Journal of Biosocial Science (2020), 52: 6, 809–831
doi:10.1017/S0021932019000804

CAMBRIDGE UNIVERSITY PRESS

RESEARCH ARTICLE

Consanguineous marriages among Andalusian *Gitanos/Calé*: a genealogical analysis (1925–2006)

Juan F. Gamella

Departamento de Antropología Social, Universidad de Granada, Spain
Corresponding author: Email: gamella@ugr.es

(Received 15 March 2019; revised 07 October 2019; accepted 14 October 2019; first published online 13 December 2019)

Abstract

Using data from the family and genealogical reconstitutions of the *Gitano* population of 22 contiguous localities in eastern Andalusia, Spain, this study analysed the intensity, structure and historical evolution of consanguinity in 3056 couples formed from 1925 to 2006. Of these unions, 54.8% were consanguineous, and 28.7% involved relatives up to and including second cousins, resulting in a mean coefficient of inbreeding up to the third degree $\alpha_3 = 12.4 \times 10^{-3}$. The rest of the consanguineous unions (26.1% of all) involved more-distant relatives, such as third cousins, fourth cousins and so forth. When all consanguinity degrees found in the genealogical reconstitution were considered, the total mean coefficient of inbreeding was $\alpha_t = 14.8 \times 10^{-3}$. The merging of families and pedigrees generated a complex genealogical network with many inbreeding loops and important founder effects. This network revealed a high rate (62%) of Multiple Consanguineous Marriages (MCMs) in which second and subsequent consanguineous ties increased inbreeding levels by a fifth (20.5%). The accumulation of multiple degrees of distant relatedness, many of which had little social or biological importance, has contributed to a significant increase in inbreeding rates. Among *Gitano* people, intra-family marriages have remained common in the last decades, in sharp contrast to other Spanish populations. Hence the highest rates of close consanguinity (34%) and inbreeding ($\alpha_3 = 14.6 \times 10^{-3}$) were found in the 1960s, the decade that saw the onset of Spain's socioeconomic modernization, internationalization and massive migration. These are among the highest rates of inbreeding found in any European population, including the most endogamous Spanish isolates. They reveal marriage strategies not constrained primarily by geographical barriers, but by ethnocultural separation. Interestingly, in recent decades mixed marriages have been increasing rapidly in this minority, although they are compatible with high rates of consanguinity. *Gitano* secular endogamy is breaking up, but not uniformly.

Keywords: Consanguineous marriage; Spain; Roma/Gypsies

Introduction

The *Gitanos* or *Calé* of Spain are an ethnocultural minority akin to other Romani groups in Europe and America. All these groups may share a remote origin in one or more founder populations that moved westwards from the Indian subcontinent over a millennium ago (Mendizabal *et al.*, 2012). Nevertheless, all Romani peoples have experienced marked transformations by their interaction with the peoples among whom they have lived. Today Romani peoples show much social and genetic differentiation and a gamut of living conditions and intercultural relationships (Fraser, 1992; Morar *et al.*, 2004; Matras, 2015).

Gitanos or *Calé* seem to descend from the first Romani migratory flows into the Iberian Peninsula documented in the 15th century. They are closely related to peoples known as *Ciganos, Calon, Calós* etc., who live in Catalonia, Portugal, Brazil and the south of France.

© Cambridge University Press 2019.

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

The approximately 600,000 Spanish *Gitanos* reside today in over 1000 localities in all Spanish regions (Fundación Secretariado *Gitano*, 2016). Present *Gitano/Calé* populations result from a long interaction with Spanish-dominant majorities, marked by discrimination, segregation, persecution and a will to make them disappear as a distinct group (Leblon, 1985; Gómez Alfaro, 1993; San Román, 1997; Pym, 2007). However, in many local communities co-operation, cultural hybridization and peaceful co-existence have also been common. This is particularly relevant in Andalusia, where *Gitanos* have contributed decisively to some of its most cherished heritages, such as Flamenco music and dance (Leblon, 2003). Today most *Gitanos* consider themselves autochthonous Spaniards, particularly facing foreign immigrants, including Roma persons from Eastern European countries such as Romania or Bulgaria.

During their difficult history, *Gitanos* adopted and contributed to the language, music and lifestyles of the regions where they lived. Often it is not easy to distinguish *Gitano* persons from their non-*Gitano* neighbours. Endogamy has been a key factor in their permanence as a collective imbued with a strong sense of a shared and distinct identity. Mixed unions occurred already in the 16th century (Gómez Alfaro, 1999), but endogamy remained a strong *habitus* and a key factor in the maintenance of boundaries with the dominant majority. In most *Gitano* communities marrying *payos* or non-*Gitanos* has been seen as contrary to *Gitano* law and the preservation of the group. Moreover, many *Gitano* families have shown a marked preference for marrying relatives by birth (or of the 'same blood', as they express it) both in their discourse and in their practice, although not without ambivalence (Lagunas, 2005; Gamella & Martín, 2007). However, *Gitano* consanguinity remains understudied. There are references dispersed in the ethnological and medical literature, but there is a lack of detailed and comprehensive information.

One exception can be found in the work of Martínez-Frías and Bermejo (1992), who studied consanguinity in their study of congenital malformations among newly born children in a long-term hospital-based, case-control project covering a long period (1976 to 1990). Data on relatedness were obtained by an interview of the parents following the birth of the child concerned. Levels of close consanguinity among *Gitano* parents ranged from 29.3% to 36.9%, compared with 1.5% to 2.3% among non-*Gitano* parents (Martínez-Frías & Bermejo, 1992, pp. 483 and 485). This level of parental consanguinity may have led to a high proportion of homozygotes for recessive alleles. Accordingly, the authors found that 'the rate of well-known recessive syndromes among Gypsies [was] seven times that among non-Gypsies' (Martínez-Frías & Bermejo, 1992, p. 485).

Another source of data is an epidemiological study on the prevalence of renal lithiasis made in south-eastern Spain in the early 1980s. In a household survey, the authors interviewed 11,871 *Gitano* and 4621 non-*Gitano* persons. They found that the rate of close consanguineous marriages among *Gitano* people, 27%, was over six times higher than among non-*Gitano* people, 4% (Ramirez *et al.* 1984).

Some precise data on consanguinity is also found in a socio-anthropological survey of the *Gitano* population of the industrial town of Linares in Andalusia. The authors collected data on 803 *Gitano* couples, 23.1% closely related, 10.8% as first cousins and 12.3% as second cousins. The study did not consider cases of first cousins once removed or any other degree of relatedness. There was considerable variation among the different cohorts. The highest rates of consanguinity, about 32%, were found among respondents born from 1964 to 1973. There were also important differences among the neighbourhoods studied (Solana & Lorenzo, 2010, pp. 117–118, 225).

In sum, the available results point to a high rate of close consanguineous marriages (up to second cousins) among *Gitano*/*Calé* people of recent generations. In other Romani groups, endogamy and high consanguinity levels have been often reported in ethnographic and medical genetics studies. Few publications, however, provide concrete estimations (for some exceptions of different scope and validity see: Cohn, 1973; Williams & Harper, 1977; Thomas *et al.*, 1987; Ferák *et al.*, 1987). On the other hand, more recent genetic reviews have concluded that the Romani populations of Europe may be described as 'a conglomerate of genetically isolated founder populations'

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

(Kalaydjieva *et al.*, 2001) that show strong genetical differentiation both among and within countries (Morar *et al.*, 2004).

In most Western societies, however, consanguineous marriage and inbreeding are widely seen as backward, undesirable and harmful (Bittles, 2012). Their association with health problems increases the negative view of the communities practising it, and may also contribute to their segregation and social introversion and, paradoxically, to an increase in intra-family marriages. Thus, studies showing high consanguinity levels may be used to reinforce stereotypical views of Romani groups and may have moral and political consequences. On the other hand, sidestepping these marriage patterns and their social and genetic consequences may also be a form of neglect and discrimination. Besides, the improvement of *Gitano* living conditions and their access to education are widening the marital choices of *Gitano* youth and facilitating mixed marriages. Hence there is nothing fixed or essential about the preference for consanguineous marriages in some Romani communities. Moreover, in the case of Spain consanguinity has been common also among mainstream populations. In fact, in the 20th century, several Spanish regions showed some of the highest rates of consanguineous marriage in Europe. These rates remained high up to the early 1960s and then fell rapidly. In the following decades, the marriage of persons closely related by birth became rare (Fuster & Colantonio, 2003, 2004; Calderón *et al.*, 2009; Gamella & Núñez Negrillo, 2018). Given the availability and quality of ecclesiastical records, consanguinity and inbreeding have been studied in Spain more than in any other European country, save Italy (Calderón *et al.*, 1998). These studies provide a good basis for comparing the results of the present study.

Therefore, this study analysed the frequency and structure of consanguineous unions in the *Gitano*/*Calé* population of an extended area of south-eastern Spain. The resulting average *F* (inbreeding coefficient) was estimated, considering the main or first degree of relatedness and all multiple relationships. Variation in *Gitano* consanguinity throughout the 20th century was also analysed. The rate and structure of cumulative consanguinity sustained through generations as revealed by genealogical methods was assessed. Finally, the results for *Gitano* consanguinity and inbreeding were compared with those found in other Spanish populations, particularly in the most endogamous regions. A comparison with other Romani populations will be the object of further publications. The differences between *Calé* consanguineous and non-consanguineous couples, and the causes and reasons for the preference of these unions as they are expressed by the families involved, will be the subject of future publications as well.

Methods

The family and genealogy reconstitutions used in this study concerned the whole *Gitano* population of 22 contiguous municipalities of the province of Granada in Andalusia (see Figure 1). These localities ranged from 400 to 22,000 people and included a variety of settlements, both rural and urban. By the end of the 20th century, the proportion of *Calé* people in some of these localities was among the highest in Western Europe (Gamella, 1996). Today around 6700 *Gitanos* live in the area, out of a total population of about 50,000 (13.5%).

In the parish registries of this region, some *Gitano* families have inscribed the births and deaths of their relatives at least since the 18th century. This practice increased with the establishment of the Spanish Civil Registry in 1871. However, during the Civil War (1936–1939) some of the parish and diocesan archives were destroyed. The study data therefore mostly came from the local civil archives, which included births, deaths and marriages from 1871 onwards. When parish archives could be consulted, the resulting genealogies could be traced back to the 18th century. Previous publications have explained the procedures followed in gathering and analysing data for the family and genealogical reconstitution (Martín & Gamella, 2005; Gamella & Martín, 2017).

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

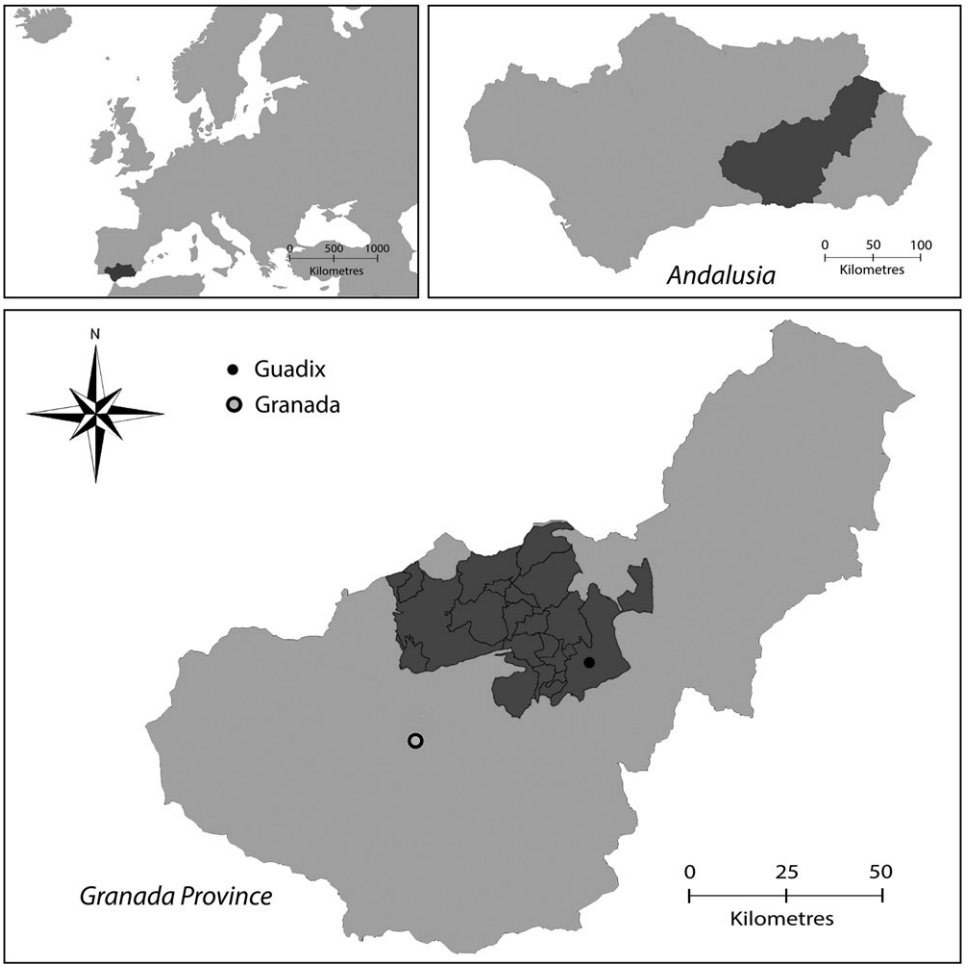


Figure 1. Area of study: 22 contiguous municipalities of the Andalusian province of Granada in south-eastern Spain.

Self-identification has been the main criterion for inclusion in this study. In almost all cases it coincided with the acknowledgment of filiation and descent (Scheffler, 2018) from other persons also identified as *Gitanos*. Primarily, one becomes *Gitano* by birth from *Gitano* parents and grandparents, and *Gitano* identity commonly has a decisive genealogical component. The main problem with this ideology, however, derives from intermarriage and the birth of persons of mixed ancestry. In this population interethnic marriages have increased significantly in recent decades, and are generating new experiences of ethnic identification. The reconstituted genealogies include mixed marriages, as well as their descendants when they continued to live in the area and married within the *Gitano* population. In many cases they tend to identify with the minority group, but this is open to individual variation and to the heterogeneous forms of integration open to second and third generations of persons of mixed ancestry.

Data gathering and genealogical reconstitution

In all the localities studied, *Gitano* identity was a salient phenomenon, and part of public local knowledge. Most residents showed little confusion about the identity and ancestry of local *Gitano* people. This has been noted in other historical–demographic studies of Romani people,

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

for instance in Hungary by the important work of Ladányi and Szelényi (2006, pp. 41–42). However, in most public records *Gitanos* are largely indistinguishable from other Spanish citizens, as references to ethnic identity are not allowed by Spanish law. Hence the demographic study of this minority or its comparison with other groups is not possible using official records only. It is necessary to use complementary sources of information. Thus, in each locality some *Gitano* neighbours provided help and co-operation in a prolonged ethnographic study that was initiated in 1993 and intensified in 2001 (Gamella, 1996, 2000, 2011; Martín & Gamella, 2005). This research generated a knowledge base of the local *Gitano* populations, their major family lines, and the more common surnames. Then the books registering births, marriages and deaths in the civil registries of the 22 studied localities were reviewed. Each entry in these books provides information about parents and grandparents – that is, seven or eight people from two or three generations. The Spanish naming system, in which each person carries both the father's and mother's first surname, is well suited for genealogical reconstitution. Old municipal censuses were also studied when available. The oldest of the censuses studied was the national census of *Gitanos* of 1783–1785, ordered by the last *Pragmática* (Royal Decree) that focused on *Gitano* people only (Gamella *et al.*, 2014).

Nevertheless, many records before 1900 identify some of the listed persons as *castellanos nuevos* – a euphemism to avoid the forbidden term *Gitano*. These ethnic labels confirmed the identities of whole lines of descendants. Records also included references to trades and occupations commonly associated with *Gitanos*, and also to streets and neighbourhoods where *Gitanos* were segregated at the time (such as the *Cañada de Los Gitanos*). Many relatives from one village or town could be traced in the registries of neighbouring towns and villages. Besides, as in other cases of intensely endogamous communities, the 'merging and reconciling' of independent sources of data often created 'new ancestor–descendant paths not present in either source alone' (Agarwala *et al.*, 2001, pp. 534–35).

Moreover, independent evidence was sought to confirm the data and links established in the genealogical networks. During ethnographic fieldwork in *Gitano* homes and public gatherings the validity and reliability of the archival data, as well as the whereabouts of the relatives who moved out of the region, were tested. After reviewing the data, about 1200 couples with the partners themselves or with relatives, less than 2% of errors or mismatches were found between the demographic records and the data provided by family members.

All the obtained information was used to locate people in a genealogical grid using GEDCOM (Genealogical Data Communication) programs, which generate files containing information about individuals in different formats, as well as metadata linking personal records according to their genealogical relationships. These programs (Reunion 9 and Reunion 11) made it possible to keep track of all bonds established, to merge all pedigrees that shared common ancestors, and to establish the consanguineous degrees among couples up to ten independent ties of relatedness. Once data were integrated into the genealogical grid, all personal and family names were eliminated to maintain the anonymity of the database.

The genealogical and family reconstitutions (Wrigley, 1966) concerned the whole *Gitano* population of the localities studied and included data on over 19,100 persons born from about 1680 to 2009. The networks included both patrilateral and matrilateral links generally with the same depth, as both mother's and father's surnames appear equally in Spanish records. In some cases, the dense genealogical networks go back twelve to fourteen generations. For instance, Gregorio H. was a *castellano nuevo* baptized on December 26th 1722, four days after his birth, in the San Miguel parish in Guadix. In the National Census of *Gitanos* performed in 1785 Gregorio appears as a 66-year-old farm worker living in Guadix with his wife María F. and their seven children. Five of these children survived and remained in the study area, and their records and those of their descendants were included in the reconstitution. Overall, the genealogical database includes 3976 direct descendants of Gregorio H. and María F. in twelve generations that extend up to the 21st century. In turn, these descendants are linked by marriage and descent with thousands of other people in the grid. Therefore, the resulting sample is not formed primarily by an accumulation of individual

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

pedigrees, but by large and complex genealogical networks that include descent lines with 'multiple inbreeding loops', and showing important founder effects (Newman *et al.*, 2001, p. 1146). Most people in the reconstituted families have from 5000 to 11,000 consanguineous relatives in the genealogical database.

By including the entire local population extracted from registry records and by merging all related pedigrees (Agarwala *et al.*, 2001), most of the problems of genealogical reconstitution (Post *et al.*, 1997; Zhao 2001) were avoided. Moreover, the registers were checked backwards and forwards to reduce the problems commonly associated with personal genealogies of known or important people (Bideau & Poulain, 1984; Dupâquier, 1993). The process also tried to avoid the under-registration of people that had little relevance for family continuity (Hollingsworth, 1976; Jette & Charbonneau, 1984). Thus, the reconstituted families and pedigrees included children who died at an early age (Gamella & Martín, 2017), as well as males and females who left the study area before marrying and having children.

Gitano marriages

The *Gitano*/*Calé* people have developed their own procedures and rituals to establish socially sanctioned unions. These procedures may be very elaborate and involve lavish ceremonies attended by hundreds of guests, but they may also be as simple as elopement followed by cohabitation (Gamella, 2000). However, *Gitano* common-law unions are not formalized until the couple marries in church or in the civil court.

Gitano common-law unions were increasingly officialized during the Francoist period, particularly between 1946 and 1975. In these decades many parish curates took an active role in marrying *Gitano* cohabiting couples, most of them with children. However, about 32% of the common-law unions in the study sample were never legalized nor registered by religious or civil authorities. Hence, in the family reconstitution couples were primarily identified by the birth records of their children and grandchildren, by the notes in their death certificates and by their presence in local censuses. The birth of the first known child (minus one year) was used as a proxy variable to estimate the beginning of cohabitation and of the union.

The study analysis included only those couples for which there was detailed information about the parents of both spouses. The resulting total sample of comparable marriages included 3056 couples formed between 1925 and 2006. For almost all these couples, genealogical information included data on three or more ascending generations. In the case of mixed marriages, however, the pedigrees of non-*Gitano* spouses rarely extend beyond their grandparents.

The family reconstitution generated a large number of variables for each couple, such as the date and place of birth of the spouses, and of their known children, the date and place of their deaths, the date, place and type of official marriage when they existed, the different households where they lived, and all the genealogical information that connected them to their forebears. From these direct variables, over 55 analytical variables were derived, such as the age of both spouses at the birth of their first and last child, their offspring size, total reproductive period, birth intervals, proportion of infant and child deaths, proportion of twins, distance between their places of birth and residence, prenuptial migrations and degrees of consanguinity.

Calculation of F values

The level of consanguinity was indicated by the coefficient of inbreeding (F). This parameter measures the probability that an individual is homozygous (more properly, autozygous) for an ancestral gene inherited from both parents. The inbreeding coefficient of the offspring of an uncle–niece couple is 1/8, that of first cousins 1/16, that of first cousins once removed 1/32 and that of second cousins 1/64. With each further degree of consanguinity, the chance is halved (Hartl & Clark, 2007; Bittles, 2012).

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

The mean inbreeding coefficient of a population, α, results from the average F values of all its members. It was calculated by applying the formula:

$$\alpha = \sum p_i F_i$$

where Σ is the sum of the proportion of couples (p_i) with each type of consanguineous relationship i regarding the total of marriages (Mt), and F_i – the corresponding inbreeding coefficient (Bittles, 2012; Calderón *et al.*, 2018). This parameter indicates the probability of homozygosis by inbreeding in an individual taken at random from the population. It is commonly used for comparing populations.

Corresponding α values were calculated both for the main degree of consanguinity (α_1) and for all the known degrees between each couple (α_t). These two parameters were also calculated considering degrees of consanguinity up to and including second cousins or equivalent ($F \leq 15.625 \times 10^{-3}$) so that results could be compared with the most important Spanish studies (α_3). It is important to stress, however, that the genetic relationships are inferred mostly from public records that were generated by interactions between authorities and subordinated persons. Hence, these inferences must be considered as hypothetical.

Results

As can be seen in Table 1, about 54.8% of the 3056 couples studied were consanguineous. Of these, 877 couples (28.7% of the total) were related as second cousins or closer. The other consanguineous unions (26.1% of the total) involved more-distant relatives, such as second cousins once removed, third cousins, fourth cousins and so forth. The most common types of close relatives were C22 (first cousins), C23 (first cousins once removed) and C33 (second cousins). Uncle–niece or aunt–nephew unions (C12) are rare among *Gitanos*, who reject them intensely. The sample included only four cases over a century, all of them perceived as wrong and even incestuous by the couples' relatives and neighbours interviewed in fieldwork.

First cousin marriages (C22) amounted to 12.1% of all unions studied. First cousins once removed (C23) involved 5.5% of these unions. This intergenerational type of marriage was favoured by the long reproductive careers experienced by *Gitano* women until recently. It was common for mothers and daughters to have children simultaneously. Hence, many children grew up with aunts, uncles and the children of cousins of their age. About 9.5% of all marriages were among second cousins (C33). However, many couples who were first cousins or cousins once removed were second cousins as well. Thus, there were 409 couples with at least a tie of second cousins – 13.4% of all marriages. Some of these couples were second cousins twice or thrice, so the total number of C33 degrees found in the 3056 couples was 458.

Moreover, when C34 (second cousins once removed) and C44 (third cousins) degrees were included, as has been done in most studies of Spanish populations up to 1918, the rate of consanguinity rose to 43.5%. Beyond third cousins, neither the spouses nor their parents were aware of their relatedness. They might know they come from the same family or descent network, but they usually ignore the actual ties that connect them. The genealogical memory of *Gitanos* does not seem to be deeper than that of their non-*Gitano* neighbours. It rarely goes much beyond three ascending generations: that is, beyond a limited knowledge of great-grandparents. However, it commonly involves a wider knowledge of collaterals.

Overall, the sample included 28 different degrees of relatedness as the main consanguineous tie between the partners. In asymmetrical unions such as C23 or C34 (marriage with a first or a second cousin once removed) when the sex of the partner in ascending/descending generation was considered, the analysis found another fourteen types of union: that is, a total of 42 different degrees of kinship as the main relationship among partners. The closest main unions were

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

Table 1. Consanguineous and mixed unions in the *Gitano* population of 22 contiguous localities of Andalusia, Spain, 3056 couples (1925–2006)

	Mt	Mixed		Mc		Mc≥C33		C22		C23		C33		$\alpha_{3.1}$	$\alpha_{3.m}$	$\alpha_{3.t}$	α_1	α_m	α_t
Period	n	n	%	%	%	n	%	n	%	n	%	n	%	$\times10^{-3}$	$\times10^{-3}$	$\times10^{-3}$	$\times10^{-3}$	$\times10^{-3}$	$\times10^{-3}$
1925–1929	93	3	3.2	32	34.4	27	29.0	10	10.8	7	7.5	9	9.7	10.753	0.335	11.089	11.173	0.551	11.724
1930–1939	196	6	3.1	76	38.8	52	26.5	25	12.8	9	4.6	16	8.2	11.400	0.319	11.719	12.109	0.668	12.776
1940–1949	246	21	8.5	97	39.4	60	24.4	23	9.3	11	4.5	25	10.2	8.892	0.254	9.146	9.746	1.094	10.839
1950–1959	316	19	6.0	138	43.7	90	28.5	36	11.4	12	3.8	38	12.0	10.433	0.791	11.224	11.167	1.626	12.793
1960–1969	372	24	6.5	220	59.1	126	33.9	52	14.0	25	6.7	44	11.8	12.937	1.680	14.617	14.051	3.157	17.207
1970–1979	447	40	8.9	286	64.0	147	32.9	59	13.2	23	5.1	60	13.4	12.654	0.979	13.633	13.799	2.366	16.165
1980–1989	494	81	16.4	306	61.9	137	27.7	55	11.1	29	5.9	41	8.3	10.944	1.360	12.304	12.114	2.900	15.014
1990–1999	566	130	23.0	323	57.1	148	26.1	72	12.7	29	5.1	34	6.0	11.015	1.270	12.285	12.120	3.196	15.316
2000–2006	326	82	25.2	196	60.1	90	27.6	37	11.3	23	7.1	24	7.4	10.928	1.630	12.558	11.960	3.774	15.734
1925–2006	**3056**	**406**	**13.3**	**1674**	**54.8**	**877**	**28.7**	**369**	**12.1**	**168**	**5.5**	**291**	**9.5**	**11.253**	**1.110**	**12.363**	**12.263**	**2.510**	**14.773**

Mt: total number of marriages; Mc: total consanguineous marriages; Mc≥C33: consanguineous marriages up to second cousins or equivalent ($F \leq 15.625$); C22: unions among first cousins; C23: unions among first cousins once removed; C33: unions among second cousins. For all these data only the main degree of relatedness was considered.
Mixed: unions between a *Gitano* and a non-*Gitano* person.
$\alpha_{3.1}$: average F values considering only the main degree of consanguinity and up to second cousins or equivalent.
$\alpha_{3.m}$: average F values for second and other multiple degrees of consanguinity up to second cousins.
$\alpha_{3.t}$: average F values considering all degrees of consanguinity found in the genealogical analysis up to second cousins.
α_1: average F values if only the main known degree of consanguinity is considered in all cases.
α_m: average F values of all the other degrees of consanguinity but the closer one.
α_t: average F values considering all degrees of consanguinity found in the genealogical analysis.

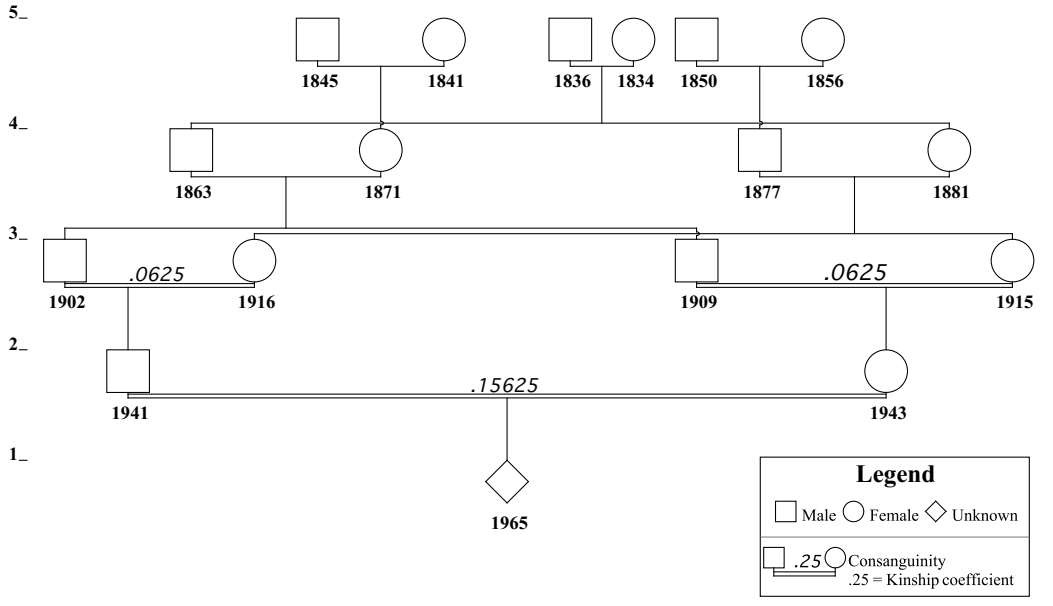


Figure 2. Pedigree of a Gitano consanguineous couple married in 1963.

between uncle–niece or aunt–nephew, and the more-distant unions were between sixth cousins once removed – a very tenuous relationship indeed.

Multiple consanguinity

The genealogical reconstruction revealed a complex set of multiple consanguineous marriages (MCMs) in which there was more than one degree of relatedness between the partners. These MCMs were more numerous and complex than those found in studies that used other sources of data, such as household- or hospital-based surveys, and ecclesiastical or civil records. Thus, when considering all the known kin ties, the sample included more than 400 different types of consanguineous marriages. If the sex of the person in the ascending/descending generation of asymmetrical unions (C12, C23, C34, C45, etc.) was taken into account, there were over 650 different types of unions.

Over 62% of all consanguineous unions involved more than one known degree of consanguinity, including distant ties such as fourth cousins, third cousins twice removed, fifth cousins, etc. If the analysis was limited to the level of second cousins the proportion of MCMs on the total of marriages was 5.4%. If it was extended to the level of third cousins (C44), the proportion of MCMs was 17.2%. Table 2 offers a summary of the MCMs up to and including second cousins. This was a much larger sample of multiple degree types than those found in most studies of consanguinity, including those using ecclesiastical Catholic dispensation records and pedigrees (see Calderón *et al.*, 1998, Cavalli-Sforza *et al.*, 2004).

Even restricting the analysis to second cousins and closer degrees, there are cases of multiple consanguinity that are rare in other Spanish populations. For instance, Figure 2 shows the pedigree of a couple who eloped in 1963 and had their first child in 1965. They were double parallel first cousins and second cousins, as their parents were first cousins as well. Hence they shared their four grandparents, and had only six great-grandparents instead of the normal sixteen. Their inbreeding coefficient was one of the highest in the whole sample, $F = 156.25 \times 10^{-3}$.

The programs used in the genealogical reconstitution recognized up to ten different links among the couples studied. They established 4114 different kin ties in 1674 consanguineous

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

Table 2. Multiple consanguineous marriages up to second cousin degree or equivalent ($F \geq 0.0156$), 1925–2006

Types of MCMs up to C33	1925–1929	1930–1940	1940–1950	1950–1960	1960–1970	1970–1980	1980–1990	1990–2000	2000–2006	MCM_3 *n*	MCM_3 %	MCM_3/Mt %	*F*
M22+M22	0	0	0	1	0	1	1	1	0	4	2.4	0.13	0.125000
M22+M23	0	0	0	1	0	3	2	1	0	7	4.2	0.23	0.093750
HM12+M23	0	0	0	0	0	0	0	0	1	1	0.6	0.03	0.093750
M22+M33	2	2	1	4	16	11	17	16	15	84	50.6	2.75	0.078125
HM23+M33	0	0	0	0	0	0	1	1	0	2	1.2	0.07	0.031250
M23+M23	0	0	0	0	0	0	0	2	1	3	1.8	0.10	0.062500
M23+M33	0	2	0	0	3	2	3	3	2	15	9.0	0.49	0.046875
M23+HM23	0	0	0	0	1	0	1	0	0	2	1.2	0.07	0.046875
HM22+M33	0	0	0	0	0	0	1	0	0	1	0.6	0.03	0.046875
M33+M33	0	0	3	1	4	5	7	6	4	30	18.1	0.98	0.031250
M22+M23+M33	0	0	0	0	0	0	1	1	0	2	1.2	0.07	0.109375
M22+M33+M33	0	0	0	0	1	0	0	2	3	6	3.6	0.20	0.093750
M23+M33+M33	0	0	0	0	1	0	1	0	0	2	1.2	0.07	0.062500
M33+HM23+HM23	0	0	0	1	0	0	0	0	0	1	0.6	0.03	0.046875
M22+M22+M33+M33	0	0	0	0	1	0	0	0	0	1	0.6	0.03	0.156250
M22+M33+M33+M33	0	0	0	1	2	0	0	1	1	5	3.0	0.16	0.109375
MCM_3	2	4	4	9	29	22	35	34	27	166	100.0	5.43	
Mt	93	196	246	316	372	447	494	566	326	3056			

MCM_3: multiple consanguineous marriages including degrees of kinship up to second cousins or equivalent ($F \geq 0.015625$).
Mt: total number of marriages studied ($N = 3056$).

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

Table 3. Number of independent consanguineous degrees found in 1674 consanguineous marriages in the *Gitano* population of 22 contiguous localities of eastern Andalusia, Spain; frequencies by decade of union, 1925–2006, $N = 3056$

	One degree	Two degrees	Three degrees	Four degrees	Five degrees	Six degrees	Seven degrees	Eight degrees	Nine degrees	Ten degrees	Mc *n*	Mean number of degrees[a]	Total number of degrees[b]	Mt *n*
1925–1929	26	6	0	0	0	0	0	0	0	0	32	1.2	38	93
1930–1939	61	14	1	0	0	0	0	0	0	0	76	1.2	92	196
1940–1949	62	27	3	4	0	1	0	0	0	0	97	1.5	147	246
1950–1959	88	33	10	3	3	1	0	0	0	0	138	1.6	217	316
1960–1969	91	58	37	26	6	2	0	0	0	0	220	2.1	464	372
1970–1979	117	74	51	27	9	2	4	1	1	0	286	2.2	628	447
1980–1989	91	81	58	44	21	4	3	2	1	1	306	2.6	788	494
1990–1999	70	87	55	42	31	10	12	4	7	5	323	3.2	1021	566
2000–2006	29	37	37	30	29	12	12	7	2	1	196	3.7	719	326
1925–2006	635	417	252	176	99	32	31	14	11	7	**1674**	2.5	4114	3056
% Mc	**37.9**	**24.9**	**15.1**	**10.5**	**5.9**	**1.9**	**1.9**	**0.8**	**0.7**	**0.4**	**100.0**			
% Mt	**20.8**	**13.6**	**8.2**	**5.8**	**3.2**	**1.0**	**1.0**	**0.5**	**0.4**	**0.2**	**54.8**			

Mc: total number of consanguineous marriages.
Mt: total number of marriages.
% Mc: percentages of all consanguineous marriages in which one, two, three... independent consanguineous degrees were found.
% Mt: percentage of all marriages in which one, two, three... independent consanguineous degrees were found.
[a]Mean number of degrees in each consanguineous marriage per decade.
[b]Total number of consanguineous degrees found in the 1674 consanguineous couples studied.

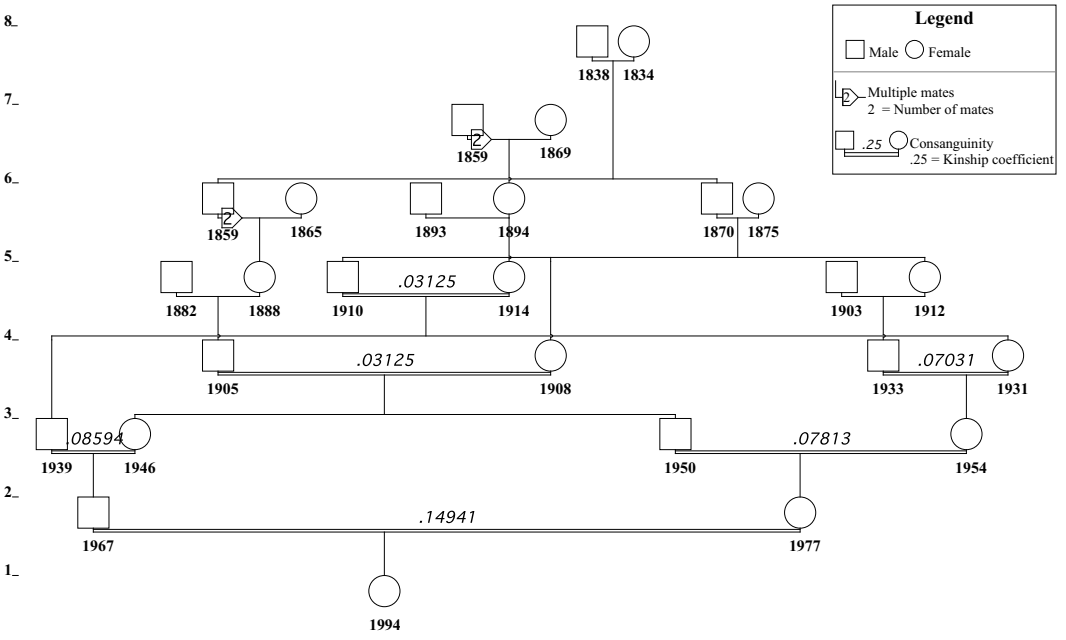


Figure 3. Pedigree of a consanguineous Gitano couple married in 1993. Note that the person born in 1859 is represented twice in his marriages with women born in 1865 and 1869.

couples: that is, 2.5 degrees per consanguineous couple on average. As can be seen in Table 3, in 24.9% of the consanguineous couples there were two independent degrees; in 15.1% of these couples, three degrees, etc. The number of degrees found in the genealogical reconstitution increased throughout the 20th century. Thus, from 1990 to 2006, consanguineous couples shared 3.4 degrees on average, and 80.9% of them were multiple.

The genealogical program, however, seemed to underestimate the consanguinity that was obtained in the genealogical grid. Thus, revision by hand of some of the personal pedigrees found couples that shared fifteen or more independent kin ties. For instance, Figure 3 shows the simplified pedigree of a *Gitano* couple born in 1967 and 1977, who moved in together in 1993 and had their first daughter in 1994. The genealogical programs found nine independent kin ties among them, but the manual revision found eighteen independent ties! They were first cousins, first cousins once removed, second cousins, three times second cousins once removed, half third cousins, four times third cousins once removed, half third cousins once removed, twice third cousins twice removed and four times fourth cousins. Their inbreeding coefficient ($F = 149.41 \times 10^{-3}$) was one of the highest in the whole sample. If only ties up to second cousins had been considered, the resulting inbreeding coefficient would be 27% smaller.

Average F values: α

When all consanguineous degrees were considered the total average of F values was $\alpha_t = 14.773$ ($\times 10^{-3}$) (see Table 1). As close consanguinity is more relevant both socially and genetically, as well as for allowing the comparison of these results with data from other Spanish sources, F values were calculated considering only consanguineous marriages up to second cousins or equivalent. This method resulted in $\alpha_{3.1} = 11.253 \times 10^{-3}$ for the main relationship, and $\alpha_{3.t} = 12.363 \times 10^{-3}$ when considering all the known relationships up to the third degree.

Close consanguineous ties play a key role in the total levels of inbreeding. Two-thirds of the total α value resulted from the contribution of first cousins (51.8%) and first cousins once removed

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

Table 4. Total number of cases by kin type in genealogical reconstitution by order of consanguineous tie and relative contribution of each type of kin tie to α_t, 1925–2006

Kin type	CNSN01	CNSN02	CNSN03	CNSN04	CNSN05	CSN06	CNSN07	CNSN08	CNSN09	CNSN10	Total *N*	*F*	% α_t	Cum. % α_t
C12 (Uncle–niece; aunt–nephew)	4										4	0.125000	1.11	1.11
C22 (First cousins)	369	5									374	0.062500	51.78	52.89
HC12 (Half uncle–niece)	1										1	0.062500	0.14	53.02
C23 (Cousins once removed)	168	13									181	0.031250	12.53	65.55
HC22 (Half first cousins)	18										18	0.031250	1.25	66.80
C24 (First cousins twice removed)	3										3	0.015625	0.10	66.90
C33 (Second cousins)	291	145	16	6							458	0.015625	15.85	82.75
HC23 (Half first cousin once removed)	23	3	1								27	0.015625	0.93	83.69
C34 (Second cousin once removed)	195	113	29	5							342	0.007813	5.92	89.61
HC24 (Half first cousin twice removed)	1	1									2	0.007813	0.03	89.64
HC33 (Half second cousins)	28	14	2								44	0.007813	0.76	90.40
C35 (Second cousin twice removed)	6	9	3		1						19	0.003906	0.16	90.57
C44 (Third cousins)	215	207	90	29	6						547	0.003906	4.73	95.30
HC34 (Half second cousin once removed)	8	17	5	1							31	0.003906	0.27	95.57
C45 (Third cousin once removed)	154	173	108	57	19	7					518	0.001953	2.24	97.81
HC36 (Half second cousin twice removed)			1	1							2	0.001953	0.01	97.82
HC44 (Half third cousin)	7	13	20	1	1	2					44	0.001953	0.19	98.01
C46 (Third cousin twice removed)	8	11	20	14	7	5	2	1	1		69	0.000977	0.15	98.16
C55 (Fourth cousins)	80	139	120	94	36	18	13	2	1		503	0.000977	1.09	99.25
HC45 (Half third cousin once removed)	6	12	7	8	3	1		1			38	0.000977	0.08	99.33
C47 (Third cousin three removed)	1										1	0.000488	0.00	99.33

(*Continued*)

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

Table 4. (*Continued*)

Kin type	CNSN01	CNSN02	CNSN03	CNSN04	CNSN05	CSN06	CNSN07	CNSN08	CNSN09	CNSN10	Total *N*	*F*	% α_t	Cum. % α_t
C56 (Fourth cousin once removed)	57	93	100	84	55	32	16	7	3	1	448	0.000488	0.48	99.81
HC46 (Half third cousin twice removed)		1									1	0.000488	0.00	99.81
C55 (Half fourth cousins)	3	1	6	2	2	1	2		1		18	0.000488	0.02	99.83
C57 (Fourth cousins twice removed)	5	6	13	9	9	2	4	4	1	1	54	0.000244	0.03	99.86
C66 (Fifth cousins)	13	30	49	33	24	11	15	12	6	2	195	0.000244	0.11	99.97
HC56 (Half fourth cousin once removed)			2		2		1	2			7	0.000244	0.00	99.97
C67 (Fifth cousin once removed)	5	15	15	14	12	5	4	1	3	1	75	0.000122	0.02	99.99
HC66 (Half fifth cousins)					1						1	0.000122	0.00	99.99
C68 (Fifth cousins twice removed)	1	4	2		2			1			10	0.000061	0.00	99.99
C77 (Sixth cousins)	2	7	4	2	4	2	1				22	0.000061	0.00	100.00
HC67 (Half fifth cousin once removed)				1	1	1					3	0.000061	0.00	100.00
C69 (Fifth cousin thrice removed)			1								1	0.000031	0.00	100.00
C78 (Sixth cousin once removed)	2	3	2	1	2	2	1	1	1	1	16	0.000031	0.00	100.00
C79 (Sixth cousin twice removed)		2	2				1				5	0.000015	0.00	100.00
C88 (Seventh cousins)		1	1	3	1	1					7	0.000015	0.00	100.00
HC78 (Half sixth cousin once removed)									1		1	0.000015	0.00	100.00
C710 (Sixth cousin thrice removed)				3		1					4	0.000008	0.00	100.00
C89 (Seventh cousin once removed)		1	1	2	5	1	1			1	12	0.000008	0.00	100.00
C711 (Sixth cousin four removed)							1				1	0.000004	0.00	100.00
C810 (Seventh cousin twice removed)					1	2					3	0.000004	0.00	100.00
C99 (Eighth cousins)			1				2				3	0.000004	0.00	100.00
C910 (Eighth cousin once removed)			1								1	0.000002	0.00	100.00
Total	1674	1039	622	370	194	94	64	32	18	7	4114	14.773	100.00	

Table 5. Genealogical types of first cousin couples in the *Gitano* population of 22 contiguous localities of Granada province, Spain, 1925 –2006 ($N = 3056$)

	FBD		MZD		FZD		MBD		FBD + MZD	FZD + MBD	Total C22	C22/Mt	Mt
Period of union	*n*	%	*n*	%	*n*	%	*n*	%	*n*	*n*	*n*	%	*n*
1925–1939	7	20.0	9	25.7	9	25.7	10	28.6	0	0	35	**12.1**	289
1940–1959	16	27.1	13	22.0	10	16.9	19	32.2	0	1	59	**10.5**	562
1960–1977	26	26.5	23	23.5	23	23.5	24	24.5	2	0	98	**13.7**	715
1978–2006	48	27.1	48	27.1	42	23.7	37	20.9	1	1	177	**11.9**	1490
1925–2006	**97**	**26.3**	**93**	**25.2**	**84**	**22.8**	**90**	**24.4**	**3**	**2**	**369**	**12.1**	**3056**

1939: end of the Civil War (1936–1939); Franco's dictatorship all over Spain.
1959: major economic reforms implemented; internationalization and growth of Spanish economy.
1977: first democratic elections after 1939; new democratic constitution approved in 1978.
FBD: the wife is father's brother's daughter of her husband. A parallel patrilateral cousin marriage; type 3 in Calderón *et al.* (2009).
FZD: the wife is father's sister's daughter of her husband. Parallel-cousin marriage, type 1 in Calderón *et al.* (2009).
MZD: the wife is mother's sister's daughter of her husband. Cross-cousin marriage, type 0 in Calderón *et al.* (2009).
MBD: the wife is mother's brother's daughter of her husband. Cross-cousin marriage, type 2 in Calderón *et al.* (2009).
Total C22: number of marriages in which the main degree of kinship is that of first cousins.
Mt: total number of marriages per period

(12.5%) (see Table 4). Hence, there was a strong positive correlation between the yearly proportion of C22 marriages and the values of α_t ($R = 0.787$). C23 couples also had a positive correlation, although smaller ($R = 0.385$). The proportion of C33 was not so strongly correlated with total average F values ($R = 0.207$).

Nevertheless, second, third and successive degrees of relatedness increased average F values significantly. When only degrees up to C33 were measured, second and subsequent degrees of consanguinity increased α values about 9.9%. However, when all ties found in the genealogical reconstitution were considered, second and subsequent ties of consanguinity increased the total average inbreeding (α_t) by about 20.5%. The accumulation of multiple degrees of distant relatedness, many of which had little social or biological importance in isolation, increased inbreeding levels significantly (see Table 4).

Subtypes of first-cousin marriage

Preferred patterns of first cousin marriage vary greatly among different cultures and populations (see Bittles, 2012, p. 80, table 6.3). The study of these subtypes has a long tradition in the cultural anthropology of kinship and marriage (see Lévi-Strauss, 1947; Leach, 1951; Barth, 1986). In genetic terms, these subtypes are also important, particularly in respect to the expression of X-linked recessive alleles, due to 'the significant number of clinically important genes located on the X-chromosome' (Bittles, 2012, p. 78). There are some important studies of this topic in Spain (Calderon *et al.*, 2009) and in many Arab and Muslim populations (for instance: Al-Gazali *et al.*, 1997; Saadat *et al.*, 2004).

In the *Gitano* population studied the differences in the proportion of the four subtypes of first cousins were not statistically significant ($p = 0.8$) (see Table 5). Patrilateral parallel-cousin marriages – that is, marriages of a male ego with the father's brother's daughter (FBD) – were somewhat more common when the whole study period was considered. However, other patterns appeared as more common in some historical periods. Contrary to what was obtained in groups with strong patrilineal biases, *Gitano* families did not show a clear preference for any of the four patterns of first cousin marriage. In this sense, they seemed closer to other Spanish populations, although they did not show the matrilateral bias found by Calderón *et al.* (2009, p. 190) in four dioceses that resulted in high F_x/F ratios. In the *Gitano*/*Calé* group, patrilateral and matrilateral

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

Table 6. Consanguineous marriages in seven Spanish 'isolates' compared with those in the *Gitano* population of 22 contiguous localities in Granada province

Region	Period	Mt	Mc	C12	C22	C23	C33	MCM	Mc/Mt	$\alpha_{3.1}$	$\alpha_{3.t}$	M22/M33	Study
		n	*n*	%	%	%	%	%	%	$\times 10^{-3}$	$\times 10^{-3}$		
Gitanos (Granada)	1925–2006	3056	1674	0.13	12.1	5.5	9.5	5.43/17.2*	28.7	11.253	12.363	1.24/0.88	Present Study
La Cabrera (León)	1880–1989	5714	1317	0.07	3.03	1.07	6.65	1.36	23.05		4.82	0.46	Blanco Villegas *et al.* (2004)
Sigüenza-Guadalajara	1891–1980[a]	27,191	5744	0.03	3.12	1.42	6.77	4.78*	21.12	3.483		0.46	Calderón *et al.* (1998)
Alpujarras (Granada)	1900–1979	34,503	3236	0.06	3.28	1.19	4.33	0.52	9.38	3.181	3.506	0.76	Núñez-Negrillo (2015)
Los Montes (Granada)	1900–1979	35,927	2734	0.02	2.92	0.94	3.39	0.33	7.61	2.690	2.920	0.86	Núñez-Negrillo (2015)
Alpujarra Oriental (Granada)	1909–1978	4118	308	0.05	2.16	0.78	3.91	0.10	7.48	2.265	2.360	0.55	Luna Gómez (1984)
Gredos (Ávila)	1875–1974	41,270	3972	0.02	1.41	0.71	5.62	2.86	9.62	2.003	–	0.25	Fuster *et al.* (1996)
Albacete-Jaén-Granada South-eastern Spain	1900–1969[a]	62,360	3154	0.01	1.97	0.56	2.27	0.25	5.06	1.95	–	0.87	Calderón *et al.* (2018) Table 2
Los Nogales (Lugo)	1871–1977	2347	121	0.13	2.13	0.34	2.47	0.09	5.16	1.984	2.300	0.86	Fuster (2003)
Goierri (Basque Country)	1862–1980	28,773	1619	0.17	1.49	0.39	1.28	0.90	5.63	1.467	2.010	1.17	Alfonso-Sánchez *et al.* (2005)
La Jara (Toledo)	1900–1979	25,061	1645	–	1.05	0.45	4.27	–	6.56	1.462	–	0.25	Calderón (1983)

Mt: total number of unions studied. Mc: total number of consanguineous unions up to second cousins.
C12: uncle–niece or aunt–nephew marriages. C22: first cousin couples; C33: second cousin couples; C23: first cousin once-removed marriages; all of these in SCM (Single Consanguineous Marriages). In the *Gitano* sample, however, these data concern the main degree of relatedness of both single and multiple consanguineous marriages.
MCM: proportion of multiple consanguinity marriages in the total sample of marriages. Most measures include only couples up to the C33 level; when C34 and C44 couples (or equivalent) are also included this is represented by the sign *.
$\alpha_{3.1}$: α values considering only the main consanguineous relationship in consanguineous unions up to and including second cousins.
$\alpha_{3.t}$: α values for all known relationships in consanguineous unions up to and including second cousins.
[a]When similar results were not included in these publications, the results were calculated with data offered in the respective papers.

types were equally frequent (ratio 0.99), and the F_x/F ratio for first cousins was 1.26 – very close to the expected value of 1.25.

In accordance with these results, the ethnographic fieldwork found that *Gitano* people do not seem to distinguish among the four types of first cousins. They categorize all of them as *primos hermanos* or first cousins and see little difference among them as relatives, although some of them may be emotionally closer if they had grown up together. The dominant norm of post-marital residence was that of patri-virilocality; that is, that the wife follows her husband to his place of residence, where his parents and brothers may reside as well. Hence there was a higher chance that patrilateral parallel cousins (type FBD) may have been raised in the same locality and had more opportunity to meet and mate in their teen years. As a counterpoint, growing up together often makes cousins see each other *como hermanos*: like siblings, more than as potential mates.

The structure of consanguinity

The structure of *Gitano* marriage showed a sustained preference for mating close family members. The proportion C22/C33 when calculated for the first or main degree was 1.27 – over five times the expected value of panmictic assumptions. However, when all ties in both SCM and MCM were analysed it resulted in 361 marriages having at least a degree of relatedness of C22, and 409 with at least one degree of C33, resulting in a C22/C33 proportion of 0.88. In every form considered, the C22/C33 ratio indicated the positive 'preferentiality' found in the sample of marriages studied. Another important factor in the structure of consanguinity in this population was the high rate of intergenerational marriages such as C23 and C34. This does not apply to C12 marriages, which are overtly rejected by *Gitano* people. The opportunity for finding partners of the right age for these asymmetrical marriages is always high due to the high fertility and long reproductive lives of *Calé* women. Before the recent fertility decline in this minority, it was common for *Gitano* women to begin having children in their teens and continue having them up to their 40s.

The historical evolution of Gitano inbreeding

The main temporal trends of *Gitano*/*Calé* consanguinity can be observed in Table 1 and Figure 4. Throughout the 20th century consanguinity rates remained high, with over a quarter of all marriages being between relatives as close as, or closer than, second cousins. The data point to a small decrease in the consanguinity rate in the late 1930s and 1940s, particularly during the Civil War and the immediate post-war period (Figure 4). These were terrible times of hunger and deprivation for many *Gitano* families, who were often separated by the conflict and the post-war exile and dislocation. After the late 1940s consanguinity grew in parallel with the decline of infant and child mortality. The rising rates of surviving children generated a rise in the size of *Gitano* domestic families, and also in the expansion of kin networks with numbers of living siblings, cousins and other collateral relatives rarely attained before (Gamella & Martín, 2017). This may have facilitated the rise of consanguineous marriages in groups that maintained such preference. In the studied data this upward trend peaked from 1959 to 1979, when a third of all marriages were between close relatives, and the α value surpassed the 17×10^{-3} value. In the following decades, the generalized incorporation of *Gitano* people into public schools, health centres and mixed neighbourhoods facilitated the growth of intermarriage, while intra-family marriages decreased slightly. In the first decade of the 21st century the preference to marry 'cousins' remained strong, although it was compatible with the increase of mixed marriages (Table 1), particularly these involving *Gitano* women marrying non-*Gitano* men (57% of all mixed marriages in the study period).

Local variations were very important in this new 'mix' of mating outcomes. In neighbouring towns there were different levels of social segregation of *Gitano* people, and very diverse

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

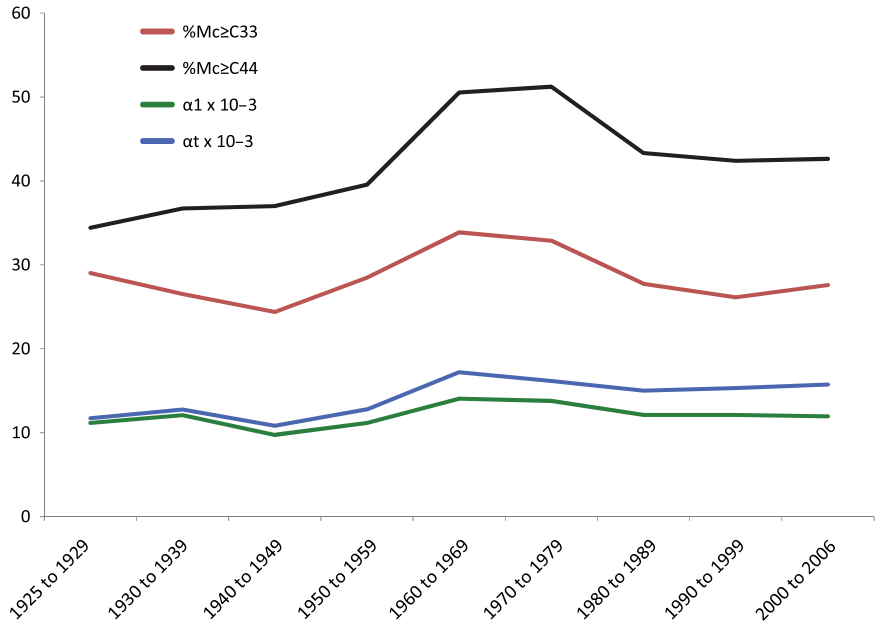


Figure 4. The evolution of consanguinity and inbreeding in the population of 22 contiguous localities of southern Spain (1925–2006).

educational and socioeconomic achievements by members of this minority. This was also evident in consanguinity and intermarriage patterns. In towns where intermarriage was growing faster, consanguinity was decreasing and it was perceived less favourably by *Gitano* residents. However, in some *Gitano* families both marriage patterns were obtained, with one child marrying a *payo* (non-*Gitano*) and another a first cousin. This points to the increasing heterogeneity and complexity of *Gitano* forms of integration into the dynamic and composite Spanish mainstream(s) (Alba & Nee, 2003).

Discussion

The obtained results cohere with those of few previous studies containing precise information on consanguinity among *Gitano* groups, although more research is needed on this topic in other regions. In this sense, the present study may offer a baseline for new studies and comparisons involving both Spanish *Gitanos* and other Romani groups.

Nevertheless, to make sense of these results, one fundamental comparison is that of the *Gitanos* of Granada with their neighbours in this same area. Thus, the prevalence of consanguineous marriages in the Diocese of Granada, where a large part of the study area was located, has been investigated by the research team. The rest of the localities belong to the Diocese of Guadix, where most ecclesiastical records have been destroyed or lost (Gamella & Núñez-Negrillo, 2018). Based on ecclesiastical records of over 15,400 marriage dispensations, Gamella and Núñez-Negrillo (2018) found a rate of consanguineous marriages up to second cousins of 5.5% in the period from 1900 to 1979. These rates of consanguinity resulted in values of $\alpha_3 = 2.044 \times 10^{-3}$. The highest levels of consanguinity were found in the 1920s, when over 7% of all marriages were consanguineous and about 2.4% were among first cousins. Consanguineous marriages, however, decreased rapidly in the 1960s and 1970s, as in most Spanish regions, and since then they have become the exception (Núñez-Negrillo, 2015; Gamella & Núñez-Negrillo, 2018). In sum, consanguineous marriages were relatively high in the non-*Gitano* population of this region as well, but over five

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

times less common than among *Gitano* families, even in the periods of highest endogamy. Moreover, *Gitano* consanguinity rates reached their maximum levels when they were plunging among their mainstream neighbours.

Other Spanish 'isolates'

The intra-family marriage patterns of *Gitanos* also need to be compared with those found in the Spanish geographical 'isolates' with the highest rates of consanguinity and inbreeding. Table 4 summarizes the results of recent studies of the most endogamous of these regions. Most of them are *comarcas* –Spanish territorial divisions formed by a set of contiguous municipalities that share climate, ecology and cultural traditions as a result of their common historical adaptations. Some of these *comarcas* have maintained the highest levels of 'reproductive isolation' ever documented in Western Europe (Blanco Villegas *et al.*, 2004, p. 193).

However, among the *Gitanos* of the study area, first cousin couples (C22) and first cousin once removed couples (C23) were about four to ten times more common than in the most endogamous regions (see Table 6). These differences were less significant for second cousins. Moreover, the structure and historical evolution of consanguinity also differed notably.

Across Spain, only two regions approach the level of consanguinity found among *Gitanos*: the diocese of Sigüenza-Guadalajara and the *comarca* of La Cabrera, both in the fringes of Central Meseta. The most endogamous of all known Spanish 'isolates' is that of La Cabrera – a mountainous *comarca* in north-western Spain secluded by steep mountains and a bad road network. Its population remained rather stable at around 9000 inhabitants up to the 1960s. Hereafter, the region suffered a quick depopulation as people migrated to industrial and urban areas in search of better jobs and living conditions. Blanco Villegas *et al.* (2004) examined 5714 marriages held between 1880 and 1989 in the 37 parishes of this region. They found 23.05% consanguineous marriages up to and including third cousins (pp. 196–197, table 1). Accordingly, rates of inbreeding were among the highest recorded in Europe. The average F value up to second cousins, α_3, was 4.82×10^{-3} for the whole period studied. If marriages up to third cousins (C44) were considered, the corresponding α_4 value would be 6.78×10^{-3}. Rates of inbreeding remained high from 1900 to 1959 and then declined rapidly (Blanco Villegas *et al.*, 2004, p. 199). Multiple Consanguineous Marriages were also common. Thus, from 1880 to 1989 MCMs up to third cousins comprised 5.43% of all marriages (Blanco Villegas *et al.*, 2004, pp. 196–197). By combining the analysis of MCMs and isonomy patterns, these authors concluded that the main causes of consanguinity and inbreeding in La Cabrera were geographic factors, particularly poor communications, together with the internal division of the rugged territory in small villages resulting in a strong Wahlund effect (Blanco Villegas *et al.*, 2004, p. 206). In a subsequent publication analysing parent–offspring and marital migration matrices, these authors confirmed that reproductive barriers commonly coincided with geographic barriers and that there was a 'dependence of the genetic structure on geographical distance' (Boattini *et al.*, 2007, p. 649).

The Diocese of Sigüenza-Guadalajara, on the eastern border of the Central Meseta, has offered another case of intense consanguinity sustained for generations. In the period from 1861 and 1980, Calderon *et al.* (1998) found a total consanguinity rate up to third cousins of 21.9%, resulting in an average inbreeding coefficient of 4.9×10^{-3} (Calderón *et al.*, 1998, pp. 549, 556). Multiple Consanguineous Marriages up to C44 were 5.24% of all marriages in the whole study period, and 8.14% between 1891 and 1920 (Calderón *et al.*, 1998, p. 549). These authors did a pioneering analysis of the weight of multiple consanguinity on total inbreeding levels, and found F_t/F_s rates of 1.51 from 1861 to 1980 (Calderón *et al.*, 1998 p. 556). Hence, MCMs increased the inbreeding values over SCM by over 50%.

However, applying the same calculation methods to the sample of *Gitano*/*Calé* people resulted in a total consanguinity rate up to third cousins of 43.5% and a F_t/F_s rate of 2.38 (the average inbreeding value for SCMs up to third cousins was 6.207×10^3, and for equivalent total with

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

MCMs it was 14.773×10^{-3}). Thus, among *Gitanos*, the cumulative weight of multiple consanguinity was significantly higher than that of the most endogamous of Spanish populations.

Study limitations and strengths

The study has its limitations. The first is the relatively small size of the population studied, and the number of marriages analysed, particularly when compared with larger samples found in ecclesiastical records or large surveys. For Romani groups, however, there seem to be very few studies on marriage patterns that approach the sample size and temporal depth of the present one.

Secondly, the obtained sample did not represent the whole population of Spanish *Gitanos*. Therefore, the results presented should be considered as a baseline for comparing results from studies of *Gitano*/*Calé* couples in other regions. A third limitation was the under-registration of *Gitano* marriages, births and deaths. This trend decreased in the 20th century, especially since the mid-1920s. Thereafter the official records of *Gitano* births and deaths became more exhaustive and complete (Gamella & Martín, 2017). A major cause of under-registration results from the mobility and migration patterns of this population. People who were born, died or married away from the study area may be under-represented. However, the present sample involved many individuals and families who migrated seasonally or permanently to other regions or countries, particularly in the 1960s and 1970s, and who later returned to their birth places. The marriage and reproductive behaviour of these 'leavers' did not seem to differ from those of their relatives who remained in the study area. Besides, the problem of 'escapes' due to migration that affects all family reconstitution projects was mitigated here by the 'extreme labour of reconstituting a large block of adjacent parishes' (Wrigley, 1994, p. 81).

Nevertheless, the family and genealogical reconstitution methods applied to this population were capable of establishing more and more distant degrees of kinship than most other methods, including those using ecclesiastical records of consanguinity dispensations. This applied even to those decades when Roman Catholic marriages became most common in this minority. For instance, in the period from 1925 to 1993, the ecclesiastical records of the Diocese of Granada (Núñez-Negrillo, 2015; Gamella & Núñez-Negrillo, 2018) included 127 *Gitano* consanguineous marriages in which at least one of the partners was born in one of the towns of the study area that belonged to this diocese. The genealogical reconstitution correctly identified 87% of these cases. Most of the other cases involved a local partner who married in a place away from the study area and did not return. On the other hand, the unions found in that exhaustive diocesan record only included 52% of all equivalent *Gitano* consanguineous couples found by the genealogical reconstitution.

Conclusion

This study shows that many *Gitano*/*Calé* families in eastern Andalusia, Spain, have maintained a culturally distinct preference for consanguineous marriage that remained 'unbroken across generations' (Bittles, 2012, p. 85). Consanguineous marriages were common among these people throughout the 20th century and remain common today. This contrasts with the processes found in most Spanish and European populations. Similar patterns, however, may be also found among other (but not all) Romani groups in Europe and America.

The structure of *Gitano* consanguinity is also different to that of their neighbours, as it includes preferential unions with first cousins and cousins once removed, as well as multiple degrees of relatedness to a level unknown in other Spanish populations. Therefore, average inbreeding values have remained much higher in the *Gitano* population than among their most endogamous neighbours. Distant kin ties, most of which may have little genetic or social relevance in isolation, when accumulated in multiple degrees of relatedness increased total inbreeding levels significantly. Most of these ties are commonly disregarded by other research methods. In this sense, the method of

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

reconstituting families and merging genealogies followed in this study may be useful, particularly with populations that sustain consanguineous marriages through generations. An ethnographic and local approach is also useful when studying a population with independent procedures for establishing common-law unions that often are not formalized or registered. This is common practice in other Romani populations.

Among *Calé* groups, socio-cultural introversion and a strong preference for endogamy may have been more important than geographical barriers and limitations. Therefore, the great socio-political and demographic transformations of the second half of the 20th century have affected *Gitano* marriage patterns in a different and more complex form than their neighbours. Thus, in the 1960s and 1970s Spain experienced accelerated processes of industrialization and economic internationalization, resulting in an 'exodus' from rural to urban areas that broke up geographical barriers and increased the urbanization of the population (Shubert, 2003). In these decades many Andalusian *Gitano* families also migrated to more prosperous regions in the centre, east and north of Spain, and abroad. However, many of these families maintained strong preferences for interfamily marriages. Surprisingly, the highest rates of consanguinity appeared during this period. It seems that the rapid population growth brought about by the fall in infant and child mortality (Gamella & Martín, 2017) increased the size of *Gitano* households and the number of surviving collateral relatives, making family endogamy more likely. This confirms the importance of demographic transitions on patterns of inbreeding.

Even in the most recent period in democratic Spain, from 1978 to 2006, when most *Gitano* families experienced a generalized improvement of living conditions and opportunities, but also new problems such as drug dependence, urban decay and ghettoization, many of them have relied on the safety and certainty of intra-family marriage to face exclusion and multiple disadvantage. In many families, however, the secular pattern of endogamy is breaking down and the number of mixed marriages is increasing. Both the rejection of powerful majorities and a strong sense of ethnic distinction and separation have shaped a unique cultural and genetic profile that requires specific study designs that 'acknowledge cultural tradition and self-identity' (Kalaydjieva *et al.*, 2005, 1084), as well as cultural and demographic transformations.

Acknowledgments. Elisa Martín Carrasco-Muñoz, a historian–demographer who died in 2009, was the heart and soul of the family and genealogical reconstitutions upon which this paper was based. She must be considered a co-author of any work deriving from this database. Mercedes Alba Maza, Mari Luz Flores Antiguedad, F. Antonio González Navarrete and Alejandro Quesada Garrido also contributed to the archival research in civil and parish registries. Jesús Martín helped with the map. Angel Heredia Amador has provided important advice over the years, and hundreds of *Gitano* friends in the localities studied shared their views and experiences with us, something for which we will always be grateful. Thomas Acton, Alan H. Bittles, María José Blanco Villegas, Alessio Boattini, Vicente Fúster, Daniel La Parra, Elena Marushiakova, Veselin Popov and one anonymous reviewer read prior versions of this paper and made important suggestions. The author, however, remains the only responsible for its shortcomings and for the views here expressed.

Funding. This research was completed within the Proyecto de Excelencia, P11.SEJ.8286 of the Junta de Andalucía, Spain.

Conflicts of Interest. The author has no conflicts of interest to declare.

Ethical Approval. The author asserts that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

References

Agarwala R, Schaffer AA and Tomlin JF (2001) Towards a complete North American Anabaptist Genealogy II: analysis of inbreeding. *Human Biology* **73**(4), 533–545.

Alba RD and Nee V (2003) *Remaking the American Mainstream: Assimilation and Contemporary Immigration.* Harvard University Press, Cambridge, MA.

Alfonso-Sánchez MA, Aresti U, Peña JA and Calderón R (2005) Inbreeding levels and consanguinity structure in the Basque province of Guipúzcoa (1862–1980). *American Journal of Physical Anthropology* **127**(2), 240–252.

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

Al-Gazali LI, Bener A, Abdulrazzaq YM, Micallef R, Al-Khayat AI and Gaber T (1997) Consanguineous marriages in the United Arab Emirates. *Journal of Biosocial Science* **29**(4), 491–497.

Barth F (1986) Father's brother's daughter marriage in Kurdistan. *Journal of Anthropological Research* **42**(3), 389–396.

Bideau A and Poulain M (1984) De la genealogie a la demographie historique: Genealogie ascendante et analyse demographique. *Annales de demographie historique* **1984**, 55–69

Bittles AH (2012) *Consanguinity in Context*. Cambridge University Press, Cambridge.

Blanco Villegas MJ, Boattini A, Rodríguez Otero H and Pettener D (2004) Inbreeding patterns in La Cabrera, Spain: dispensations, multiple consanguinity analysis, and isonymy. *Human Biology* **76**(2), 191–210

Boattini A, Blanco Villegas MJ and Pettener D (2007) Genetic structure of La Cabrera, Spain, from surnames and migration matrices. *Human Biology* **79**(6), 649–666.

Calderón R (1983) Inbreeding migration and age at marriage in rural Toledo Spain. *Journal of Biosocial Science* **15**(1), 47–57.

Calderón R, Aresti U, Ambrosio B and González-Martín A (2009) Inbreeding coefficients for X-linked and autosomal genes in consanguineous marriages in Spanish populations: the case of Guipúzcoa (Basque Country). *Annals of Human Genetics* **73**(2), 184–195.

Calderón R, Hernández CL, García-Varela G et al. (2018) Inbreeding in Southeastern Spain. *Human Nature* **29**(1), 45–64.

Calderón R, Peña JA, Delgado J and Morales B (1998) Multiple kinship in two Spanish regions. New model relating multiple and simple consanguinity. *Human Biology* **70**(3), 535–561.

Cavalli-Sforza LL, Moroni A and Zei G (2004) *Consanguinity, Inbreeding, and Genetic Drift in Italy*. Princeton University Press, Princeton, NJ.

Cohn W (1973) *The Gypsies*. Addison Wesley Publishing Company, Reading, MA.

Dupâquier J (1993). Généalogie et démographie historique. *Annales de démographie historique* **1993**, 391–395

Ferák V, Sivakova D and Sieglova Z (1987) The Slovak gypsies (Romany) – a population with the highest coefficient of inbreeding in Europe. *Bratislavské lekárske listy* **87**(2), 168–175.

Fraser A M (1992) *The Gypsies*. Blackwell, Oxford.

Fundación Secretariado Gitano (2016) *Estudio-Mapa sobre vivienda y población gitana 2015*. Ministerio de Sanidad Servicios Sociales e Igualdad, Madrid.

Fuster V (2003) Inbreeding pattern and reproductive success in a rural community from Galicia (Spain). *Journal of Biosocial Science* **35**(1), 83–93.

Fuster V and Colantonio SE (2003) Inbreeding coefficients and degree of consanguineous marriages in Spain: a review. *American Journal of Human Biology* **15**(5), 709–716.

Fuster V and Colantonio SE (2004) Socioeconomic, demographic and geographic variables affecting the diverse degrees of consanguineous marriages in Spain. *Human Biology* **76**(1), 1–14.

Fuster V, Morales B, Mesa MS and Martin J (1996) Inbreeding patterns in the Gredos mountain range (Spain). *Human Biology* **68**(1), 75–93.

Gamella JF (1996) *La población gitana en Andalucía. Un estudio exploratorio de sus condiciones de vida*. Consejería de Trabajo y Asuntos Sociales Junta de Andalucía, Seville.

Gamella JF (2000) *Mujeres gitanas Matrimonio y género en la cultura gitana de Andalucía*. Junta de Andalucía, Seville.

Gamella JF (2011) *Historias de éxito Modelos para reducir el abandono escolar de la adolescencia gitana*. Ministerio de Educación, Madrid.

Gamella JF, Gómez Alfaro A and Pérez J (2014) Nominal assimilation. The national and ethnic identity of the Gitanos of Spain in the 1783–85 census. *Names* **62**(3), 147–164.

Gamella JF and Martín E (2007) 'Vien avec moi cousine'. Le mariage entre cousins germains chez le Gitans Andalous. *Etudes Tsiganes* **30**, 110–151.

Gamella JF and Martín E (2017) The decline of infant and child mortality among Spanish Gitanos or Calé (1871–2005): A microdemographic study in Andalusia. *Demographic Research* **36**, 945–988.

Gamella JF and Núñez-Negrillo AM (2018) The evolution of consanguineous marriages in the Archbishopric of Granada, Spain (1900–1979). *Human Biology* **90**(2), 97–114.

Gómez Alfaro A (1993) *The Great Gypsy Round-up Spain: The General Imprisonment of Gypsies in 1749*. Presencia Gitana, Madrid.

Gómez Alfaro A (1999) Tipologías, Matrimonios mixtos y mestizajes Gitanos en los censos históricos andaluces. *Demófilo* **30**, 30–52.

Hartl DL and Clark AG (1997) *Principles of Population Genetics*. Sinauer Associates, Sunderland, MA.

Hollingsworth TH (1976) Genealogy and historical demography. *Annales de démographie historique*, **1976**, 167–170.

Jette R and Charbonneau H (1984) Généalogies descendantes et analyse demographique. *Annales de demographie historique* **1984**, 45–54.

Kalaydjieva L, Gresham D and Calafell F (2001) Genetic studies of the Roma (Gypsies): a review. *BMC Medical Genetics* **2**(1), 5.

Kalaydjieva L, Morar B, Chaix R and Tang H (2005) A newly discovered founder population: the Roma/Gypsies. *Bioessays* **27**(10), 1084–1094.

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press

Ladányi J and Szelényi I (2006) *Patterns of Exclusion: Constructing Gypsy Ethnicity and the Making of an Underclass in Transitional Societies of Europe*. Columbia University Press, New York.

Lagunas D (2005) *Los tres cromosomas: modernidad identidad y parentesco entre los Gitanos catalanes*. Editorial Comares, Granada.

Leach ER (1951) The structural implications of matrilateral cross-cousin marriage. *Journal of the Royal Anthropological Institute of Great Britain and Ireland* **81**(1/2), 23–55.

Leblon B (1985) *Les Gitans d'Espagne: le prix de la différence*. Presses Universitaires de France, Paris.

Leblon B (2003) *Gypsies and Flamenco: The Emergence of the Art of Flamenco in Andalusia*. Second Edition. University of Hertfordshire Press, Hatfield.

Lévi-Strauss C (1947) *Les structures élémentaires de la parenté*. Maison des Sciences de l'Homme, Paris.

Luna Gómez F (1984) *Demografía de la Alpujarra (Estructura y biodinámica Granada)*. Universidad de Granada, Granada.

Martín E and Gamella JF (2005) Marriage practices and ethnic differentiation: the case of Spanish Gypsies (1870–2000). *History of the Family* **10**(1), 45–63.

Martínez-Frías ML and Bermejo E (1992) Prevalence of congenital anomaly syndromes in a Spanish Gypsy population. *Journal of Medical Genetics* **29**(7), 483–486.

Matras Y (2015) *The Romani Gypsies*. Harvard University Press, Cambridge, MA.

Mendizabal I, Lao O, Marigorta UM, Wollstein A et al. (2012) Reconstructing the population history of European Romani from genome-wide data. *Current Biology* **22**(24), 2342–2349.

Morar B, Gresham D, Angelicheva D, Tournev I et al. (2004) Mutation history of the Roma/Gypsies. *American Journal of Human Genetics* **75**(4), 596–609.

Newman DL, Abney M, McPeek MS, Ober C and Cox NJ (2001) The importance of genealogy in determining genetic associations with complex traits. *American Journal of Human Genetics* **69**(5), 1146–1148.

Nuñez-Negrillo AM (2015) Un siglo de matrimonios consanguíneos en la archidiócesis de Granada (1900-1999). Un análisis antropológico. PhD Thesis, Universidad de Granada, Granada.

Post W, Van Poppel F, Van Imhoff E and Kruse E (1997) Reconstructing the extended kin-network in the Netherlands with genealogical data: methods problems and results. *Population Studies* **51**(3), 263–278.

Pym RJ (2007) *The Gypsies of Early Modern Spain, 1425–1783*. Palgrave Macmillan, New York.

Ramirez CT, Morales EF, Gómez AZ, Alcaraz LG and Samper SDR (1984) An epidemiological study of renal lithiasis in Gypsies and others in Spain. *Journal of Urology* **131**(5), 853–856.

Saadat M, Ansari-Lari M and Farhud DD (2004) Short report consanguineous marriage in Iran. *Annals of Human Biology* **31**(2), 263–269.

San Roman T (1997) *La diferencia inquietante: viejas y nuevas estrategias culturales de los Gitanos*. Siglo XXI, Madrid.

Scheffler HW (2018) *Filiation and Affiliation*. Routledge, London.

Shubert A (2003) *A Social History of Modern Spain*. Routledge, London.

Solana JL and Lorenzo S (2010) *La población gitana de Linares: Situación actual y evolución durante las dos últimas décadas (1989–2009)*. Comares, Granada.

Thomas JD, Doucette MM, Thomas DC and Stoeckle J (1987) Disease lifestyle and consanguinity in 58 American Gypsies. *The Lancet* **330**(8555), 377–379.

Williams EM and Harper PR (1977) Genetic study of Welsh gypsies. *Journal of Medical Genetics* **14**(3), 172–176.

Wrigley EA (1966) Family reconstitution. In Wrigley EA (ed.) *An Introduction to English Historical Demography: From the Sixteenth to the Nineteenth Century*. Basic Books, New York, pp. 96–159.

Wrigley EA (1994) The effect of migration on the estimation of marriage age in family reconstitution studies. *Population Studies* **48**(1), 81–97.

Zhao Z (2001) Chinese genealogies as a source for demographic research: a further assessment of their reliability and biases. *Population Studies* **55**(2), 181–193.

Cite this article: Gamella JF (2020). Consanguineous marriages among Andalusian *Gitanos/Calé*: a genealogical analysis (1925–2006). *Journal of Biosocial Science* **52**, 809–831. https://doi.org/10.1017/S0021932019000804

https://doi.org/10.1017/S0021932019000804 Published online by Cambridge University Press