

# Aetiology of Colla 9-0-9 Configuration

It is almost certain that the values of 9-0-9 for markers DYS 511, 425, 505 are stable and defining for the Colla population (with a couple of exceptions). In order to explore the variability of these markers, I

SNPs	Core Value	511,425,505 Single step Mutants (forward & reverse from core)										Non Colla		Colla			Totals		
		10-12-12	10-12-13	10-12-11	11-12-12	9-12-12	9-12-13	11-12-13	12-12-12	8-12-12	10-13-12	10-12-10	11-12-11	10-0-12	10-0-13	9-0-9		9-0-10	10-0-9
<b>L21 and Descendant SNPs</b>																			
L21+	96	12	5	13	1	1	1	2	1								18		150
DF63+ (L21>DF63)	9				4														13
DF13+ (L21>DF13)	70	11	12	8	4	1	1		1								3		111
DF21+ (L21>DF13>DF21)	14	6		1	1		2							1			18	1	45
Z246+ (L21>DF13>DF21>Z246)	1		1																2
DF25+, DF5- (L21>DF13>DF21>Z246>DF25)	2																		2
DF5+ (L21>DF13>DF21>Z246>DF25>DF5)	18				1														19
P314.2+ (L21>DF13>DF21>P314.2)	5																		5
L362+ (L21>DF13>DF21>P314.2>L362)						1													1
L720+ (L21>DF13>DF21>L720)	3																		3
DF41+ (L21>DF13>DF41)	12																		12
L744/L746+, L745- (L21>DF13>DF41>L744/L746)	1																		1
L745+ (L21>DF13>DF41>L744/L746>L745)	7																		7
L563+ (L21>DF13>DF41>L563)	1																		1
DF49+ (L21>DF13>DF49)	3																		3
DF23+, M222- (L21>DF13>DF49>DF23)	7					1													8
M222+ (L21>DF13>DF49>DF23>M222)	38	2	2								1			1					44
L144+ (L21>DF13>L144)	7																		7
L371+ (L21>DF13>L371)	4																		4
L513+, P66-, L193- (L21>DF13>L513)	23	16	1			1	3												44
L706.2+, L705.2- (L21>DF13>L513>L706.2)	1																		1
L705.2+ (L21>DF13>L513>L706.2>L705.2)	6																		6
L193+ (L21>DF13>L513>L193)	37	1									1			1					40
P66+ (L21>DF13>L513>P66)	2																		2
L555+ (L21>DF13>L555)	4																		4
L1335+ (L21>DF13>L1335)	22											2							24
Z253+, L226- (L21>DF13>Z253)	9	1	2	6															18
L226+ (L21>DF13>Z253>L226; Irish Type III)	12		1																13
L554+ (L21>DF13>Z253>L554)	1																		1
L643+ (L21>DF13>Z253>L643)	1																		1
Z2185+ L1066- (L21>DF13>Z253>Z2185)	3				1														4
L1066+ (L21>DF13>Z253>Z2185>L1066)	9	1										1							11
Z255+, L159.2- (L21>DF13>Z255)	2																		2
L159.2+ (L21>DF13>Z255>L159.2)	17																		17
Totals	445	52	24	32	10	3	9	2	1	2	1	1	2	1	1	39	1	1	626

Table 1. Distribution of R-L21 by haplogroup and values for markers 511, 425, 505.

examined all R-L21 (from the L21 Project as at Dec 2012) that had tested to 111 markers. In all 626 testers qualified of whom 445 (71%) had values of 10-12-12 for these three markers (Table 1). I have termed these 'core values' on account of their frequency.

### R-L21 tested to 111 markers

The testers in the R-L21 Project are ordered by the SNPs they have tested for; this layout is reproduced in Table 1. The distribution of 'three marker' configurations for each haplogroup is shown horizontally across Table 1. These variants (from the core values) are attributable to single (or more than one cumulatively) step mutation(s) occurring at meiosis. These have occurred in both forward and reverse directions from the core values for 511 and 505, mostly 11 and 9 for 511 and 13 and 11 for 505 (Table 2).

DYS 511	Repeats	No.	DYS 505	Repeats	No.
Core	10	524	Core	12	492
Var	11	42	Var	13	64
Var	9	13	Var	11	25
Var	12	2	Var	10	1
Var	8	1			
10% variability			15% variability		

**Table 2. Number of variants from core values for DYS 511 and 505 among 582 Non-null Testers.**

There are no values of nine repeats for 505 which is not surprising as the above distribution would predict that three sequential mutations would be extremely rare, probably so rare as not to survive to the present day. Nevertheless, such an event must have occurred to give 9-12-9 (or close to this) prior to the 425 null event. The remarkable stability of the 9-0-9 configuration might be attributable to the coincidental occurrence of the 425 deletion. Its present day high proportion in the L21 population is attributable to its early amplification due to high fecundity and low attrition, a situation which history suggests applied to the early Collas.

The Colla configuration of 9-0-9 is clear-cut and its most downstream haplogroup is DF21 (amber in Table 1), the assumption being that the earlier occurrences simply hadn't tested for DF21. The two exceptions (light amber) are probably single step mutants from 9-0-9; less likely, is that one of them (but not both) could have been the Colla precursor. The evidence suggests that three additional null events (pink in Table 1) occurred in the L21 population (in addition to the Colla null).

There are five examples of null configurations other than 9-0-9 (Table 3). The first two can be accounted for by subsequent single step mutations in 511 and 505 respectively. The three remaining nulls occurred in haplogroups DF21, R-M222 and R-L193. As none of these null configurations show any significant relationships to each other (in McGee), it is probable that all five configurations arose independently.

Configuration	Haplogroup	ID	Name	Key Marker Matches (excl nulls)	GD to DURRQ @ 67 mrks	Derivation	Classification
10-0-9	DF21	21971	McDougall	3	8	Single-step	Colla
9-0-10	DF21	156013	Glennon	2	11	Single-step	Colla
10-0-13	DF21	208397	McCloud	1	20	Independent Null	Non-Colla
10-0-12	M222	30771	Burns	0	23	Independent Null	Non-Colla
10-0-12	L193	144090	Little	0	22	Independent Null	Non-Colla

**Table 3. Null configurations other than 9-0-9**

A combination of a high number of key matches and low GD values (to DURRQ) distinguishes Colla nulls from the opposite which indicates non-Colla nulls (Table 3). Haplogroups can be a contributory identifier.

### R-L21 tested to 67 markers

It was quickly realized that among the 111 testers who were non-Colla, there were no obvious Colla precursors; the closest any of them came to 9-0-9 was four steps away. Consequently, 67 marker non-Colla data was examined on the basis of the Colla key markers (385, 511, 413, 534) and GD to the DURRQ modal. The data was sorted by the number of key marker matches and by GD values (Table 4).

There were no incidences of four marker matches but four 3 marker and a large number of 2 and 1 marker matches were found; only those having 3, 2 and 1 matches are shown in Table 4. GDs ranged from 9 to 30. Where available, values for 505 and the number of steps needed to become 9-0-9, were filled-in.





William Bush, b. c. 1655, England; d. 1739, MD	England	R1b1a2a1a1b4	19 36886	11-14	9	12	20-23	15	1
Fred House 1900 - 1970	Unknown Origin	R1b1a2a1a1b4	19 48292	11-13	10	12	22-23	14	1
Nathan Arnett, b.c. 1760, Kent Co. Del.	Unknown Origin	R1b1a2a1a1b4	19 51353	11-14	10	12	22-23	14	1
Unknown	Unknown Origin	R1b1a2a1a1b4	19 53904	11-15	10	12	23-23	15	1
John Hamilton, b.c. 1634, Scotland	Scotland	R1b1a2a1a1b4	19 64670	11-14	10	12	22-23	15	1
Hugh Boyd, Patrick Cnty. VA USA late 1700's	Unknown Origin	R1b1a2a1a1b4	19 78805	11-14	10	12	22-23	14	1
Guillaume Hamon b: ca 1666, Mayenne, FR	France	R1b1a2a1a1b4	19 84034	11-16	9	12	23-23	15	13 1 5
john lawrie 1580 Fife scotland	Scotland	R1b1a2a1a1b4	19 93409	11-14	10	12	22-23	15	1
John Watkins b 1694-1763,. d. Halifax County	Unknown Origin	R1b1a2a1a1b4	19 102970	13-14	10	12	23-23	16	1
Alexander McMillan, b.1819, Carsphairn, Kirkcudbri	Scotland	R1b1a2a1a1b4	19 104203	11-14	10	12	22-23	15	1
Alexander MacGruar b.10/7/1706 Boleskine Scotland	Ireland	R1b1a2a1a1b4	19 114664	11-15	10	12	23-23	15	1
Patrick Feeney B1790-Maureen,Gorumna Island Galway	Ireland	R1b1a2a1a1b4	19 124898	10-11	10	12	21-23	16	1
Leysmill, Angus, Scotland	United Kingdom	R1b1a2a1a1b4	19 125139	11-14	10	12	22-23	15	1
James McCarthy b c 1782 COR IRL	Ireland	R1b1a2a1a1b4	19 128856	11-15	8	12	23-23	15	1
John of Nuide>Donald 1614>William 1638>Blairgowrie	Scotland	R1b1a2a1a1b4	19 132463	11-14	10	12	22-23	15	1
Richard White, 1710 - 1757	England	R1b1a2a1a1b4	19 138906	12-15	10	12	23-23	16	1
Walter Matheson, 1770-1861	Scotland	R1b1a2a1a1b4	19 144926	11-14	10	12	22-23	14	1
John Gibbons 1780-1855, Louisburgh, Co Mayo	Ireland	R1b1a2a1a1b4	19 167144	11-14	9	12	23-23	15	1
Adam Cunningham b.1713 Ireland(of Scotland)	Ireland	R1b1a2	19 173987	11-14	10	12	22-23	15	1
John Sorley b. 1776 Fowlls Wester PerthshireScotla	Scotland	R1b1a2a1a1b4	19 174145	11-14	10	12	22-23	15	13 1 6
Henrik Magnusson Jukonen,1789-1842,Johannes,Finlan	Finland	R1b1a2a1a1b4	19 176545	11-14	10	12	23-24	16	1
Oluf Aase 1537-1601 Kvam, Hordaland	Norway	R1b1a2a1a1b4	19 200859	11-14	10	12	21-23	16	1
Michael Lynch, born 1820 County Clare	Ireland	R1b1a2a1a1b4	19 213449	11-15	10	12	23-23	15	1
Thomas Watson,c1690	Scotland	R1b1a2a1a1b4	19 E2651	11-14	10	12	22-23	15	1
William McKee, b.c. 1835, Pomeroy, Co. Tyrone, Ir	Ireland	R1b1a2a1a1b4	19 N2261	11-14	10	12	22-23	15	1
Christopher Lenares, born c. 1911, Spain	Spain	R1b1a2a1a1b4	19 N43805	11-14	10	12	23-23	16	1
Laban C. Marsh, b. abt 1790, Edgefield Co. SC	United Kingdom	R1b1a2a1a1b4	19 N61764	11-14	10	12	23-23	16	1
	Ireland	R1b1a2a1a1b4	19 N65235	11-14	10	12	23-23	16	1
Austin Shipp Price, b. 26 Jun 1840, Johnson Co, IN	United Kingdom	R1b1a2a1a1b4	20 9452	11-14	9	12	23-24	15	12 1 4
Andrew Lamont Young, b 1646 Dunoon, Scotland	Scotland	R1b1a2a1a1b4	20 10429	11-14	10	12	22-23	15	1
John Harvey, b. abt. 1615, Warwickshire, England	England	R1b1a2a1a1b4	20 21011	11-14	10	12	23-24	16	1
Lachlan Macdonald, born abt 1740 North Uist	Scotland	R1b1a2a1a1b4	20 26569	11-14	10	12	22-23	15	1
Donald McComas/McGregor, b.c. 1720 Brig o' Turk	Scotland	R1b1a2a1a1b4	20 28296	11-14	10	12	22-23	15	1
Neil Mathesonb1823LochAlshSCT>CAN Z2534+L643+ 111p	Scotland	R1b1a2a1a1b4	20 57521	11-14	10	12	23-23	16	1
James Moore, ca.1650-1694, b.UK, d.PA, USA; Scotti	United Kingdom	R1b1a2a1a1b4	20 67708	11-14	10	12	21-23	16	1
John Woods, b. c 1720, Ireland; d. 13 Nov 1813, NC	Ireland	R1b1a2a1a1b4	20 76375	11-14	10	12	22-23	11	1
Elijah Campbell (b.1833) Drumgoon, Cavan, Ireland	Ireland	R1b1a2a1a1b4	20 82992	12-14	10	12	22-23	15	1
John Phillips d:1801 Rowan Co. NC	Unknown Origin	R1b1a2a1a1b4	20 84729	11-13	9	12	21-24	15	1
Thomas Griffin, b c1765 NC, d 1812 Tattnall Co, GA	Unknown Origin	R1b1a2a1a1b4	20 96772	11-15	10	12	23-23	17	1
James D Robinson III, 1935, Atlanta, GA	Unknown Origin	R1b1a2a1a1b4	20 103494	11-14	10	12	23-23	16	1
George Thomas Hamilton, (1844-1914)	Unknown Origin	R1b1a2a1a1b4	20 112391	11-14	10	12	22-23	14	1
James RODDY b 1784 Gamaliel, KY poss Cork ancest	Ireland	R1b1a2a1a1b4	20 140532	11-15	10	12	23-23	15	1
Zedekiah Morgan, 1795-after 1860	Unknown Origin	R1b1a2a1a1b4	20 173316	11-14	9	12	23-23	18	1
James Robertson b.1850, Ball Play, Cherokee Co, AL	Scotland	R1b1a2	20 193641	11-14	10	12	21-23	16	1
Jeremie(?) Onfray, b. 1620 in Fresnes (Normandy)	France	R1b1a2a1a1b4	20 E15470	11-14	10	12	23-23	16	1
James Sutherland, b.1755c Unknown Scotland	Scotland	R1b1a2a1a1b4	20 N25121	11-15	10	12	22-23	15	1
James Diver, b.c. 1824, Kilmacrennan, Donegal, Ire	Ireland	R1b1a2a1a1b4	21 10800	10-14	10	12	22-23	17	1
Edward Baker c.1610-1687; d. Lynn, MA, USA	England	R1b1a2a1a1b4	21 12539	11-15	10	12	23-23	15	1
James Guthrie c1720-1800, IRL/MD/NC (Elizabeth)	Northern Ireland	R1b1a2a1a1b4	21 24607	11-14	9	12	23-23	14	12 1 4
	Scotland	R1b1a2a1a1b4	21 42875	11-14	9	12	23-24	17	1
William Addison, unkn- 1811	United Kingdom	R1b1a2a1a1b4	21 85688	11-14	10	12	23-24	16	1
David Enix, b.c. 1750, Albemarle Co. VA	Scotland	R1b1a2a1a1b4	21 102770	11-13	10	12	22-23	15	1
Michael Byrne, 1818 - 1871	Ireland	R1b1a2a1a1b4	21 127795	11-16	10	12	22-23	16	1
Walter Kelly, b.c.1730, Timahoe, Kildare, Ireland	Ireland	R1b1a2a1a1b4	21 129844	11-14	10	12	23-23	16	1
Stephen Harding b 1623 MA d 1698 RI	England	R1b1a2a1a1b4	21 132486	11-15	10	12	21-23	15	1
Jeffrey Robertson, b. 1654, Scotland	Scotland	R1b1a2a1a1b4	21 134396	11-14	10	12	21-23	16	1
John Woods, b. c 1720, Ireland; d. 13 Nov 1813, NC	Ireland	R1b1a2a1a1b4	21 152967	11-14	10	12	22-23	11	1
Edward Culver 1600-1685 Colonial MA and CT	United Kingdom	R1b1a2a1a1b4	21 205239	11-13	10	12	23-23	16	1
Pere ROMA, b. 1500, Borredà (Catalonia)	Spain	R1b1a2a1a1b4	21 232541	11-14	9	12	20-23	15	1
George Brown, 1816 - 1892	England	R1b1a2a1a1b4	21 N18363	11-14	10	12	22-23	15	1
Richard Harvey b @ 1642 prob. Warwickshire, UK	United Kingdom	R1b1a2a1a1b4	21 N40691	11-14	10	12	23-24	16	1
Dougald Matheson, born Lochalsh, Wester Ross, Scot	Scotland	R1b1a2a1a1b4	21 N68552	12-14	10	12	22-23	15	1
Patrick Dalton born 1841 Ballyknockane, Kilcash	Ireland	R1b1a2a1a1b4	22 8211	11-14	10	12	23-23	16	1
William White b. 1792, West Twp. Huntingdon County	Unknown Origin	R1b1a2	22 18569	11-15	10	12	23-23	15	1
	Unknown Origin	R1b1a2a1a1b4	22 28460	11-14	10	12	23-23	16	1
	Unknown Origin	R1b1a2a1a1b4	22 35786	11-14	10	12	23-23	16	1
John J Barrett 1908-1985 Proctor,MN. U.S.A.	Unknown Origin	R1b1a2a1a1b4	22 43096	11-14	10	12	22-23	14	1
William Harley 1830 - 1900	Ireland	R1b1a2a1a1b4	22 52460	12-14	10	12	22-23	19	1
John Anderson ca.1706 Scot/Ire -1787VA	Scotland	R1b1a2a1a1b4	22 56732	11-16	9	12	23-23	15	13 1
William Center, bc. 1782, NC; d. 1839, SC	Unknown Origin	R1b1a2a1a1b4	22 82080	11-14	10	12	22-23	11	1
Benjamin W. Elliott b. c. 1812 NC d. c. 1865 AL	Ireland	R1b1a2a1a1b4	22 100202	11-15	10	12	21-23	14	1
Jack Fields, b.1859, Tishomingo, MS	Unknown Origin	R1b1a2a1a1b4	22 103139	11-13	10	12	23-23	14	1
	United Kingdom	R1b1a2a1a1b4	22 140003	11-13	9	12	23-23	15	1
Alexander McLachlan b1790 St Ninians, Scot.	Scotland	R1b1a2a1a1b4	22 147767	11-14	10	12	22-23	15	1
John Etherington, 1763-1838	England	R1b1a2a1a1b4	22 155793	11-14	10	12	22-23	15	1
Jean Bodin, 1645	France	R1b1a2a1a1b4	22 160587	11-13	9	12	23-23	14	1
Andrew Bryant, 1825-1864	Unknown Origin	R1b1a2a1a1b4	22 169471	12-15	10	12	23-23	16	1
Lauchlan Rose, 15 Oct 1723, Cawdor, Nairnshire, Sc	Scotland	R1b1a2a1a1b4	22 183786	11-14	10	12	22-24	16	1
Jared McDonald, 1740 - 1808	Scotland	R1b1a2a1a1b4	22 188279	11-15	10	12	23-23	15	1
Alexander Thomson, born 1819, Lesmahagow, Scotland	Scotland	R1b1a2a1a1b4	22 189779	11-15	10	12	23-23	17	1
James MacGregor alias Drummond b 1760 Comrie	Scotland	R1b1a2a1a1b4	22 213368	11-17	10	11	23-23	16	1
Breen	Ireland	R1b1a2a1a1b4	22 251976	11-14	10	12	22-23	17	1
Laverty	Ireland	R1b1a2a1a1b4	22 254744	11-15	10	12	23-23	15	1
Joseph Griffith b. 1875 MO d.1904 KY	Wales	R1b1a2	22 259187	11-14	9	12	23-23	14	1
Henry Ferguson, b.1807 and d. 1891	Canada	R1b1a2a1a1b4	22 B2715	11-14	10	12	23-23	16	1
Anders Nielsen of Vejle Amt, DK	Denmark	R1b1a2a1a1b4	22 N29988	11-15	10	12	17-21	13	1

Lauritz Lasseson Heihiller b c1630 Fusa, Hordaland	Norway	R1b1a2a1a1b4	22 N36461	11-14	10	12	21-23	16	1
Gaetano C. Basil, b. 1845 Sicily - d.13 Jan. 1903	Italy	R1b1a2a1a1b4	23 11217	11-14	9	12	23-23	14	1
James H. Mitchell b. c1810 TN, prob. Bedford Co.	United Kingdom	R1b1a2a1a1b4	23 14517	11-14	10	12	22-23	15	1
George McCracken, Born: abt 1725 Scotland moved to	Northern Ireland	R1b1a2a1a1b4	23 14749	11-14	10	12	23-23	16	1
Charles P. Lewis (John LEWIS of Wales)	Wales	R1b1a2a1a1b4	23 44100	11-15	10	12	23-23	15	1
Benjamin Jones, 1762 - 1844	Unknown Origin	R1b1a2a1a1b4	23 95968	11-14	9	12	23-23	15	1
James Downie b. ca 1614 Fife Scotland	Scotland	R1b1a2a1a1b4	23 186668	11-14	10	12	22-23	17	1
Archibald or Alexander McLaren, c1785	Scotland	R1b1a2a1a1b4	23 230581	11-14	10	12	22-23	15	1
John Leonard Marth, b 1854, Baden, Germany	Germany	R1b1a2a1a1b4	23 N66020	11-14	10	12	22-23	18	1
Philippe Seville 1570-1662 Quemper-Guezennec (Brit	Unknown Origin	R1b1a2a1a1b4	23 N81310	11-14	9	12	23-25	15	1
Edmund Dalton, b c1840, Newcastle, Co. Tipperary	Ireland	R1b1a2a1a1b4	24 24123	11-14	10	12	23-23	16	1
Edmund Moore, ?-1689	United Kingdom	R1b1a2a1a1b4	24 81136	11-15	10	12	23-23	15	1
William Denson (b.1620,Westminster;d.1676,VA)	England	R1b1a2a1a1b4	24 95499	11-14	10	12	22-23	17	1
Archibald Harvey Johnston, Scotland to Ire 1700s	Scotland	R1b1a2a1a1b4	24 125553	11-14	10	12	22-23	17	1
William Adams Sr. b. abt. 1750 Mullavilly, Armagh	Northern Ireland	R1b1a2a1a1b4	24 191515	11-15	10	12	23-23	15	1
Lemoine	France	R1b1a2a1a1b4	24 224274	11-15	10	12	23-23	15	1
John Elliott, 1878-1947, born in County Donegal	Ireland	R1b1a2a1a1b4	25 11435	11-15	10	12	23-23	14	1
	Unknown Origin	R1b1a2a1a1b4	25 53579	11-14	9	12	23-23	18	1
Benjamin McCullar, 1790 - 1863	Northern Ireland	R1b1a2a1a1b4	25 121376	11-15	10	12	23-23	15	1
JohnCouncil POOL, bc.1825 NC s/o Samuel&Lucretia	Wales	R1b1a2a1a1b4	25 133436	11-16	10	12	24-25	16	1
John Hight, c1757-1824, m. FranklinCo, NC, d. WilsonC, TN	Unknown Origin	R1b1a2a1a1b4	25 133988	11-15	10	12	23-24	15	1
William Grannum b.c.1700 unkn, d.c.1750 Barbados	United Kingdom	R1b1a2a1a1b4	25 147534	11-14	10	12	23-23	16	1
George Stoney, b 1793, Yorkshire, England	England	R1b1a2a1a1b4	25 147536	11-14	9	12	21-23	13	1
Thomas Cross Christmas, 1689-1769	United Kingdom	R1b1a2a1a1b4	25 200075	11-14	10	12	22-23	14	1
Daniel Martin born Galway, died 1847 Dublin, Irela	Ireland	R1b1a2a1a1b4	25 206262	11-14	10	12	22-23	18	1
charles raymond b. c.1850 Massachusetts	Ireland	R1b1a2a1a1b4	26 30889	11-15	10	12	23-23	15	1
y-DNA John Hoyt, James Hight, 1835-98, CampbellCo.VA	Unknown Origin	R1b1a2a1a1b4	26 87805	11-15	10	12	23-25	15	1
	France	R1b1a2a1a1b4	26 182980	12-14	10	12	23-23	16	1
William C. Walker b ca 1836/37 d 1886	Ireland	R1b1a2a1a1b4	27 18396	11-16	10	12	23-23	16	1
Richard Sambell, c 19.07.1661 d. poss 18.08.1695	England	R1b1a2a1a1b4	27 234946	11-14	10	12	22-23	15	1
Thomas Rogers, b 1740, Virginia	United Kingdom	R1b1a2a1a1b4	28 173673	11-14	9	12	23-25	15	1
unknown	Unknown Origin	R1b1a2a1a1b4	30 230096	11-14	9	12	23-23	13	1

**Table 4. Colla key marker matches to R-L21 non-Collas.**

It is surprising that so many Colla Key marker matches were found among the R-L21 non-Collas (Table 5). With as many as 13% having 2 key marker matches and 44% having one match, it would appear that these key marker values are a property of R-L21/DF21 as a whole rather than being specific for Colla exclusively. They indicate the most likely ‘stock’ from which Colla arose.

Key Markers	No.	%
4	0	0
3	4	1
2	64	13
1	220	44
0	206	42

**Table 5. Distribution of Key Matches**

## Relationships

The first 68 testers (cut-off at two marker matches) from Table 4 were compared with 103 known Collas in McGee (with 425 disabled) to identify any significant relationships between Colla and non-Colla. The significance level @67 markers is GD values of 9 or less.

Table 6 shows the relationships identified. The two non-Collas with the lowest GD to DURRQ, Corbitt and Long, exhibited most relationships with Collas. There is always the possibility, although unlikely, that some or all of these non-Collas were misclassified by FTDNA.

ID	Non-Colla	GD	DURRQ	Related to Collas	at GD of
134487	Francis Corbitt, b.c. 1790, Ballymena, Antrim, Ireland	9	412	Peden	9
			112	Walker	7
			173	Calkins	9
			930	Calkins	8
			N16	Calkins	8
			150	Calkins	9
			401	McDaniel	9
			167	O'Carroll	8
			306	Carroll	9
			N41	Carroll	7
			146	Mahan*	6
78252	William Long, b 1740, d 1800 Penn	10	166	Beggan	9
			334	Carroll	9
			100	McKenna	9
			171	McKenna	9
			146	Mahan*	7
156866	William Broom b abt 1800>Daniel Broom, b.1822 S.C.	11	829	McQuillen	9
			368	Paden	9
42048	Cornelius Erwin, b. c. 1780 Ireland	13	150	Calkins	9

\* Representative of a non-Colla cluster

**Table 6. Relationships of R-L21 non-Collas to Collas at GDs of 9 or less at 67 markers.**

Not a lot can be deduced from these relationships other than a suggestion that these non-Collas were from the same 'stock' as the Collas and evolved independently in parallel with the Collas. High GD relationships would be expected for those branching early in the evolutionary tree.

## Conclusions

From this examination of the R-L21 population, the following conclusions were drawn:

- The distinguishing Colla values of 9-0-9 for markers 511, 425, 505 are a unique part of the larger L21/DF21 population. The most common values for these markers are 10-12-12 (core values) accounting for 71% of the L21 and descendant SNP populations.
- Markers 511 and 505 have exhibited the expected variability across the spectrum, showing increased number of copies (forward mutation) and decreased number of copies (reverse mutation) from the core values.
- It is proposed that the occurrence of a Colla precursor such as 9-12-9 would have been a rare event. The configuration of 9-0-9, following a deletion at 425, must have been amplified early in the L21 population in order to achieve its present day high representation in L21,
- Within the wider L21 population, two groups were identified carrying a null value for marker 425. The main one was Colla with a 9-0-9 configuration together with two variants, 9-0-10 and 10-0-9, attributable to single step mutations in 505 and 511. The second group consisted of three independently arisen non-Collas carrying the 425 null.
- Colla key markers are a good indicator of Colla when accompanied by the null value at 425. Otherwise, they only indicate the background population from which Colla arose. 58% of non-null L21 had between 1 and 3 key marker matches.
- A limited number of non-Collas had distant relationships (around GD of 9) with some Collas. These non-Collas were probably representatives of Colla kinsmen who evolved in parallel with them. It was not possible to identify any obvious non-null Colla precursor.