89. See, e.g., Cordaux et al. 2004a; Sengupta et al. 2006; Arunkumar et al. 2012; Khurana et al. 2014. Clearly, further testing is needed to attain a more accurate determination of haplogroup H variation in South Asia.

Additionally it should be explained at this time why we define F-M89 as an evolutionary marker between the main haplogroups and Y-Chromosome Adam rather than a main haplogroup as found in the standard phylogeny (i.e. Karafet et al. 2008). (**Note** that the M89 mutation is labeled FR-M89 in Figure 5.1.1.) This action was taken because, as demonstrated in the previous paragraph, frequency data for F-M89, in most cases, may well represent more informative haplogroups that had not been identified at the time of publication. Within the global linguistic tapestry, a small number of men probably have the actual F-M89 mutation rather than a variant. However, for purposes of deciphering linguistic variation, the number of men with F-M89 would be too small, and consequently, uninformative.

Section 6. H2-P56 and Sardinia.

As noted earlier, H2-P56 is a downstream haplogroup H-M2713 mutation found on the Mediterranean Island of Sardinia. In their 2015 study, Günther et al. reported the discovery of the mutation from Neolithic remains found at a cave near Atapuerca in Spain. This discovery helps to clarify data from the I-M26 mutation, a topic discussed in the next Paper (5.9).

Section 7. Conclusions for H-M2713

The discussion of language variation in South Asia continues in Paper 5.10, Section 5, and the presentation of J2-M172 variation in this region. Turning now to the present discussion of haplogroup H-M2713, almost all the published frequency data is for H1a-M69 and its downstream variants. H1a-M69 data favor the language-farming hypothesis as an explanation for the origins of Indo-Aryan languages. Furthermore, the same mutation supports the origins of Dravidian languages in Pakistan, and a southwards Neolithic expansion of this language family. Finally, the H1a-M69 places Romani origins among the populations of India.

Bibliography for Report

Arunkumar, Ganesh Prasad et al. 2012. "Population differentiation of southern Indian male lineages correlates with agricultural expansions predating the caste system." *Public Library of Science One* 7(11): e50269.

Bellwood, Peter 2005. *First farmers: the origins of agricultural societies.* Malden, MA; Oxford, UK; Victoria, Australia: Blackwell Publishing.

CIA Work Fact Book. https://www.cia.gov/library/publications/the-world-factbook/ Accessed March 6, 2018.

Cordaux, Richard et al. 2004a. "Independent origins of Indian caste and tribal paternal lineages." *Current Biology* 14: 231-235.

Debnath, Monojit et al. 2011. "Y-chromosome haplogroup diversity in the sub-Himalayan Terai and Duars populations of East India." *Journal of Human Genetics* 56: 765-771.

Diamond, Jared and Peter Bellwood 2003. "Farmers and their languages: the first expansions." *Science* 300: 597-603.

Ethnologue: Languages of the World, Twenty-first edition, 2018, Simons, Gary F. and Charles D. Fennig (Eds.). Dallas, Texas: SIL International. Online version: http://www.ethnologue.com.

Francalacci, Paolo et al. 2015. "Detection of Phylogenetically informative polymorphisms in the entire euchromatic portion of human Y chromosome from a Sardinian sample." *BioMed Central Research Notes* 8:174

Günther, Torsten et al. 2015. "Ancient genomes link early farmers from Atapuerca in Spain to modern-day Basques." *Proceedings of the National Academy of Sciences of the United States of America* 112(38): 11917-11922.

Gusmão, Al. et al. 2008. "A perspective on the history of the Iberian gypsies provided by phylogenetic analysis of Y-chromosome lineages." *Annals of Human Genetics* 72: 215-227.

ISOGG (International Society of Genetic Genealogy). https://isogg.org

Karafet, Tatiana et al. 2008. "New binary polymorphisms reshape and increase resolution of the human Y chromosomal haplogroup tree." *Genome Research* 18: 830-838.

Karmin, Monika et al. 2015. "A recent bottleneck of Y chromosome diversity coincides with a global change in culture." *Genome Research* 25: 459-466.

Khurana, Priyanka et al. 2014. "Y chromosome haplogroup distribution in Indo-European speaking tribes of Gujarat, Western India." *Public Library of Science One* 9(3): e90414.

Kivisild, T. et al. 2003. "The genetic heritage of the earliest settlers persists both in Indian tribal and caste populations." *American Journal of Human Genetics* 72: 313-332.

Pamjav, Horolma et al. 2011. "Genetic structure of the parental lineage of the Roma people." *American Journal of Physical Anthropology* 145: 21-29.

Poznik, G. David et al. 2016. "Punctuated bursts in human male demography inferred from 1,244 worldwide Y-chromosome sequences." *Nature Genetics* 48(6): 593-600.

Rai, Niraj et al. 2012. "The phylogeography of Y-chromosome haplogroup H1a1a-M82 reveals the likely Indian origin of the European Romani populations." *Public Library of Science One* 7(11): e 48477.

Sahoo, Sanghamitra et al. 2006. "A prehistory of Indian Y-chromosomes: evaluating demic diffusion scenarios." *Proceedings of the National Academy of Sciences of the United States of America* 103(3): 843-848.

Sengupta, Sanghamitra et al. 2006. "Polarity and temporality of high-resolution Y-chromosome distributions in India identify both indigenous and exogenous expansions and reveals minor genetic influence of central Asian pastoralists." *American Journal of Human Genetics* 78: 201-221.

Tcherenkov, Lev and Stéphane Laederich 2004. *The Rroma: Otherwise Known as Gypsies, Gitanos, Gyphtoi, Tsiganes, Tigani, Çingene, Zigeuner, Bohémiens, Travellers, Fahrende, etc.* Volume 1: History, language and groups. Basel: Schwabe Verlag.

Trivedi, R. et al. 2008. "Genetic imprints of Pleistocene origins of Indian populations: a comprehensive phylogenetic sketch of Indian Y-chromosomes." *International Journal of Human Genetics* 8(1-2) 97-118.

Figure 5.8.1. The 2017 Phylogeny of H-M2713 and its Informative Variants.

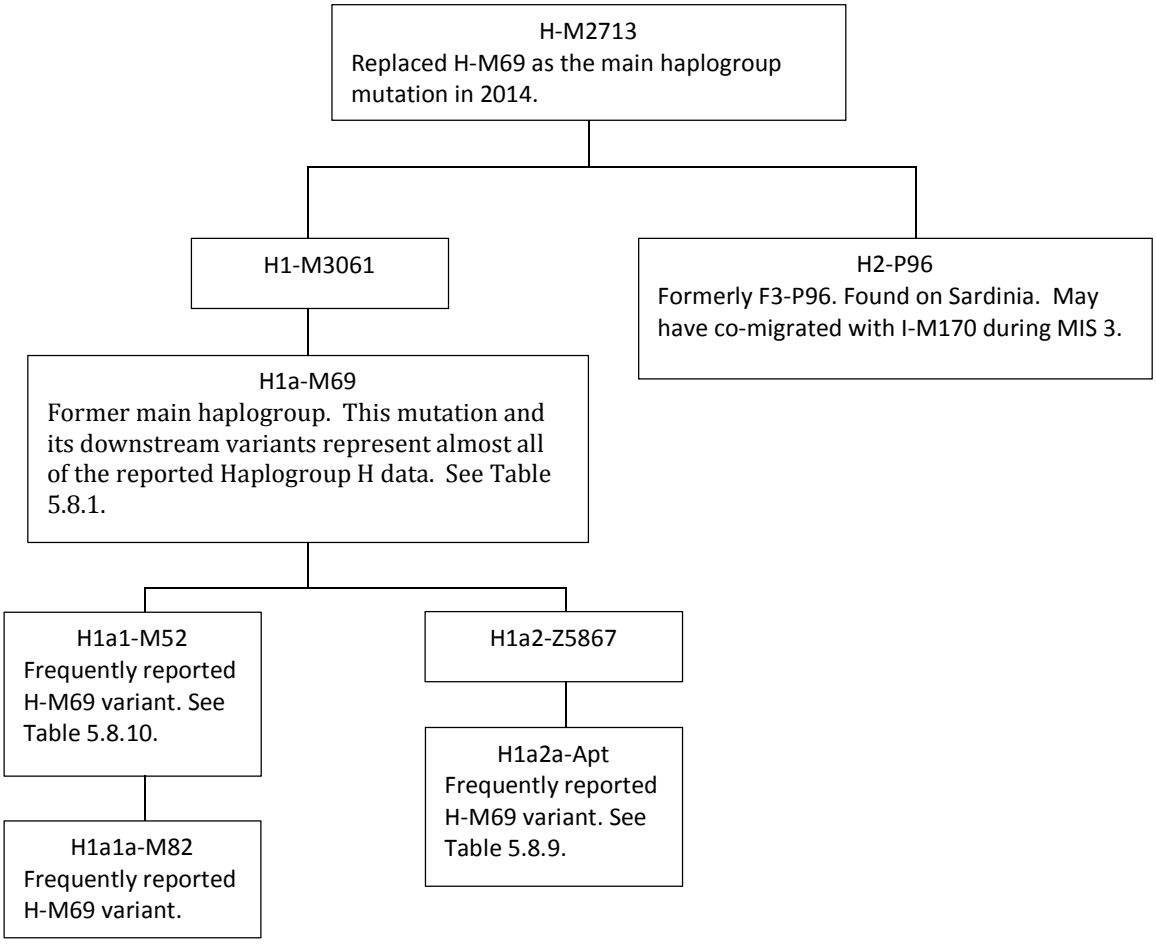
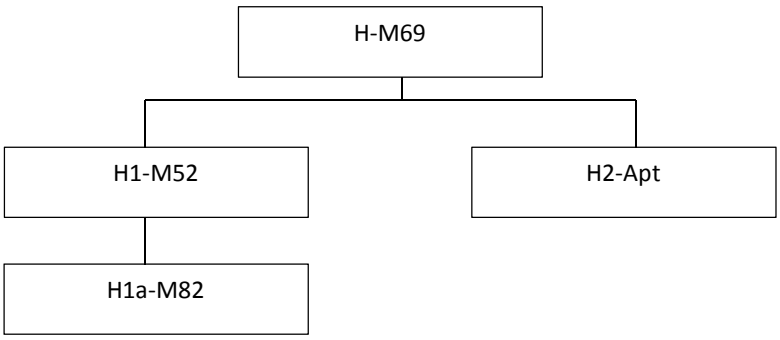


Diagram follows ISOGG 2017.

Figure 5.8.2. The 2008 Phylogeny of H-M69 and its Commonly Reported Variants.



Source: Karafet et al. (2008).

Table 5.8.1. Survey of H-M69 Populations.

Region	Location	Population	Lang Fam	Branch	Sample Size	Frequency Hg H	Reference
South Asia	Uttar Pradesh	Kurmi	Indo-European	Indo-Aryan	6	1.00	Sahoo et al. 2006
South Asia	Tamil Nadu	Chakkliar	Dravidian		9	0.89	Sahoo et al. 2006
South Asia	Karnataka	Koraga	Dravidian		33	0.88	Cordaux et al. 2004a
South Asia	Tamil Nadu	Irular	Dravidian		10	0.80	Sahoo et al. 2006
South Asia	Central India	Muria	Dravidian		20	0.80	Sengupta et al. 2006
South Asia	South India	Kurumba	Dravidian		19	0.74	Sengupta et al. 2006
South Asia	East India	Bagdi	Indo-European	Indo-Aryan	11	0.73	Sengupta et al. 2006
South Asia	West Bengal	Oraon	Dravidian		31	0.71	Debnath et al. 2011
South Asia	Andhra Pradesh	Koya	Dravidian		41	0.71	Kivisild et al. 2003
South Asia	Karnataka	Bhovi	Dravidian		13	0.69	Sahoo et al. 2006
South Asia	West Bengal	Maheli	Indo-European	Indo-Aryan	13	0.69	Sahoo et al. 2006
South Asia	Tamil Nadu	Kurumba	Dravidian		35	0.69	Arunkumar et al. 2012
South Asia	Maharastra	Pawara	Indo-European	Indo-Aryan	16	0.69	Sahoo et al. 2006
South Asia	Andra Pradesh	Naikpod Gond	Dravidian		18	0.67	Sahoo et al. 2006
South Asia	Gujarat	Mota Chaudhari	Indo-European	Indo-Aryan	27	0.67	Khurana et al. 2014
South Asia	West Bengal	Kora	Andamanese		17	0.65	Sahoo et al. 2006
South Asia	Jharkhand; West Bengal	Paharia	Dravidian		11	0.64	Kumar et al. 2007
South Asia	Maharastra	Katkari	Indo-European	Indo-Aryan	19	0.63	Sahoo et al. 2006
South Asia	Gujarat	Vasava	Indo-European	Indo-Aryan	24	0.63	Khurana et al. 2014
South Asia	Madhya Pradesh	Gonds	Dravidian		31	0.62	Sharma et al. 2009
South Asia	Gujarat	Gamit	Indo-European	Indo-Aryan	18	0.61	Khurana et al. 2014
Eastern Europe	Macedonia	Roma	Indo-European	Indo-Aryan	57	0.60	Peričić et al. 2005

Region	Location	Population	Lang Fam	Branch	Sample Size	Frequency Hg H	Reference
South Asia	Gujarat	Nana Chaudhari	Indo-European	Indo-Aryan	25	0.60	Khurana et al. 2014
South Asia	East India	Gaud	Indo-European	Indo-Aryan	5	0.60	Sengupta et al. 2006
South Asia	Tamil Nadu	Pallar	Dravidian		15	0.60	Sahoo et al. 2006
South Asia	Uttar Pradesh	Gonds	Dravidian		38	0.59	Sharma et al. 2009
Eastern Europe	Tiszavasvari, Hungary	Roma	Indo-European	Indo-Aryan	29	0.59	Pamjav et al. 2011
South Asia	Tamil Nadu	Kattunaickan	Dravidian		46	0.58	Arunkumar et al. 2012
South Asia	Maharastra	Madia Gond	Dravidian		14	0.57	Sahoo et al. 2006
South Asia	Tamil Nadu	Gounder	Dravidian		14	0.57	Sahoo et al. 2006
South Asia	Jharkhand; Chattisgarh	Oraon	Dravidian		91	0.57	Kumar et al. 2007
South Asia	South India	Kota	Dravidian		16	0.56	Sengupta et al. 2006
South Asia	Maharastra	Mahadeo Koli	Indo-European	Indo-Aryan	11	0.55	Sahoo et al. 2006
South Asia	East India	Mahishya	Indo-European	Indo-Aryan	13	0.54	Sengupta et al. 2006
South Asia	Northern India	Chamar	Indo-European	Indo-Aryan	18	0.50	Sengupta et al. 2006
South Asia	Tamil Nadu	Vanniyar	Dravidian		10	0.50	Sahoo et al. 2006
South Asia	Bihar	Kayastha	Indo-European	Indo-Aryan	14	0.50	Sahoo et al. 2006
South Asia	South India	Ambalakarar	Dravidian		29	0.48	Sengupta et al. 2006
South Asia	Gujarat	Dubla	Indo-European	Indo-Aryan	42	0.48	Khurana et al. 2014
South Asia	Karnataka	Iyengar	Dravidian		17	0.47	Sahoo et al. 2006
South Asia	Jharkhand	Oraon	Dravidian		110	0.45	Borkar et al. 2011
South Asia	Gujarat	Patel	Indo-European	Indo-Aryan	9	0.44	Sahoo et al. 2006
South Asia	Tamil Nadu	Kallar	Dravidian		9	0.44	Sahoo et al. 2006
South Asia	Central India	Kamar	Dravidian		30	0.43	Sengupta et al. 2006
South Asia	West Bengal	Santhal	Austro-Asiatic		51	0.43	Debnath et al. 2011

Region	Location	Population	Lang Fam	Branch	Sample Size	Frequency Hg H	Reference
South Asia	Jharkhand; West Bengal	Mudi	Austro-Asiatic		37	0.43	Kumar et al. 2007
South Asia	West India	Nav Buddha	Indo-European	Indo-Aryan	14	0.43	Sengupta et al. 2006
South Asia	West Bengal	Kol	Austro-Asiatic		62	0.42	Debnath et al. 2011
Eastern Europe	Slovakia	Roma	Indo-European	Indo-Aryan	200	0.40	Petrejčíková et al. 2009
South Asia	Orissa	Paroja	Dravidian		15	0.40	Sahoo and Kashyap 2006
South Asia	Tamil Nadu	Bettakurumba	Dravidian		5	0.40	Cordaux et al. 2004a
South Asia	Jharkhand; West Bengal	Mahali	Austro-Asiatic		25	0.40	Kumar et al. 2007
South Asia	South India	Irula	Dravidian		30	0.40	Sengupta et al. 2006
South Asia	Karnataka	Lingayat	Dravidian		10	0.40	Sahoo et al. 2006
South Asia	Orissa	Bathudi	Indo-European	Indo-Aryan	36	0.39	Kumar et al. 2007
South Asia	Chitwan, Nepal	Tharu	Indo-European	Indo-Aryan	77	0.39	Fornarino et al. 2009
South Asia	Jharkhand; West Bengal	Santhal	Austro-Asiatic		109	0.39	Kumar et al. 2007
South Asia	Tamil Nadu	Parayar NTN	Dravidian		52	0.39	Arunkumar et al. 2012
South Asia	Orissa	Paroja	Dravidian		13	0.38	Sahoo et al. 2006
South Asia	Bihar	Kurmi	Indo-European	Indo-Aryan	13	0.38	Sahoo et al. 2006
South Asia	Maharastra	Maratha	Indo-European	Indo-Aryan	16	0.38	Sahoo et al. 2006
South Asia	Andhra Pradesh	Chenchu	Dravidian		41	0.37	Kivisild et al. 2003
South Asia	Bihar	Baniya	Indo-European	Indo-Aryan	11	0.36	Sahoo et al. 2006
South Asia	Chattisgarh	Nagesia	Dravidian		14	0.36	Kumar et al. 2007
South Asia	Tamil Nadu	Irula	Dravidian		80	0.36	Arunkumar et al. 2012
South Asia	Jharkhand	Pahariya	Indo-European	Indo-Aryan	100	0.35	Borkar et al. 2011
South Asia	Jharkhand	Munda	Austro-Asiatic		94	0.34	Borkar et al. 2011

Region	Location	Population	Lang Fam	Branch	Sample Size	Frequency Hg H	Reference
South Asia	Tamil Nadu	Mullukurumba	Dravidian		29	0.34	Arunkumar et al. 2012
South Asia	Maharastra	Chitpavan Brahmin	Indo-European	Indo-Aryan	15	0.33	Sahoo et al. 2006
South Asia	Jharkhand	Oroan	Dravidian		9	0.33	Sahoo et al. 2006
South Asia	Himachal Pradesh	Rajput	Indo-European	Indo-Aryan	15	0.33	Sahoo et al. 2006
South Asia	Central India	Halba	Indo-European	Indo-Aryan	21	0.33	Sengupta et al. 2006
South Asia	Gujarat	Dhodia	Indo-European	Indo-Aryan	63	0.33	Khurana et al. 2014
South Asia	Madhya Pradesh	Saharia	Indo-European	Indo-Aryan	57	0.33	Sharma et al. 2009
South Asia	Tamil Nadu	Kota	Dravidian		62	0.33	Arunkumar et al. 2012
South Asia	Jharkhand; Chattisgarh	Korwa	Austro-Asiatic		42	0.33	Kumar et al. 2007
South Asia	Jharkhand; West Bengal; Orissa	Kharia	Austro-Asiatic		36	0.33	Kumar et al. 2007
South Asia	Andra Pradesh	Naikpod	Dravidian		68	0.32	Thanseem et al. 2006
South Asia	Jharkhand; West Bengal; Orissa	Savar	Austro-Asiatic		47	0.32	Kumar et al. 2007
South Asia	Tamil Nadu	Kadar	Dravidian		28	0.32	Arunkumar et al. 2012
Eastern Europe	Hungary	Roma	Indo-European	Indo-Aryan	107	0.32	Pamjav et al. 2011
South Asia	Maharastra	Dhangar	Indo-European	Indo-Aryan	16	0.31	Sahoo et al. 2006
South Asia	West Bengal	Namasudra	Indo-European	Indo-Aryan	13	0.31	Sahoo et al. 2006
Eastern Europe	Slovakia	Roma	Indo-European	Indo-Aryan	62	0.31	Pamjav et al. 2011
South Asia	East India	Lodha	Austro-Asiatic		20	0.30	Sengupta et al. 2006
South Asia	Tamil Nadu	Mukkuvar	Dravidian		17	0.30	Arunkumar et al. 2012
South Asia	Tamil Nadu	Ezhava	Dravidian		95	0.30	Arunkumar et al. 2012
South Asia	Gujarat	Konkana	Indo-European	Indo-Aryan	24	0.29	Khurana et al. 2014
South Asia	South India	Vellalar	Dravidian		31	0.29	Sengupta et al. 2006

Region	Location	Population	Lang Fam	Branch	Sample Size	Frequency Hg H	Reference
South Asia	Tamil Nadu	Nadar TNV	Dravidian		59	0.29	Arunkumar et al. 2012
South Asia	Chattisgarh	Kanwar	Indo-European	Indo-Aryan	41	0.29	Kumar et al. 2007
South Asia	Tamil Nadu	Kanikaran	Dravidian		17	0.29	Arunkumar et al. 2012
South Asia	East India	Santhal	Austro-Asiatic		14	0.29	Sengupta et al. 2006
South Asia	Tamil Nadu	Tamil Jains	Dravidian		100	0.28	Arunkumar et al. 2012
South Asia	Jharkhand	Birhor	Austro-Asiatic		100	0.28	Borkar et al. 2011
South Asia	Jharkhand; West Bengal	Bhumij	Austro-Asiatic		89	0.27	Kumar et al. 2007
South Asia	Gujarat	Bhils	Indo-European	Indo-Aryan	22	0.27	Sharma et al. 2009
South Asia	Southern India	Mullukurunan	Dravidian		15	0.27	Cordaux et al. 2004a
South Asia	Andra Pradesh	Pardhan	Dravidian		128	0.26	Thanseem et al. 2006
South Asia	Orissa	Yadav (Gope)	Indo-European	Indo-Aryan	16	0.25	Sahoo et al. 2006
South Asia	Karnataka	Gowda	Dravidian		4	0.25	Sahoo et al. 2006
South Asia	West India	Maratha	Indo-European	Indo-Aryan	20	0.25	Sengupta et al. 2006
South Asia	West Bengal	Lodha	Austro-Asiatic		4	0.25	Sahoo et al. 2006
South Asia	Orissa	Ho	Austro-Asiatic		79	0.25	Kumar et al. 2007
South Asia	Jharkhand; West Bengal; Orissa	Munda	Austro-Asiatic		53	0.25	Kumar et al. 2007
South Asia	Orissa	Gope	Indo-European	Indo-Aryan	16	0.25	Sahoo and Kashyap 2006
South Asia	Tamil Nadu	Sourashtra	Indo-European	Indo-Aryan	40	0.25	Arunkumar et al. 2012
South Asia	Karnataka India	Lingayat	Dravidian		101	0.25	Chennakrishnaiah et al. 2013
South Asia	Tamil Nadu	Yadhava	Dravidian		107	0.24	Arunkumar et al. 2012
South Asia	Jharkhand; West Bengal; Orissa	Birhor	Austro-Asiatic		38	0.24	Kumar et al. 2007
South Asia	South India	Vanniyar	Dravidian		25	0.24	Sengupta et al. 2006
South Asia	Karnataka India	Vokkaliga	Dravidian		102	0.24	Chennakrishnaiah et al. 2013

Region	Location	Population	Lang Fam	Branch	Sample Size	Frequency Hg H	Reference
South Asia	Orissa	Khandayat	Indo-European	Indo-Aryan	13	0.23	Sahoo and Kashyap 2006
South Asia	Orissa	Khandayat	Indo-European	Indo-Aryan	13	0.23	Sahoo et al. 2006
South Asia	Tamil Nadu	Piramalai Kallar	Dravidian		53	0.23	Arunkumar et al. 2012
South Asia	Tamil Nadu	Mullukurumba	Dravidian		9	0.22	Cordaux et al. 2004a
South Asia	Chattisgarh	Pando	Indo-European	Indo-Aryan	23	0.22	Kumar et al. 2007
South Asia	Jharkhand	Asur	Austro-Asiatic		55	0.22	Kumar et al. 2007
South Asia	Tamil Nadu	Parayar	Dravidian		24	0.21	Arunkumar et al. 2012
Eastern Europe	Tokaj, Hungary	Roma	Indo-European	Indo-Aryan	39	0.21	Pamjav et al. 2011
South Asia	Karnataka	Kuruva	Dravidian		10	0.20	Sahoo et al. 2006
South Asia	Tamil Nadu	Brahacharanam	Indo-European	Indo-Aryan	21	0.20	Arunkumar et al. 2012
South Asia	Tamil Nadu	Vanniyar NTN	Dravidian		96	0.20	Arunkumar et al. 2012
South Asia	Pakistan	Kalash	Indo-European	Indo-Aryan	20	0.20	Di Cristofaro et al. 2013
South Asia	Uttar Pradesh	Bhoksha	Indo-European	Indo-Aryan	10	0.20	Sahoo et al. 2006
South Asia	Uttar Pradesh	Kanyakubj Brahmins	Indo-European	Indo-Aryan	10	0.20	Sahoo et al. 2006
South Asia	North Pakistan	Pathans	Indo-European	Iranian	20	0.20	Sengupta et al. 2006
South Asia	Tamil Nadu	Valayar	Dravidian		95	0.20	Arunkumar et al. 2012
South Asia	Andra Pradesh	Brahmin	Dravidian		15	0.20	Sahoo et al. 2006
South Asia	Tamil Nadu	Pallar	Dravidian		51	0.20	Arunkumar et al. 2012
South Asia	Andra Pradesh	Vizag Brahmins	Dravidian		41	0.20	Cordaux et al. 2004a; Ramana et al. 2001
South Asia	Southern India	Yerava	Dravidian		41	0.20	Cordaux et al. 2004a
South Asia	Orissa	Saora	Austro-Asiatic		21	0.19	Sahoo and Kashyap 2006
South Asia	Maharastra	Desasth Brahmin	Indo-European	Indo-Aryan	16	0.19	Sahoo et al. 2006
South Asia	Tamil Nadu	Yadhava	Dravidian		129	0.19	Cordaux et al. 2004a; Wells et al. 2001

Region	Location	Population	Lang Fam	Branch	Sample Size	Frequency Hg H	Reference
South Asia	Maharashtra	Mahadeo Koli	Indo-European	Indo-Aryan	50	0.18	Thangaraj et al. 2010
South Asia	West Bengal	Kharia	Austro-Asiatic		34	0.18	Debnath et al. 2011
South Asia	South India	Pallan	Dravidian		29	0.17	Sengupta et al. 2006
South Asia	Northern India	Rajput	Indo-European	Indo-Aryan	29	0.17	Sengupta et al. 2006
South Asia	Tamil Nadu	Maravar	Dravidian		80	0.17	Arunkumar et al. 2012
South Asia	Tamil Nadu	Pulayar	Dravidian		63	0.17	Arunkumar et al. 2012
South Asia	East India	Ho	Austro-Asiatic		30	0.17	Sengupta et al. 2006
South Asia	Uttar Pradesh	Bhargavas	Indo-European	Indo-Aryan	96	0.17	Zhao et al. 2009
South Asia	Orissa	Karan	Indo-European	Indo-Aryan	18	0.17	Sahoo and Kashyap 2006
South Asia	Andra Pradesh	Andh	Indo-European	Indo-Aryan	54	0.17	Thanseem et al. 2006
South Asia	Uttar Pradesh	Bhargavas	Indo-European	Indo-Aryan	96	0.17	Zhao et al. 2009
South Asia	West Bengal	Bengali	Indo-European	Indo-Aryan	54	0.17	Debnath et al. 2011
Western Europe	Portugal	Roma	Indo-European	Indo-Aryan	126	0.17	Gusmao et al. 2008
South Asia	Orissa	Karan	Indo-European	Indo-Aryan	18	0.17	Sahoo et al. 2006
South Asia	West Bengal	Rajbanshi	Indo-European	Indo-Aryan	45	0.16	Borkar et al. 2011
South Asia	Uttar Pradesh	Brahmin	Indo-European	Indo-Aryan	31	0.16	Sharma et al. 2009
South Asia	Chitwan, Nepal	Tharu	Indo-European	Indo-Aryan	57	0.16	Fornarino et al. 2009
South Asia	Gujarat	Valvi Chaudhari	Indo-European	Indo-Aryan	32	0.16	Khurana et al. 2014
South Asia	Tamil Nadu	Kallar	Dravidian		84	0.15	Cordaux et al. 2004a; Wells et al. 2001
South Asia	Orissa	Saora	Austro-Asiatic		13	0.15	Sahoo et al. 2006
South Asia	West Bengal	Rabha	Sino-Tibetan	Tibeto-Burman	26	0.15	Debnath et al. 2011
South Asia	Tamil Nadu	Sourashtran	Indo-European	Indo-Aryan	46	0.15	Cordaux et al. 2004a; Wells et al. 2001
South Asia	Tamil Nadu	Nadar Cape	Dravidian		98	0.15	Arunkumar et al. 2012
South Asia	Pakistan	Burusho	Isolate		20	0.15	Di Cristofaro et al. 2013

Region	Location	Population	Lang Fam	Branch	Sample Size	Frequency Hg H	Reference
South Asia	West Bengal	Lodha	Austro-Asiatic		47	0.15	Kumar et al. 2007
South Asia	North Pakistan	Burusho	Isolate		20	0.15	Sengupta et al. 2006
South Asia	Bihar	Bhumihar	Indo-European	Indo-Aryan	20	0.15	Sahoo et al. 2006
South Asia	Bihar	Paswan	Indo-European	Indo-Aryan	27	0.15	Sharma et al. 2009
South Asia	Tamil Nadu	Paravar	Dravidian		27	0.15	Arunkumar et al. 2012
South Asia	Kerala	Kurichiya	Dravidian		14	0.14	Cordaux et al. 2004a
South Asia	Kerala	Panyia	Dravidian		7	0.14	Cordaux et al. 2004a
South Asia	Tamil Nadu	Paliyan	Dravidian		95	0.14	Arunkumar et al. 2012
South Asia	Gujarat	Gujarati	Indo-European	Indo-Aryan	29	0.14	Kivisild et al. 2003
Central Asia	Afghanistan	Hazara-Bamiyan	Indo-European	Iranian	69	0.13	Di Cristofaro et al. 2013
South Asia	Morang, Nepal	Tharu	Indo-European	Indo-Aryan	37	0.13	Fornarino et al. 2009
South Asia	Bihar	Yadav	Indo-European	Indo-Aryan	8	0.13	Sahoo et al. 2006
South Asia	Andra Pradesh	Valmiki	Dravidian		24	0.13	Cordaux et al. 2004a; Ramana et al. 2001
South Asia	Tamil Nadu	Thoda	Dravidian		26	0.12	Arunkumar et al. 2012
South Asia	Tamil Nadu	Betta Kurumba	Dravidian		17	0.12	Arunkumar et al. 2012
South Asia	West India	Koknasth Brahmin	Indo-European	Indo-Aryan	25	0.12	Sengupta et al. 2006
South Asia	Uttar Pradesh	Brahmins	Indo-European	Indo-Aryan	118	0.12	Zhao et al. 2009
South Asia	Uttar Pradesh	Brahmins	Indo-European	Indo-Aryan	118	0.12	Zhao et al. 2009
South Asia	West Bengal	Rajbanshi	Indo-European	Indo-Aryan	51	0.12	Debnath et al. 2011
South Asia	West Bengal	Mahishiya	Indo-European	Indo-Aryan	17	0.12	Sahoo et al. 2006
South Asia	Himachal	Brahmin	Indo-European	Indo-Aryan	30	0.11	Sharma et al. 2009
South Asia	Tamil Nadu	Vadama	Indo-European	Indo-Aryan	63	0.11	Arunkumar et al. 2012
South Asia	Uttar Pradesh	Kols	Austro-Asiatic		30	0.11	Sharma et al. 2009
South Asia	Orissa	Bhuiyan	Indo-European	Indo-Aryan	81	0.11	Kumar et al. 2007

Region	Location	Population	Lang Fam	Branch	Sample Size	Frequency Hg H	Reference
Central Asia	Afghanistan	Tajik-Badakhshan	Indo-European	Iranian	37	0.11	Di Cristofaro et al. 2013
Eastern Europe	Taktakoz, Hungary	Roma	Indo-European	Indo-Aryan	19	0.11	Pamjav et al. 2011
South Asia	Sri Lanka	Sinhalese	Indo-European	Indo-Aryan	39	0.10	Kivisild et al. 2003
South Asia	Andra Pradesh	Komati	Dravidian		20	0.10	Sahoo et al. 2006
South Asia	Kashmir	Pandits	Indo-European	Indo-Aryan	51	0.10	Sharma et al. 2009
South Asia	East India	Agharia	Austro-Asiatic		10	0.10	Sengupta et al. 2006
South Asia	Jharkhand	Kharia	Austro-Asiatic		10	0.10	Sahoo et al. 2006
South Asia	Maharashtra	Brahmin	Indo-European	Indo-Aryan	32	0.10	Sharma et al. 2009
South Asia	Kashmir	Gujars	Indo-European	Indo-Aryan	49	0.10	Sharma et al. 2009
South Asia	South India	Iyengar	Dravidian		30	0.10	Sengupta et al. 2006
South Asia	Andra Pradesh	Poroja	Dravidian		20	0.10	Cordaux et al. 2004a; Ramana et al. 2001
South Asia	Pakistan	Pathans	Indo-European	Iranian	20	0.10	Di Cristofaro et al. 2013
South Asia	Bombay	Konkani Brahmins	Indo-European	Indo-Aryan	43	0.09	Kivisild et al. 2003
South Asia	Sikkim	Lachungpa	Sino-Tibetan	Tibeto-Burman	11	0.09	Debnath et al. 2011
South Asia	Northeast India	Apatani	Sino-Tibetan	Tibeto-Burman	33	0.09	Cordaux et al. 2004b
South Asia	Meghalaya	Garo	Sino-Tibetan	Tibeto-Burman	33	0.09	Kumar et al. 2007
South Asia	Tamil Nadu	Iyengar	Indo-European	Indo-Aryan	11	0.09	Arunkumar et al. 2012
Central Asia	Afghanistan	Pashtun-Baghlan	Indo-European	Iranian	34	0.09	Di Cristofaro et al. 2013
South Asia	Andra Pradesh	Bagata	Dravidian		23	0.09	Cordaux et al. 2004a; Ramana et al. 2001
South Asia	Orissa	Brahmin	Indo-European	Indo-Aryan	23	0.09	Sahoo and Kashyap 2006
South Asia	Andhra Pradesh	Banjara (Lambadi)	Indo-European	Iranian	35	0.09	Kivisild et al. 2003

Region	Location	Population	Lang Fam	Branch	Sample Size	Frequency Hg H	Reference
Central Asia	Afghanistan	Tajik-Takhar	Indo-European	Iranian	35	0.09	Di Cristofaro et al. 2013
South Asia	West Bengal	Dhimal	Sino-Tibetan	Tibeto-Burman	36	0.08	Debnath et al. 2011
South Asia	Bihar	Rajput	Indo-European	Indo-Aryan	12	0.08	Sahoo et al. 2006
East Asia	Xingjiang	Uygur	Turkic		48	0.08	Zhong et al. 2011
South Asia	Orissa	Oriya Brahmin	Indo-European	Indo-Aryan	24	0.08	Sahoo et al. 2006
South Asia	Maharashtra	Thakur	Indo-European	Indo-Aryan	48	0.08	Thangaraj et al. 2010
South Asia	Maharashtra	Korku	Austro-Asiatic		59	0.08	Kumar et al. 2007
Central Asia	Afghanistan	Pashtun-Kunduz	Indo-European	Iranian	53	0.08	Di Cristofaro et al. 2013
South Asia	Northern India	Uttar Pradesh Brahmin	Indo-European	Indo-Aryan	14	0.07	Sengupta et al. 2006
Central Asia	Uzbekistan-Karakalpakstan	Turkmen	Turkic		83	0.07	Zhabagin et al. 2017
South Asia	Madhya Pradesh	Brahmin	Indo-European	Indo-Aryan	42	0.07	Sharma et al. 2009
South Asia	Khasi Hills; Jaintia Hills; Meghalaya	Khasi	Austro-Asiatic		92	0.07	Kumar et al. 2007
South Asia	South India	Iyer	Dravidian		29	0.07	Sengupta et al. 2006
South Asia	Gujarat	Pavagadhi Chaudhari	Indo-European	Indo-Aryan	29	0.07	Khurana et al. 2014
South Asia	Uttar Pradesh	Chaturvedis	Indo-European	Indo-Aryan	88	0.07	Zhao et al. 2009
South Asia	Uttar Pradesh	Chaturvedis	Indo-European	Indo-Aryan	88	0.07	Zhao et al. 2009
South Asia	Andra Pradesh	Kamma Chaudhary	Dravidian		15	0.07	Sahoo et al. 2006
Central Asia	Afghanistan	Tajik-Samangan	Indo-European	Iranian	16	0.06	Di Cristofaro et al. 2013
Central Asia	Afghanistan	Pashtun	Indo-European	Iranian	49	0.06	Haber et al. 2012
Middle East	Iran-Mazandaran	Mazandarani	Indo-European	Iranian	72	0.06	Grugni et al. 2012
South Asia	West Bengal	Brahmin	Indo-European	Indo-Aryan	30	0.06	Sharma et al. 2009
South Asia	Andra Pradesh	Lambadi	Indo-European	Iranian	18	0.06	Sahoo et al. 2006

Region	Location	Population	Lang Fam	Branch	Sample Size	Frequency Hg H	Reference
South Asia	East India	West Bengal Brahmin	Indo-European	Indo-Aryan	18	0.06	Sengupta et al. 2006
Central Asia	Afghanistan	Pashtun	Indo-European	Iranian	56	0.05	Haber et al. 2012
South Asia	Sikkim	Lachung	Sino-Tibetan	Tibeto-Burman	20	0.05	Borkar et al. 2011
South Asia	Tamil Nadu	Vanniyar	Dravidian		21	0.05	Arunkumar et al. 2012
East Asia	Guangxi	Hui	Sino-Tibetan	Chinese	62	0.05	Zhong et al. 2011
South Asia	Punjab	Punjabi	Indo-European	Indo-Aryan	66	0.05	Kivisild et al. 2003
Central Asia	Afghanistan	Uzbek-Jawzjan	Turkic		94	0.04	Di Cristofaro et al. 2013
East Asia	Xingjiang	Uygur	Turkic		71	0.04	Zhong et al. 2011
South Asia	Pakistan	Burusho	Isolate		97	0.04	Firasat et al. 2007
Central Asia	Uzbekistan-Tashkent	Uzbeks	Turkic		52	0.04	Zhabagin et al. 2017
South Asia	Pakistan	Balochi	Indo-European	Iranian	25	0.04	Di Cristofaro et al. 2013
South Asia	Pakistan	Brahui	Dravidian		25	0.04	Di Cristofaro et al. 2013
South Asia	Jharkhand	Ho	Austro-Asiatic		28	0.04	Borkar et al. 2011
South Asia	South Pakistan	Brahui	Dravidian		25	0.04	Sengupta et al. 2006
South Asia	South Pakistan	Balochi	Indo-European	Iranian	25	0.04	Sengupta et al. 2006
South Asia	Northeast India	Mizo	Sino-Tibetan	Tibeto-Burman	27	0.04	Sengupta et al. 2006
South Asia	South India	Koya Dora	Dravidian		27	0.04	Sengupta et al. 2006
Central Asia	Afghanistan	Hazara	Indo-European	Iranian	60	0.03	Haber et al. 2012
South Asia	South India	Konda Reddy	Dravidian		30	0.03	Sengupta et al. 2006
South Asia	Northeast India	Jamatia	Sino-Tibetan	Tibeto-Burman	30	0.03	Sengupta et al. 2006
South Asia	Pakistan	Pathan	Indo-European	Iranian	96	0.03	Firasat et al. 2007
South Asia	Jharkhand	Santhal	Austro-Asiatic		90	0.03	Borkar et al. 2011

Region	Location	Population	Lang Fam	Branch	Sample Size	Frequency Hg H	Reference
Middle East	Iran-Khorasan	Persians	Indo-European	Iranian	59	0.03	Grugni et al. 2012
South Asia	Pakistan	Kalash	Indo-European	Indo-Aryan	44	0.03	Firasat et al. 2007
Central Asia	Kyrgyzstan	Kyrgyz-NorthWest	Turkic		37	0.03	Di Cristofaro et al. 2013
South Asia	Andra Pradesh	Kammas	Dravidian		40	0.03	Cordaux et al. 2004a; Ramana et al. 2001
Central Asia	Tajikistan	Tajiks	Indo-European	Iranian	40	0.03	Malyarchuck et al. 2013
East Asia	Ningxia	Jing	Austro-Asiatic		45	0.02	Zhong et al. 2011
Central Asia	Kazakhstan-Shymkent	Kazakhs	Turkic		55	0.02	Zhabagin et al. 2017
Middle East	Iran-Fars+Isfahan	Persians	Indo-European	Iranian	55	0.02	Grugni et al. 2012
Middle East	Iran-Gilan	Gilaki	Indo-European	Iranian	64	0.02	Grugni et al. 2012
South Asia	Gujarat	Brahmin	Indo-European	Indo-Aryan	64	0.02	Sharma et al. 2009
South Asia	Northeast India	Nishi	Sino-Tibetan	Tibeto-Burman	51	0.02	Cordaux et al. 2004b
East Asia	Xingjiang	Hazak	Turkic		53	0.02	Zhong et al. 2011
South Asia	Northeast India	Adi	Sino-Tibetan	Tibeto-Burman	55	0.02	Cordaux et al. 2004b
Middle East	Iran-Golestan	Turkmen	Turkic		68	0.01	Grugni et al. 2012

Table 5.8.2. Survey of H-M69 in Pakistan.

Location	Population	Lang Fam	Branch	Sample Size	Hg H	Reference
North Pakistan	Pathans	Indo-European	Iranian	20	0.20	Sengupta et al. 2006
Pakistan	Kalash	Indo-European	Indo-Aryan	20	0.20	Di Cristofaro et al. 2013
North Pakistan	Burusho	Isolate		20	0.15	Sengupta et al. 2006
Pakistan	Burusho	Isolate		20	0.15	Di Cristofaro et al. 2013
Pakistan	Pathans	Indo-European	Iranian	20	0.10	Di Cristofaro et al. 2013
Pakistan	Burusho	Isolate		97	0.04	Firasat et al. 2007
South Pakistan	Brahui	Dravidian		25	0.04	Sengupta et al. 2006
South Pakistan	Balochi	Indo-European	Iranian	25	0.04	Sengupta et al. 2006
Pakistan	Brahui	Dravidian		25	0.04	Di Cristofaro et al. 2013
Pakistan	Balochi	Indo-European	Iranian	25	0.04	Di Cristofaro et al. 2013
Pakistan	Pathan	Indo-European	Iranian	96	0.03	Firasat et al. 2007
Pakistan	Kalash	Indo-European	Indo-Aryan	44	0.03	Firasat et al. 2007

Table 5.8.3. H-M69 and India.

Region	Location	Population	Lang Fam	Branch	Sample Size	Hg H	Reference
South Asia	Karnataka	Koraga	Dravidian		33	0.88	Cordaux et al. 2004a
South Asia	Central India	Muria	Dravidian		20	0.80	Sengupta et al. 2006
South Asia	West Bengal	Oraon	Dravidian		31	0.71	Debnath et al. 2011
South Asia	Andhra Pradesh	Koya	Dravidian		41	0.71	Kivisild et al. 2003
South Asia	Tamil Nadu	Kurumba	Dravidian		35	0.69	Arunkumar et al. 2012
South Asia	Gujarat	Mota Chaudhari	Indo-European	Indo-Aryan	27	0.67	Khurana et al. 2014
South Asia	Gujarat	Vasava	Indo-European	Indo-Aryan	24	0.63	Khurana et al. 2014
South Asia	Madhya Pradesh	Gonds	Dravidian		31	0.62	Sharma et al. 2009
South Asia	Gujarat	Nana Chaudhari	Indo-European	Indo-Aryan	25	0.60	Khurana et al. 2014
South Asia	Uttar Pradesh	Gonds	Dravidian		38	0.59	Sharma et al. 2009
South Asia	Tamil Nadu	Kattunaickan	Dravidian		46	0.58	Arunkumar et al. 2012
South Asia	Jharkhand; Chattisgarh	Oraon	Dravidian		91	0.57	Kumar et al. 2007
South Asia	South India	Ambalakarar	Dravidian		29	0.48	Sengupta et al. 2006
South Asia	Gujarat	Dubla	Indo-European	Indo-Aryan	42	0.48	Khurana et al. 2014
South Asia	Jharkhand	Oraon	Dravidian		110	0.45	Borkar et al. 2011
South Asia	Central India	Kamar	Dravidian		30	0.43	Sengupta et al. 2006
South Asia	West Bengal	Santhal	Austro-Asiatic		51	0.43	Debnath et al. 2011
South Asia	Jharkhand; West Bengal	Mudi	Austro-Asiatic		37	0.43	Kumar et al. 2007
South Asia	West Bengal	Kol	Austro-Asiatic		62	0.42	Debnath et al. 2011
South Asia	South India	Irula	Dravidian		30	0.40	Sengupta et al. 2006

Region	Location	Population	Lang Fam	Branch	Sample Size	Hg H	Reference
South Asia	Jharkhand; West Bengal	Mahali	Austro-Asiatic		25	0.40	Kumar et al. 2007
South Asia	Jharkhand; West Bengal	Santhal	Austro-Asiatic		109	0.39	Kumar et al. 2007
South Asia	Orissa	Bathudi	Indo-European	Indo-Aryan	36	0.39	Kumar et al. 2007
South Asia	Chitwan, Nepal	Tharu	Indo-European	Indo-Aryan	77	0.39	Fornarino et al. 2009
South Asia	Tamil Nadu	Parayar NTN	Dravidian		52	0.39	Arunkumar et al. 2012
South Asia	Andhra Pradesh	Chenchu	Dravidian		41	0.37	Kivisild et al. 2003
South Asia	Tamil Nadu	Irula	Dravidian		80	0.36	Arunkumar et al. 2012
South Asia	Jharkhand	Pahariya	Indo-European	Indo-Aryan	100	0.35	Borkar et al. 2011
South Asia	Jharkhand	Munda	Austro-Asiatic		94	0.34	Borkar et al. 2011
South Asia	Tamil Nadu	Mullukurumba	Dravidian		29	0.34	Arunkumar et al. 2012
South Asia	Gujarat	Dhodia	Indo-European	Indo-Aryan	63	0.33	Khurana et al. 2014
South Asia	Central India	Halba	Indo-European	Indo-Aryan	21	0.33	Sengupta et al. 2006
South Asia	Tamil Nadu	Kota	Dravidian		62	0.33	Arunkumar et al. 2012
South Asia	Jharkhand; West Bengal; Orissa	Kharia	Austro-Asiatic		36	0.33	Kumar et al. 2007
South Asia	Madhya Pradesh	Saharia	Indo-European	Indo-Aryan	57	0.33	Sharma et al. 2009
South Asia	Jharkhand; Chattisgarh	Korwa	Austro-Asiatic		42	0.33	Kumar et al. 2007
South Asia	Andra Pradesh	Naikpod	Dravidian		68	0.32	Thanseem et al. 2006
South Asia	Tamil Nadu	Kadar	Dravidian		28	0.32	Arunkumar et al. 2012

Region	Location	Population	Lang Fam	Branch	Sample Size	Hg H	Reference
South Asia	Jharkhand; West Bengal; Orissa	Savar	Austro-Asiatic		47	0.32	Kumar et al. 2007
South Asia	East India	Lodha	Austro-Asiatic		20	0.30	Sengupta et al. 2006
South Asia	Tamil Nadu	Ezhava	Dravidian		95	0.30	Arunkumar et al. 2012
South Asia	Gujarat	Konkana	Indo-European	Indo-Aryan	24	0.29	Khurana et al. 2014
South Asia	South India	Vellalar	Dravidian		31	0.29	Sengupta et al. 2006
South Asia	Tamil Nadu	Nadar TNV	Dravidian		59	0.29	Arunkumar et al. 2012
South Asia	Chattisgarh	Kanwar	Indo-European	Indo-Aryan	41	0.29	Kumar et al. 2007
South Asia	Jharkhand	Birhor	Austro-Asiatic		100	0.28	Borkar et al. 2011
South Asia	Tamil Nadu	Tamil Jains	Dravidian		100	0.28	Arunkumar et al. 2012
South Asia	Jharkhand; West Bengal	Bhumij	Austro-Asiatic		89	0.27	Kumar et al. 2007
South Asia	Gujarat	Bhils	Indo-European	Indo-Aryan	22	0.27	Sharma et al. 2009
South Asia	Andra Pradesh	Pardhan	Dravidian		128	0.26	Thanseem et al. 2006
South Asia	Orissa	Ho	Austro-Asiatic		79	0.25	Kumar et al. 2007
South Asia	Tamil Nadu	Sourashtra	Indo-European	Indo-Aryan	40	0.25	Arunkumar et al. 2012
South Asia	West India	Maratha	Indo-European	Indo-Aryan	20	0.25	Sengupta et al. 2006
South Asia	Jharkhand; West Bengal; Orissa	Munda	Austro-Asiatic		53	0.25	Kumar et al. 2007
South Asia	Karnataka India	Lingayat	Dravidian		101	0.25	Chennakrishnaiah et al. 2013
South Asia	Tamil Nadu	Yadhava	Dravidian		107	0.24	Arunkumar et al. 2012
South Asia	South India	Vanniyar	Dravidian		25	0.24	Sengupta et al. 2006

Region	Location	Population	Lang Fam	Branch	Sample Size	Hg H	Reference
South Asia	Jharkhand; West Bengal; Orissa	Birhor	Austro-Asiatic		38	0.24	Kumar et al. 2007
South Asia	Karnataka India	Vokkaliga	Dravidian		102	0.24	Chennakrishnaiah et al. 2013
South Asia	Tamil Nadu	Piramalai Kallar	Dravidian		53	0.23	Arunkumar et al. 2012
South Asia	Jharkhand	Asur	Austro-Asiatic		55	0.22	Kumar et al. 2007
South Asia	Chattisgarh	Pando	Indo-European	Indo-Aryan	23	0.22	Kumar et al. 2007
South Asia	Tamil Nadu	Parayar	Dravidian		24	0.21	Arunkumar et al. 2012
South Asia	Tamil Nadu	Brahacharanam	Indo-European	Indo-Aryan	21	0.20	Arunkumar et al. 2012
South Asia	Tamil Nadu	Vanniyar NTN	Dravidian		96	0.20	Arunkumar et al. 2012
South Asia	Tamil Nadu	Valayar	Dravidian		95	0.20	Arunkumar et al. 2012
South Asia	Tamil Nadu	Pallar	Dravidian		51	0.20	Arunkumar et al. 2012
South Asia	Southern India	Yerava	Dravidian		41	0.20	Cordaux et al. 2004a
South Asia	Andra Pradesh	Vizag Brahmins	Dravidian		41	0.20	Cordaux et al. 2004a; Ramana et al. 2001
South Asia	Orissa	Saora	Austro-Asiatic		21	0.19	Sahoo and Kashyap 2006
South Asia	Tamil Nadu	Yadhava	Dravidian		129	0.19	Cordaux et al. 2004a; Wells et al. 2001
South Asia	Maharashtra	Mahadeo Koli	Indo-European	Indo-Aryan	50	0.18	Thangaraj et al. 2010
South Asia	West Bengal	Kharia	Austro-Asiatic		34	0.18	Debnath et al. 2011
South Asia	Northern India	Rajput	Indo-European	Indo-Aryan	29	0.17	Sengupta et al. 2006
South Asia	South India	Pallan	Dravidian		29	0.17	Sengupta et al. 2006
South Asia	Tamil Nadu	Maravar	Dravidian		80	0.17	Arunkumar et al. 2012
South Asia	Tamil Nadu	Pulayar	Dravidian		63	0.17	Arunkumar et al. 2012
South Asia	Uttar Pradesh	Bhargavas	Indo-European	Indo-Aryan	96	0.17	Zhao et al. 2009
South Asia	East India	Ho	Austro-Asiatic		30	0.17	Sengupta et al. 2006

Region	Location	Population	Lang Fam	Branch	Sample Size	Hg H	Reference
South Asia	Andra Pradesh	Andh	Indo-European	Indo-Aryan	54	0.17	Thanseem et al. 2006
South Asia	Uttar Pradesh	Bhargavas	Indo-European	Indo-Aryan	96	0.17	Zhao et al. 2009
South Asia	West Bengal	Bengali	Indo-European	Indo-Aryan	54	0.17	Debnath et al. 2011
South Asia	Uttar Pradesh	Brahmin	Indo-European	Indo-Aryan	31	0.16	Sharma et al. 2009
South Asia	Chitwan, Nepal	Tharu	Indo-European	Indo-Aryan	57	0.16	Fornarino et al. 2009
South Asia	West Bengal	Rajbanshi	Indo-European	Indo-Aryan	45	0.16	Borkar et al. 2011
South Asia	Gujarat	Valvi Chaudhari	Indo-European	Indo-Aryan	32	0.16	Khurana et al. 2014
South Asia	Tamil Nadu	Kallar	Dravidian		84	0.15	Cordaux et al. 2004a; Wells et al. 2001
South Asia	West Bengal	Rabha	Sino-Tibetan	Tibeto-Burman	26	0.15	Debnath et al. 2011
South Asia	Tamil Nadu	Sourashtran	Indo-European	Indo-Aryan	46	0.15	Cordaux et al. 2004a; Wells et al. 2001
South Asia	Tamil Nadu	Nadar Cape	Dravidian		98	0.15	Arunkumar et al. 2012
South Asia	Bihar	Paswan	Indo-European	Indo-Aryan	27	0.15	Sharma et al. 2009
South Asia	Tamil Nadu	Paravar	Dravidian		27	0.15	Arunkumar et al. 2012
South Asia	West Bengal	Lodha	Austro-Asiatic		47	0.15	Kumar et al. 2007
South Asia	Bihar	Bhumihar	Indo-European	Indo-Aryan	20	0.15	Sahoo et al. 2006
South Asia	Tamil Nadu	Paliyan	Dravidian		95	0.14	Arunkumar et al. 2012
South Asia	Gujarat	Gujarati	Indo-European	Indo-Aryan	29	0.14	Kivisild et al. 2003
South Asia	Andra Pradesh	Valmiki	Dravidian		24	0.13	Cordaux et al. 2004a; Ramana et al. 2001
South Asia	West India	Koknasth Brahmin	Indo-European	Indo-Aryan	25	0.12	Sengupta et al. 2006
South Asia	Tamil Nadu	Thoda	Dravidian		26	0.12	Arunkumar et al. 2012
South Asia	Uttar Pradesh	Brahmins	Indo-European	Indo-Aryan	118	0.12	Zhao et al. 2009
South Asia	Uttar Pradesh	Brahmins	Indo-European	Indo-Aryan	118	0.12	Zhao et al. 2009

Region	Location	Population	Lang Fam	Branch	Sample Size	Hg H	Reference
South Asia	West Bengal	Rajbanshi	Indo-European	Indo-Aryan	51	0.12	Debnath et al. 2011
South Asia	Orissa	Bhuiyan	Indo-European	Indo-Aryan	81	0.11	Kumar et al. 2007
South Asia	Tamil Nadu	Vadama	Indo-European	Indo-Aryan	63	0.11	Arunkumar et al. 2012
South Asia	Uttar Pradesh	Kols	Austro-Asiatic		30	0.11	Sharma et al. 2009
South Asia	Himachal	Brahmin	Indo-European	Indo-Aryan	30	0.11	Sharma et al. 2009
South Asia	Andra Pradesh	Komati	Dravidian		20	0.10	Sahoo et al. 2006
South Asia	Kashmir	Pandits	Indo-European	Indo-Aryan	51	0.10	Sharma et al. 2009
South Asia	Kashmir	Gujars	Indo-European	Indo-Aryan	49	0.10	Sharma et al. 2009
South Asia	Andra Pradesh	Poroja	Dravidian		20	0.10	Cordaux et al. 2004a; Ramana et al. 2001
South Asia	Maharashtra	Brahmin	Indo-European	Indo-Aryan	32	0.10	Sharma et al. 2009
South Asia	South India	Iyengar	Dravidian		30	0.10	Sengupta et al. 2006
South Asia	Bombay	Konkani Brahmins	Indo-European	Indo-Aryan	43	0.09	Kivisild et al. 2003
South Asia	Northeast India	Apatani	Sino-Tibetan	Tibeto-Burman	33	0.09	Cordaux et al. 2004b
South Asia	Meghalaya	Garo	Sino-Tibetan	Tibeto-Burman	33	0.09	Kumar et al. 2007
South Asia	Orissa	Brahmin	Indo-European	Indo-Aryan	23	0.09	Sahoo and Kashyap 2006
South Asia	Andra Pradesh	Bagata	Dravidian		23	0.09	Cordaux et al. 2004a; Ramana et al. 2001
South Asia	Andhra Pradesh	Banjara (Lambadi)	Indo-European	Iranian	35	0.09	Kivisild et al. 2003
South Asia	West Bengal	Dhimal	Sino-Tibetan	Tibeto-Burman	36	0.08	Debnath et al. 2011
South Asia	Orissa	Oriya Brahmin	Indo-European	Indo-Aryan	24	0.08	Sahoo et al. 2006
South Asia	Maharashtra	Korku	Austro-Asiatic		59	0.08	Kumar et al. 2007

Region	Location	Population	Lang Fam	Branch	Sample Size	Hg H	Reference
South Asia	Maharashtra	Thakur	Indo-European	Indo-Aryan	48	0.08	Thangaraj et al. 2010
South Asia	Khasi Hills; Jaintia Hills; Meghalaya	Khasi	Austro-Asiatic		92	0.07	Kumar et al. 2007
South Asia	Madhya Pradesh	Brahmin	Indo-European	Indo-Aryan	42	0.07	Sharma et al. 2009
South Asia	Gujarat	Pavagadhi Chaudhari	Indo-European	Indo-Aryan	29	0.07	Khurana et al. 2014
South Asia	South India	Iyer	Dravidian		29	0.07	Sengupta et al. 2006
South Asia	Uttar Pradesh	Chaturvedis	Indo-European	Indo-Aryan	88	0.07	Zhao et al. 2009
South Asia	Uttar Pradesh	Chaturvedis	Indo-European	Indo-Aryan	88	0.07	Zhao et al. 2009
South Asia	West Bengal	Brahmin	Indo-European	Indo-Aryan	30	0.06	Sharma et al. 2009
South Asia	Tamil Nadu	Vanniyar	Dravidian		21	0.05	Arunkumar et al. 2012
South Asia	Sikkim	Lachung	Sino-Tibetan	Tibeto-Burman	20	0.05	Borkar et al. 2011
South Asia	Punjab	Punjabi	Indo-European	Indo-Aryan	66	0.05	Kivisild et al. 2003
South Asia	Jharkhand	Ho	Austro-Asiatic		28	0.04	Borkar et al. 2011
South Asia	South India	Koya Dora	Dravidian		27	0.04	Sengupta et al. 2006
South Asia	Northeast India	Mizo	Sino-Tibetan	Tibeto-Burman	27	0.04	Sengupta et al. 2006
South Asia	South India	Konda Reddy	Dravidian		30	0.03	Sengupta et al. 2006
South Asia	Northeast India	Jamatia	Sino-Tibetan	Tibeto-Burman	30	0.03	Sengupta et al. 2006
South Asia	Jharkhand	Santhal	Austro-Asiatic		90	0.03	Borkar et al. 2011
South Asia	Andra Pradesh	Kammas	Dravidian		40	0.03	Cordaux et al. 2004a; Ramana et al. 2001
South Asia	Gujarat	Brahmin	Indo-European	Indo-Aryan	64	0.02	Sharma et al. 2009

Region	Location	Population	Lang Fam	Branch	Sample Size	Hg H	Reference
South Asia	Northeast India	Nishi	Sino-Tibetan	Tibeto-Burman	51	0.02	Cordaux et al. 2004b
South Asia	Northeast India	Adi	Sino-Tibetan	Tibeto-Burman	55	0.02	Cordaux et al. 2004b

Table 5.8.4. Indo-European Populations of South Asia and H-M69.

Population	Location	Branch	Sample Size	No. H-M69	Freq. H-M69	Reference
Mota Chaudhari	Gujarat	Indo-Aryan	27	18	0.67	Khurana et al. 2014
Vasava	Gujarat	Indo-Aryan	24	15	0.63	Khurana et al. 2014
Nana Chaudhari	Gujarat	Indo-Aryan	25	15	0.60	Khurana et al. 2014
Dubla	Gujarat	Indo-Aryan	42	20	0.48	Khurana et al. 2014
Tharu	Chitwan, Nepal	Indo-Aryan	77	30	0.39	Fornarino et al. 2009
Bathudi	Orissa	Indo-Aryan	36	14	0.39	Kumar et al. 2007
Pahariya	Jharkhand	Indo-Aryan	100	35	0.35	Borkar et al. 2011
Dhodia	Gujarat	Indo-Aryan	63	21	0.33	Khurana et al. 2014
Halba	Central India	Indo-Aryan	21	7	0.33	Sengupta et al. 2006
Saharia	Madhya Pradesh	Indo-Aryan	57	19	0.33	Sharma et al. 2009
Konkana	Gujarat	Indo-Aryan	24	7	0.29	Khurana et al. 2014
Kanwar	Chattisgarh	Indo-Aryan	41	12	0.29	Kumar et al. 2007
Bhils	Gujarat	Indo-Aryan	22	6	0.27	Sharma et al. 2009
Sourashtra	Tamil Nadu	Indo-Aryan	40	10	0.25	Arunkumar et al. 2012
Maratha	West India	Indo-Aryan	20	5	0.25	Sengupta et al. 2006
Pando	Chattisgarh	Indo-Aryan	23	5	0.22	Kumar et al. 2007
Brahacharanam	Tamil Nadu	Indo-Aryan	21	4	0.20	Arunkumar et al. 2012
Pathans	North Pakistan	Iranian	20	4	0.20	Sengupta et al. 2006
Kalash	Pakistan	Indo-Aryan	20	4	0.20	Di Cristofaro et al. 2013
Mahadeo Koli	Maharashtra	Indo-Aryan	50	9	0.18	Thangaraj et al. 2010
Rajput	Northern India	Indo-Aryan	29	5	0.17	Sengupta et al. 2006
Bengali	West Bengal	Indo-Aryan	54	9	0.17	Debnath et al. 2011
Bhargavas	Uttar Pradesh	Indo-Aryan	96	16	0.17	Zhao et al. 2009

Population	Location	Branch	Sample Size	No. H-M69	Freq. H-M69	Reference
Bhargavas	Uttar Pradesh	Indo-Aryan	96	16	0.17	Zhao et al. 2009
Andh	Andra Pradesh	Indo-Aryan	54	9	0.17	Thanseem et al. 2006
Rajbanshi	West Bengal	Indo-Aryan	45	7	0.16	Borkar et al. 2011
Tharu	Chitwan, Nepal	Indo-Aryan	57	9	0.16	Fornarino et al. 2009
Brahmin	Uttar Pradesh	Indo-Aryan	31	5	0.16	Sharma et al. 2009
Valvi Chaudhari	Gujarat	Indo-Aryan	32	5	0.16	Khurana et al. 2014
Sourashtran	Tamil Nadu	Indo-Aryan	46	7	0.15	Cordaux et al. 2004a; Wells et al. 2001
Bhumihar	Bihar	Indo-Aryan	20	3	0.15	Sahoo et al. 2006
Paswan	Bihar	Indo-Aryan	27	4	0.15	Sharma et al. 2009
Gujarati	Gujarat	Indo-Aryan	29	4	0.14	Kivisild et al. 2003
Tharu	Morang, Nepal	Indo-Aryan	37	5	0.13	Fornarino et al. 2009
Koknasth Brahmin	West India	Indo-Aryan	25	3	0.12	Sengupta et al. 2006
Brahmins	Uttar Pradesh	Indo-Aryan	118	14	0.12	Zhao et al. 2009
Brahmins	Uttar Pradesh	Indo-Aryan	118	14	0.12	Zhao et al. 2009
Rajbanshi	West Bengal	Indo-Aryan	51	6	0.12	Debnath et al. 2011
Bhuiyan	Orissa	Indo-Aryan	81	9	0.11	Kumar et al. 2007
Brahmin	Himachal	Indo-Aryan	30	3	0.11	Sharma et al. 2009
Vadama	Tamil Nadu	Indo-Aryan	63	7	0.11	Arunkumar et al. 2012
Sinhalese	Sri Lanka	Indo-Aryan	39	4	0.10	Kivisild et al. 2003
Brahmin	Maharashtra	Indo-Aryan	32	3	0.10	Sharma et al. 2009
Pathans	Pakistan	Iranian	20	2	0.10	Di Cristofaro et al. 2013
Pandits	Kashmir	Indo-Aryan	51	5	0.10	Sharma et al. 2009
Gujars	Kashmir	Indo-Aryan	49	5	0.10	Sharma et al. 2009
Konkani Brahmins	Bombay	Indo-Aryan	43	4	0.09	Kivisild et al. 2003
Brahmin	Orissa	Indo-Aryan	23	2	0.09	Sahoo and Kashyap 2006

Population	Location	Branch	Sample Size	No. H-M69	Freq. H-M69	Reference
Banjara (Lambadi)	Andhra Pradesh	Iranian	35	3	0.09	Kivisild et al. 2003
Oriya Brahmin	Orissa	Indo-Aryan	24	2	0.08	Sahoo et al. 2006
Thakur	Maharashtra	Indo-Aryan	48	4	0.08	Thangaraj et al. 2010
Brahmin	Madhya Pradesh	Indo-Aryan	42	3	0.07	Sharma et al. 2009
Pavagadhi Chaudhari	Gujarat	Indo-Aryan	29	2	0.07	Khurana et al. 2014
Chaturvedis	Uttar Pradesh	Indo-Aryan	88	6	0.07	Zhao et al. 2009
Chaturvedis	Uttar Pradesh	Indo-Aryan	88	6	0.07	Zhao et al. 2009
Brahmin	West Bengal	Indo-Aryan	30	2	0.06	Sharma et al. 2009
Punjabi	Punjab	Indo-Aryan	66	3	0.05	Kivisild et al. 2003
Balochi	South Pakistan	Iranian	25	1	0.04	Sengupta et al. 2006
Balochi	Pakistan	Iranian	25	1	0.04	Di Cristofaro et al. 2013
Pathan	Pakistan	Iranian	96	3	0.03	Firasat et al. 2007
Kalash	Pakistan	Indo-Aryan	44	1	0.03	Firasat et al. 2007
Brahmin	Gujarat	Indo-Aryan	64	1	0.02	Sharma et al. 2009

Total Samples	2853	Total Hg. H-M69	483	Lang Fam Freq.	0.17

Table 5.8.5. Dravidian Populations of South Asia and H-M69.

Population	Location	Sample Size	No. H-M69	Freq. H-M69	Reference
Koraga	Karnataka	33	29	0.88	Cordaux et al. 2004a
Muria	Central India	20	16	0.80	Sengupta et al. 2006
Oraon	West Bengal	31	22	0.71	Debnath et al. 2011
Koya	Andhra Pradesh	41	29	0.71	Kivisild et al. 2003
Kurumba	Tamil Nadu	35	24	0.69	Arunkumar et al. 2012
Gonds	Madhya Pradesh	31	19	0.62	Sharma et al. 2009
Gonds	Uttar Pradesh	38	22	0.59	Sharma et al. 2009
Kattunaickan	Tamil Nadu	46	27	0.58	Arunkumar et al. 2012
Oraon	Jharkhand; Chattisgarh	91	52	0.57	Kumar et al. 2007
Ambalakarar	South India	29	14	0.48	Sengupta et al. 2006
Oraon	Jharkhand	110	50	0.45	Borkar et al. 2011
Kamar	Central India	30	13	0.43	Sengupta et al. 2006
Irula	South India	30	12	0.40	Sengupta et al. 2006
Parayar NTN	Tamil Nadu	52	20	0.39	Arunkumar et al. 2012
Chenchu	Andhra Pradesh	41	15	0.37	Kivisild et al. 2003
Irula	Tamil Nadu	80	29	0.36	Arunkumar et al. 2012
Mullukurumba	Tamil Nadu	29	10	0.34	Arunkumar et al. 2012
Kota	Tamil Nadu	62	20	0.33	Arunkumar et al. 2012
Naikpod	Andra Pradesh	68	22	0.32	Thanseem et al. 2006
Kadar	Tamil Nadu	28	9	0.32	Arunkumar et al. 2012
Ezhava	Tamil Nadu	95	29	0.30	Arunkumar et al. 2012
Vellalar	South India	31	9	0.29	Sengupta et al. 2006

Population	Location	Sample Size	No. H-M69	Freq. H-M69	Reference
Nadar TNV	Tamil Nadu	59	17	0.29	Arunkumar et al. 2012
Tamil Jains	Tamil Nadu	100	28	0.28	Arunkumar et al. 2012
Pardhan	Andra Pradesh	128	33	0.26	Thanseem et al. 2006
Lingayat	Karnataka India	101	25	0.25	Chennakrishnaiah et al. 2013
Yadhava	Tamil Nadu	107	26	0.24	Arunkumar et al. 2012
Vanniyar	South India	25	6	0.24	Sengupta et al. 2006
Vokkaliga	Karnataka India	102	24	0.24	Chennakrishnaiah et al. 2013
Piramalai Kallar	Tamil Nadu	53	12	0.23	Arunkumar et al. 2012
Parayar	Tamil Nadu	24	5	0.21	Arunkumar et al. 2012
Vanniyar NTN	Tamil Nadu	96	19	0.20	Arunkumar et al. 2012
Valayar	Tamil Nadu	95	19	0.20	Arunkumar et al. 2012
Pallar	Tamil Nadu	51	10	0.20	Arunkumar et al. 2012
Yerava	Southern India	41	8	0.20	Cordaux et al. 2004a
Vizag Brahmins	Andra Pradesh	41	8	0.20	Cordaux et al. 2004a; Ramana et al. 2001
Yadhava	Tamil Nadu	129	24	0.19	Cordaux et al. 2004a; Wells et al. 2001
Pallan	South India	29	5	0.17	Sengupta et al. 2006
Maravar	Tamil Nadu	80	14	0.17	Arunkumar et al. 2012
Pulayar	Tamil Nadu	63	11	0.17	Arunkumar et al. 2012
Kallar	Tamil Nadu	84	13	0.15	Cordaux et al. 2004a; Wells et al. 2001
Nadar Cape	Tamil Nadu	98	15	0.15	Arunkumar et al. 2012
Paravar	Tamil Nadu	27	4	0.15	Arunkumar et al. 2012
Paliyan	Tamil Nadu	95	13	0.14	Arunkumar et al. 2012
Valmiki	Andra Pradesh	24	3	0.13	Cordaux et al. 2004a; Ramana et al. 2001
Thoda	Tamil Nadu	26	3	0.12	Arunkumar et al. 2012
Komati	Andra Pradesh	20	2	0.10	Sahoo et al. 2006

Population	Location	Sample Size	No. H-M69	Freq. H-M69	Reference
Iyengar	South India	30	3	0.10	Sengupta et al. 2006
Poroja	Andra Pradesh	20	2	0.10	Cordaux et al. 2004a; Ramana et al. 2001
Bagata	Andra Pradesh	23	2	0.09	Cordaux et al. 2004a; Ramana et al. 2001
Iyer	South India	29	2	0.07	Sengupta et al. 2006
Vanniyar	Tamil Nadu	21	1	0.05	Arunkumar et al. 2012
Brahui	South Pakistan	25	1	0.04	Sengupta et al. 2006
Brahui	Pakistan	25	1	0.04	Di Cristofaro et al. 2013
Koya Dora	South India	27	1	0.04	Sengupta et al. 2006
Konda Reddy	South India	30	1	0.03	Sengupta et al. 2006
Kammas	Andra Pradesh	40	1	0.03	Cordaux et al. 2004a; Ramana et al. 2001

Total Sample	3019	Total Hg. H-M69	854	Lang Fam Freq.	0.28

Table 5.8.6. Austro-Asiatic Populations of South Asia and H-M69.

Population	Location	Sample Size	No. H-M69	Freq. H-M69	Reference
Kol	West Bengal	62	26	0.42	Debnath et al. 2011
Santhal	West Bengal	51	22	0.43	Debnath et al. 2011
Kharia	West Bengal	34	6	0.18	Debnath et al. 2011
Saora	Orissa	21	4	0.19	Sahoo and Kashyap 2006
Ho	East India	30	5	0.17	Sengupta et al. 2006
Lodha	East India	20	6	0.30	Sengupta et al. 2006
Munda	Jharkhand	94	32	0.34	Borkar et al. 2011
Birhor	Jharkhand	100	28	0.28	Borkar et al. 2011
Santhal	Jharkhand	90	3	0.03	Borkar et al. 2011
Ho	Jharkhand	28	1	0.04	Borkar et al. 2011
Kols	Uttar Pradesh	30	3	0.11	Sharma et al. 2009
Santhal	Jharkhand; West Bengal	109	43	0.39	Kumar et al. 2007
Bhumij	Jharkhand; West Bengal	89	24	0.27	Kumar et al. 2007
Mudi	Jharkhand; West Bengal	37	16	0.43	Kumar et al. 2007
Mahali	Jharkhand; West Bengal	25	10	0.40	Kumar et al. 2007
Asur	Jharkhand	55	12	0.22	Kumar et al. 2007
Birhor	Jharkhand; West Bengal; Orissa	38	9	0.24	Kumar et al. 2007
Munda	Jharkhand; West Bengal; Orissa	53	13	0.25	Kumar et al. 2007
Ho	Orissa	79	20	0.25	Kumar et al. 2007

Population	Location	Sample Size	No. H-M69	Freq. H-M69	Reference
Korwa	Jharkhand; Chattisgarh	42	14	0.33	Kumar et al. 2007
Korku	Maharashtra	59	5	0.08	Kumar et al. 2007
Kharia	Jharkhand; West Bengal; Orissa	36	12	0.33	Kumar et al. 2007
Savar	Jharkhand; West Bengal; Orissa	47	15	0.32	Kumar et al. 2007
Lodha	West Bengal	47	7	0.15	Kumar et al. 2007
Khasi	Khasi Hills; Jaintia Hills; Meghalaya	92	6	0.07	Kumar et al. 2007

Total Sample	1368	Total Hg. H-M69	342	Lang Fam Freq.	0.25

Table 5.8.7. Tibeto-Burman Populations of South Asia and H-M69.

Population	Location	Branch	Sample Size	No. H-M69	Freq. H-M69	Reference
Rabha	West Bengal	Tibeto-Burman	26	4	0.15	Debnath et al. 2011
Apatani	Northeast India	Tibeto-Burman	33	3	0.09	Cordaux et al. 2004b
Garo	Meghalaya	Tibeto-Burman	33	3	0.09	Kumar et al. 2007
Dhimal	West Bengal	Tibeto-Burman	36	3	0.08	Debnath et al. 2011
Lachung	Sikkim	Tibeto-Burman	20	1	0.05	Borkar et al. 2011
Mizo	Northeast India	Tibeto-Burman	27	1	0.04	Sengupta et al. 2006
Jamatia	Northeast India	Tibeto-Burman	30	1	0.03	Sengupta et al. 2006
Nishi	Northeast India	Tibeto-Burman	51	1	0.02	Cordaux et al. 2004b
Adi	Northeast India	Tibeto-Burman	55	1	0.02	Cordaux et al. 2004b

Total Sample	311	Total Hg. H-M69	18	Lang Branch Freq.	0.06

Table 5.8.8. South Asian Languages and H-M69: Comparison of Previously Published Frequency Data with Present Report.

	Sengupta et al. 2006 n = 709	Trivedi et al. 2007 n = 1,152	Present Report n = 7,551
Frequency of H-M69 for Indo-European populations.	.28	.26	.17
Frequency of H-M69 for Dravidian populations.	.33	.30	.28
Frequency of H-M69 for Austro-Asiatic populations.	.23	.06	.25
Frequency of H-M69 for Tibeto-Burman populations.	.02	.10	.06

Table 5.8.9. Survey of H-M69 Populations in South Asia, East Asia and the Middle East.

Region	Location	Population	Lang Fam	Branch	Sample Size	Hg H	Reference
Central Asia	Afghanistan	Hazara-Bamiyan	Indo-European	Iranian	69	0.13	Di Cristofaro et al. 2013
Central Asia	Afghanistan	Tajik-Badakhshan	Indo-European	Iranian	37	0.11	Di Cristofaro et al. 2013
Central Asia	Afghanistan	Pashtun-Baghlan	Indo-European	Iranian	34	0.09	Di Cristofaro et al. 2013
Central Asia	Afghanistan	Tajik-Takhar	Indo-European	Iranian	35	0.09	Di Cristofaro et al. 2013
East Asia	Xingjiang	Uygur	Turkic		48	0.08	Zhong et al. 2011
Central Asia	Afghanistan	Pashtun-Kunduz	Indo-European	Iranian	53	0.08	Di Cristofaro et al. 2013
Central Asia	Uzbekistan-Karakalpakstan	Turkmen	Turkic		83	0.07	Zhabagin et al. 2017
Central Asia	Afghanistan	Tajik-Samangan	Indo-European	Iranian	16	0.06	Di Cristofaro et al. 2013
Central Asia	Afghanistan	Pashtun	Indo-European	Iranian	49	0.06	Haber et al. 2012
Middle East	Iran-Mazandaran	Mazandarani	Indo-European	Iranian	72	0.06	Grugni et al. 2012
Central Asia	Afghanistan	Pashtun	Indo-European	Iranian	56	0.05	Haber et al. 2012
East Asia	Guangxi	Hui	Sino-Tibetan	Chinese	62	0.05	Zhong et al. 2011
Central Asia	Afghanistan	Uzbek-Jawzjan	Turkic		94	0.04	Di Cristofaro et al. 2013
East Asia	Xingjiang	Uygur	Turkic		71	0.04	Zhong et al. 2011
Central Asia	Uzbekistan-Tashkent	Uzbeks	Turkic		52	0.04	Zhabagin et al. 2017
Central Asia	Afghanistan	Hazara	Indo-European	Iranian	60	0.03	Haber et al. 2012
Middle East	Iran-Khorasan	Persians	Indo-European	Iranian	59	0.03	Grugni et al. 2012
Central Asia	Kyrgyzstan	Kyrgyz-NorthWest	Turkic		37	0.03	Di Cristofaro et al. 2013
Central Asia	Tajikistan	Tajiks	Indo-European	Iranian	40	0.03	Malyarchuck et al. 2013

Region	Location	Population	Lang Fam	Branch	Sample Size	Hg H	Reference
East Asia	Ningxia	Jing	Austro-Asiatic		45	0.02	Zhong et al. 2011
Central Asia	Kazakhstan-Shymkent	Kazakhs	Turkic		55	0.02	Zhabagin et al. 2017
Middle East	Iran-Fars+Isfahan	Persians	Indo-European	Iranian	55	0.02	Grugni et al. 2012
Middle East	Iran-Gilan	Gilaki	Indo-European	Iranian	64	0.02	Grugni et al. 2012
East Asia	Xingjiang	Hazak	Turkic		53	0.02	Zhong et al. 2011
Middle East	Iran-Golestan	Turkmen	Turkic		68	0.01	Grugni et al. 2012

Table 5.8.10. H-M69 and European Romani.

Location	Sample Size	Hg H	Reference
Macedonia	57	0.60	Peričić et al. 2005
Tiszavasvari, Hungary	29	0.59	Pamjav et al. 2011
Slovakia	200	0.40	Petrejčíková et al. 2009
Hungary	107	0.32	Pamjav et al. 2011
Slovakia	62	0.31	Pamjav et al. 2011
Tokaj, Hungary	39	0.21	Pamjav et al. 2011
Portugal	126	0.17	Gusmao et al. 2008
Taktakoz, Hungary	19	0.11	Pamjav et al. 2011

Bibliography for Tables

Arunkumar, Ganesh Prasad et al. 2012. "Population differentiation of southern Indian male lineages correlates with agricultural expansions predating the caste system." *Public Library of Science One* 7(11): e50269.

Borkar, Minal et al. 2011. "Paleolithic spread of Y-chromosomal lineage of tribes in eastern and northeastern India." *Annals of Human Biology* 38(6): 736–746.

Chennakrishnaiah, et al. 2013. "Indigenous and foreign Y-chromosomes characterize the Lingayat and Vokkaliga populations of Southwest India." *Gene* 526: 96-106.

Cordaux, Richard et al. 2004. "Independent origins of Indian caste and tribal paternal lineages." *Current Biology* 14: 231-235.

Debnath, Monojit et al. 2011. "Y-chromosome haplogroup diversity in the sub-Himalayan Terai and Duars populations of East India." *Journal of Human Genetics* 56: 765-771.

Di Cristofaro, Julie et al. 2013. "Afghan Hindu Kush: where Eurasian Sub-Continent gene flows converge." *Public Library of Science One* 8(10): e76748.

Firasat, Sadaf et al. 2007. "Y-chromosomal evidence for a limited Greek contribution to the Pathan population of Pakistan." *European Journal of Human Genetics* 15: 121-126.

Fornarino, Simona et al. 2009. "Mitochondria and Y-chromosome diversity of the Tharus (Nepal): a reservoir of genetic variation." *BioMed Central Evolutionary Biology* 9:154.

Gusmão, Al. et al. 2008. "A perspective on the history of the Iberian gypsies provided by phylogenetic analysis of Y-chromosome lineages." *Annals of Human Genetics* 72: 215-227.

Grugni, Viola et al. 2012. "Ancient migratory events in the Middle East: new clues from the Y-Chromosome variation of modern Iranians." *Public Library of Science One* 7(7): e41252.

Haber, Marc et al. 2012. "Afghanistan's ethnic groups share a Y-chromosomal heritage structured by historical events." *Public Library of Science One* 7(3): e34288.

Khurana, Priyanka et al. 2014. "Y Chromosome Haplogroup Distribution in Indo-European Speaking Tribes of Gujarat, Western India." *Public Library of Science One* 9(3): e90414.

Kivisild, T. et al. 2003. "The genetic heritage of the earliest settlers persists both in Indian tribal and caste populations." *American Journal of Human Genetics* 72: 313-332.

Kumar, Vikrant et al. 2007. "Y-chromosome evidence suggests a common paternal heritage of Austro-Asiatic populations." *BioMed Central Evolutionary Biology* 7: 47.

Malyarchuk, Boris et al. 2013. "Y-chromosome variation in Tajiks and Iranians." *Annals of Human Biology* 40(1): 48-54.

Pamjav, Horolma et al. 2011. "Genetic structure of the parental lineage of the Roma people." *American Journal of Physical Anthropology* 145: 21-29.

Peričić, Marijana et al. 2005. "High-resolution phylogenetic analysis of southeastern Europe traces major episodes of paternal gene flow among Slavic populations." *Molecular Biology and Evolution* 22(10): 1964-1975.

Petrejčíková, Eva et al. 2009**.** "Y-haplogroup frequencies in the Slovak Romany population." *Anthropological Science* 117(2): 89-94.

Ramana, Gutala Venkate et al. 2001. "Y-chromosome SNP haplotypes suggest evidence of gene flow among caste, tribe, and migrant Siddi populations of Andhra Pradesh, South India." *European Journal of Human Genetics* 9: 695-700.

Sahoo, Sanghamitra and V.K. Kashyap 2006. "Phylogeography of mitochondrial DNA and Y-chromosome haplogroups reveal asymmetric gene flow in populations of Eastern India." *American Journal of Physical Anthropology* 131: 84-97.

Sahoo, Sanghamitra et al. 2006. "A prehistory of Indian Y-chromosomes: evaluating demic diffusion scenarios." *Proceedings of the National Academy of Sciences of the United States of America* 103(3): 843-848.

Sengupta, Sanghamitra et al. 2006. "Polarity and temporality of high-resolution Y-chromosome distributions in India identify both indigenous and exogenous expansions and reveals minor genetic influence of central Asian pastoralists." *American Journal of Human Genetics* 78: 201-221.

Sharma, Swarkar et al. 2009. "The Indian origin of paternal haplogroup R1a1* substantiates the autochthonous origin of Brahmins and the caste system." *Journal of Human Genetics* 54: 47-55.

Thangaraj, Kumarasamy et al. 2010. "The influence of natural barriers in shaping the genetic structure of Maharashtra Populations." *Public Library of Science One* 5(12): e15283.

Thanseem, Ismail et al. 2006. "Genetic affinities among the lower castes and tribal groups of India: inference from Y chromosome and mitochondrial DNA." *BioMed Central Genetics* 7: 42.

Wells, Spencer R. et al. 2001. "The Eurasian heartland: a continental perspective on Y-chromosome diversity." *Proceedings of the National Academy of Sciences of the United States of America* 98(18): 10244-10249.

Zhabagin, Maxat et al. 2017. "The connection of the genetic, cultural and geographic landscapes of Transoxiana." *Scientific Reports* 7: 3085.

Zhao, Zhongming et al. 2009. "Presence of three different paternal lineages among North Indians: a study of 560 Y chromosomes." *Annals of Human Biology* 36(1) 46-59.

Zhong, Hua et al. 2011. "Extended Y-chromosome investigations suggests postglacial migrations of modern humans into East Asia via the northern route." *Molecular Biology and Evolution* 28(1): 717-727.