Molecular Characterization, Phylogenetic and Variation Analyzes of SARS-CoV-2 strains in Turkey

Running Title: Molecular Characterization of SARS-CoV-2

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ABSTRACT

Introduction: We present the sequence analysis for 47 complete genomes for SARS-CoV-2 isolates on Turkish patients. To identify their genetic similarity, phylogenetic analysis was performed by comparing the worldwide SARS-CoV-2 sequences, selected from GISAID, to the complete genomes from Turkish isolates. In addition, we focused on the variation analysis to show the mutations on SARS-CoV-2 genomes.

Methods: Illumina MiSeq platform was used for sequencing the libraries. The raw reads were aligned to the known SARS-CoV-2 genome (GenBank: MN908947.3) using the Burrows-Wheeler aligner (v.0.7.1). The phylogenetic tree was constructed using Phylip v.3.6 with Neighbor-Joining and composite likelihood method. The variants were detected by using Genome Analysis Toolkit -HaplotypeCaller v.3.8.0 and were inspected on GenomeBrowse v2.1.2.

Results: All viral genome sequences of our isolates were located in lineage B under the different clusters such as B.1 (n=3), B.1.1 (n=28), and B.1.9 (n=16). According to the GISAID nomenclature, all our complete genomes were placed in G, GR and GH clades. Five hundred forty-nine total and 53 unique variants were detected. All 47 genomes exhibited different kinds of variants. The distinct variants consist of 274 missense, 225 synonymous, and 50 non-coding alleles.

Conclusion: The results indicated that the SARS-CoV-2 sequences of our isolates have great similarity with all Turkish and European sequences. Further studies should be performed for better comparison of strains, after more complete genome sequences will be released. We also believe that collecting and sharing any data about SARS-CoV-2 virus and COVID-19 will be effective and may help the related studies.

Keywords: COVID-19, SARS-CoV-2, Complete genome sequencing, phylogenetic analysis, variation analysis

Introduction

A new virus-associated disease named as coronavirus disease-2019 (COVID-19) by Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) was firstly declared in late December of 2019 in Wuhan, China (1). Right now, there have been more than 16 million confirmed infections and over 645.000 deaths reported worldwide (2). The etiological agent of this disease, SARS-CoV-2 virus has a ssRNA (single-stranded) genome and its length is approximately 29,890 base-pairs (bps) according to the data obtained from NCBI GenBank (GenBank NC_045512.2) (3). After the confirmation of human-to-human transmission and extensive global spread, World Health Organization (WHO) declared COVID-19 as a pandemic on the 11th of March, 2020 (4).

To understand the transmission patterns and evolution of SARS-CoV-2 virus is crucial and necessary for creating better drug and vaccine designs for disease control and prevention (4-6). The analysis of genetic sequence data from a pathogen is known as an important tool in infectious disease epidemiology (7, 8). There are nearly 73.000 SARS-CoV-2 complete genome sequences available on the database of Global Initiative on Sharing All Influenza Data (GISAID) (9). The availability of these genomic data has been helping hundreds of researchers to analyze the genomic diversity of SARS-CoV-2 virus. Firstly, Rambaut et al. (8) have defined the lineage A and B (both of them includes sublineages such as A.1, B.1 or A.1.1) to help for tracking and understanding the patterns and determinants of the global spread of SARS-CoV-2. Then, at 4th of July, 2020, GISAID published the new clade and lineage nomenclature aids in genomic epidemiology studies of SARS-CoV-2 viruses. They developed a nomenclature system based on marker mutations in phylogenetic groups and named as S, L, V, G, GH and GR (10).

In this study, we performed the NGS analysis for 47 complete genomes for SARS-CoV-2 isolates on Turkish patients. To identify their genetic similarity, phylogenetic analysis was performed by comparing the worldwide SARS-CoV-2 sequences, selected from GISAID, to the complete genomes from Turkish isolates. In addition, we focused on the variation analysis to show the mutations on SARS-CoV-2 genomes.

Methods

This study was approved by both the Republic of Turkey Ministry of Health COVID-19 Scientific Research Evaluation Commission (Approval date: 02/05/2020; number: 2020-05-02T16_13_50) and the Local Ethics Committee of Kafkas University Faculty of Medicine (Approval date: 06/05/2020 number: 80576354-050-99/130).

Of the patients who tested positive for SARS-CoV-2, the 63 samples with the highest viral loads (assessed by Real time PCR targeting RdRp gene) were selected for Next-Generation Sequencing (NGS)-based assays. Forty-seven of those samples were used for complete genome sequencing and variation analyzes.

The library preparation was performed using CleanPlex® SARS-CoV-2 Panel (Paragon Genomics Inc., Iowa, USA) with isolated RNA samples following the manufacturer instructions. Then, Illumina MiSeq (Illumina, USA) platform with a 2x150-cycle kit was used for sequencing the libraries. The quality of the raw data was examined by FastQC v.0.11.5, and low-quality bases and primers were trimmed using Trimmomatic (version 0.32). The raw reads were aligned to the known SARS-CoV-2 genome (GenBank Accession: MN908947.3) using the Burrows-Wheeler aligner (version 0.7.1). The consensus sequences were aligned via multiple sequence alignment using MAFFT v7.450 tool. The phylogenetic tree was constructed using Phylip v.3.6 with Neighbor-Joining and composite likelihood method and 100 bootstrap replications. For phylogenetic analysis of our data, GISAID database was used to collect SARS-CoV-2 complete genomes of different patients all around the world (i.e. Belgium, Bosnian-Herzegovina, Czech Republic, Croatia, Cyprus, Finland, France, Germany, Hungary, Italy, Poland, Portugal, Spain, Russia, Australia, USA, Mexico, Costa Rica, Canada, Austria, Thailand, China, Kuwait, Senegal, Egypt, Japan, Chile, Nigeria, Algeria, Brazil, Ecuador, Mongolia, Colombia, India, Indonesia, Malaysia, Bangladesh, Kazakhstan, and Turkey). Only complete genomes (28,000–30,000 bps) were analyzed. The variants were detected by using Genome Analysis Toolkit -HaplotypeCaller (GATK) v.3.8.0 and were inspected on GenomeBrowse v2.1.2 (GoldenHelix). The variants with low quality and a low variant fraction ($\% < 60$) were removed. The filtered variants and reference SARS-CoV-2 genome were used to generate the consensus sequence using bcftools v1.9.

Results

A database of 68 complete genome of SARS-CoV-2 strains belonging to different countries randomly selected from the GISAID database were compared to our isolations. The reference SARS-CoV-2 strain, which was rooted from Wuhan (NCBI GenBank, NC_045512) was also selected for comparison. A total of 115 SARS-CoV-2 genomes were placed in the phylogenetic tree. The maximum likelihood phylogenetic tree in Figure 1 and Figure 2 shows a main lineage including several sublineages. All viral genome sequences of our isolates was located in lineage B under the different clusters such as B.1 (n=3), B.1.1 (n=28), and B.1.9 (n=16). According to the GISAID nomenclature, all our complete genomes were placed in G, GR and GH clades (Figure 1, Figure 2 and Table 1).

Figure 1. Global diversity of circulating SARS-CoV-2 strains including at least one strain in different countries. Our viruses are shown in red font color.

Figure 2. Sub-tree showing the SARS-CoV-2 strains containing also at least one strain in different countries. Our viruses are shown in red font color.

Table 1: The accession numbers obtained from GenBank and GISAID database and GISAID clades of our isolates

GenBank Name	GenBank Accession Number	GISAID Name	GISAID Accession Number	GISAID Clade
Kafkas-SARSCoV2-001	MT786327	hCoV-19/Turkey/KU-001/2020	EPI_ISL_495411	B.1.1 (GR)
Kafkas-SARSCoV2-002	MT786861	hCoV-19/Turkey/KU-002/2020	EPI_ISL_495412	B.1.1 (GR)
Kafkas-SARSCoV2-003	MT786865	hCoV-19/Turkey/KU-003/2020	EPI_ISL_495413	B.1.1 (GR)
Kafkas-SARSCoV2-004	MT786329	hCoV-19/Turkey/KU-004/2020	EPI_ISL_495414	B.1.9 (GH)
Kafkas-SARSCoV2-005	MT786797	hCoV-19/Turkey/KU-005/2020	EPI_ISL_495415	B.1.1 (GR)
Kafkas-SARSCoV2-006	MT786331	hCoV-19/Turkey/KU-006/2020	EPI_ISL_495416	B.1.1 (GR)
Kafkas-SARSCoV2-007	MT786334	hCoV-19/Turkey/KU-007/2020	EPI_ISL_495417	B.1.9 (GH)
Kafkas-SARSCoV2-008	MT786859	hCoV-19/Turkey/KU-008/2020	EPI_ISL_495418	B.1.1 (GR)
Kafkas-SARSCoV2-009	MT786860	hCoV-19/Turkey/KU-009/2020	EPI_ISL_495419	B.1 (G)
Kafkas-SARSCoV2-010	MT786335	hCoV-19/Turkey/KU-010/2020	EPI_ISL_495420	B.1.1 (GR)
Kafkas-SARSCoV2-011	MT786868	hCoV-19/Turkey/KU-011/2020	EPI_ISL_495421	B.1.1 (GR)
Kafkas-SARSCoV2-012	MT787647	hCoV-19/Turkey/KU-012/2020	EPI_ISL_495422	B.1.1 (GR)
Kafkas-SARSCoV2-013	MT787564	hCoV-19/Turkey/KU-013/2020	EPI_ISL_495423	B.1.1 (GR)
Kafkas-SARSCoV2-014	MT786866	hCoV-19/Turkey/KU-014/2020	EPI_ISL_495424	B.1.1 (GR)
Kafkas-SARSCoV2-015	MT787648	hCoV-19/Turkey/KU-015/2020	EPI_ISL_495425	B.1.1 (GR)
Kafkas-SARSCoV2-016	MT787650	hCoV-19/Turkey/KU-016/2020	EPI_ISL_495426	B.1 (GH)
Kafkas-SARSCoV2-017	MT787578	hCoV-19/Turkey/KU-017/2020	EPI_ISL_495427	B.1 (G)
Kafkas-SARSCoV2-018	MT787645	hCoV-19/Turkey/KU-018/2020	EPI_ISL_495428	B.1.9 (GH)
Kafkas-SARSCoV2-019	MT787577	hCoV-19/Turkey/KU-019/2020	EPI_ISL_495429	B.1.9 (GH)
Kafkas-SARSCoV2-020	MT787646	hCoV-19/Turkey/KU-020/2020	EPI_ISL_495430	B.1.9 (GH)
Kafkas-SARSCoV2-021	MT787582	hCoV-19/Turkey/KU-021/2020	EPI_ISL_495431	B.1.1 (GR)
Kafkas-SARSCoV2-022	MT787581	hCoV-19/Turkey/KU-022/2020	EPI_ISL_495432	B.1.1 (GR)
Kafkas-SARSCoV2-023	MT786336	hCoV-19/Turkey/KU-023/2020	EPI_ISL_495433	B.1.1 (GR)
Kafkas-SARSCoV2-024	MT786337	hCoV-19/Turkey/KU-024/2020	EPI_ISL_495434	B.1.9 (GH)
Kafkas-SARSCoV2-025	MT787580	hCoV-19/Turkey/KU-025/2020	EPI_ISL_495435	B.1.1 (GR)
Kafkas-SARSCoV2-026	MT789689	hCoV-19/Turkey/KU-026/2020	EPI_ISL_495436	B.1.1 (GR)
Kafkas-SARSCoV2-027	MT787500	hCoV-19/Turkey/KU-027/2020	EPI_ISL_495437	B.1.9 (GH)
Kafkas-SARSCoV2-028	MT787749	hCoV-19/Turkey/KU-028/2020	EPI_ISL_495438	B.1.1 (GR)
Kafkas-SARSCoV2-029	MT787745	hCoV-19/Turkey/KU-029/2020	EPI_ISL_495439	B.1.9 (GH)
Kafkas-SARSCoV2-030	MT787748	hCoV-19/Turkey/KU-030/2020	EPI_ISL_495440	B.1 (G)
Kafkas-SARSCoV2-031	MT787742	hCoV-19/Turkey/KU-031/2020	EPI_ISL_495441	B.1.1 (GR)
Kafkas-SARSCoV2-032	MT787486	hCoV-19/Turkey/KU-032/2020	EPI_ISL_495442	B.1.9 (GH)
Kafkas-SARSCoV2-033	MT787553	hCoV-19/Turkey/KU-033/2020	EPI_ISL_495443	B.1.9 (GH)
Kafkas-SARSCoV2-034	MT787473	hCoV-19/Turkey/KU-034/2020	EPI_ISL_495444	B.1.1 (GR)
Kafkas-SARSCoV2-035	MT787747	hCoV-19/Turkey/KU-035/2020	EPI_ISL_495445	B.1.9 (GH)
Kafkas-SARSCoV2-036	MT787743	hCoV-19/Turkey/KU-036/2020	EPI_ISL_495446	B.1.1 (GR)
Kafkas-SARSCoV2-037	MT787506	hCoV-19/Turkey/KU-037/2020	EPI_ISL_495447	B.1.1 (GR)
Kafkas-SARSCoV2-038	MT789691	hCoV-19/Turkey/KU-038/2020	EPI_ISL_495448	B.1.9 (GH)
Kafkas-SARSCoV2-039	MT787744	hCoV-19/Turkey/KU-039/2020	EPI_ISL_495449	B.1.1 (GR)
Kafkas-SARSCoV2-040	MT787746	hCoV-19/Turkey/KU-040/2020	EPI_ISL_495450	B.1.1 (GR)
Kafkas-SARSCoV2-041	MT789690	hCoV-19/Turkey/KU-041/2020	EPI_ISL_495451	B.1 (GH)
Kafkas-SARSCoV2-042	MT787503	hCoV-19/Turkey/KU-042/2020	EPI_ISL_495452	B.1.1 (GR)
Kafkas-SARSCoV2-043	MT789688	hCoV-19/Turkey/KU-043/2020	EPI_ISL_495453	B.1.1 (GR)
Kafkas-SARSCoV2-044	MT789692	hCoV-19/Turkey/KU-044/2020	EPI_ISL_495454	B.1.1 (GR)
Kafkas-SARSCoV2-045	MT787558	hCoV-19/Turkey/KU-045/2020	EPI_ISL_495455	B.1.9 (GH)
Kafkas-SARSCoV2-046	MT789694	hCoV-19/Turkey/KU-046/2020	EPI_ISL_495456	B.1.1 (GR)
Kafkas-SARSCoV2-047	MT787487	hCoV-19/Turkey/KU-047/2020	EPI_ISL_495457	B.1.9 (GH)

Five hundred forty-nine (549) total and 53 unique variants were detected as shown in Table 2. All 47 genomes exhibited different kinds of variants. The distinct variants consist of 274 missense, 225 synonymous, and 50 non-coding alleles (Table 2). The most common detected variants were c.1-25G>T (5'UTR), c.2772C>T (ORF1ab), c.14143C>T (ORF1ab), c.1841A>G (S) in all our genomes (n=47), c.608G>A (N), c.609G>A (N), c.610G>C (N) in 28 samples, and c.2700G>T (S), c.310G>T (ORF7a) in 23 samples. Additionally, 31 variants were detected only once. Two hundred ninety-one (53%) variants were detected in ORF1ab, which is the longest ORF consisting approximately 70% of the whole genome. The ORF1ab is cleaved into 16 nonstructural proteins (nsp). Among those, nsp3 and nsp2 had more variants in our study (n=100 and n=27, respectively). On the other hand, all non-coding mutations were detected in 5'UTR region. All genomes had c.1-25C>T nucleotide variation; however only two genomes had additional non-coding mutations which were c.1-56G>T and c.1-77G>T. In terms of base changing, the most common detected (96%) was C>T. The detailed data about coding and non-coding mutations in our isolates is in Table 2.

Table 2: Coding and non-coding mutation list detected in SARS-CoV-2 genomes of our isolates.

Sample ID	GenBank Accession	GISAID Accession	Genome position	Gene	Final product	Protein	Nucleotide variation	Mutation type	Number of isolates
Kafkas-SARSCoV2-001	MT786327	EPI_ISL_495411	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-001			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	22
Kafkas-SARSCoV2-001			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	22
Kafkas-SARSCoV2-001			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-001			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	22
Kafkas-SARSCoV2-001			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-001			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	22
Kafkas-SARSCoV2-001			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-001			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	22
Kafkas-SARSCoV2-001			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	22
Kafkas-SARSCoV2-001			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	22
Kafkas-SARSCoV2-001			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	22
Kafkas-SARSCoV2-001			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	22
Kafkas-SARSCoV2-002	MT786861	EPI_ISL_495412	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-002			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	22
Kafkas-SARSCoV2-002			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	22
Kafkas-SARSCoV2-002			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-002			5015	ORF1ab	nsp3	p.(Val1584Met)	c.4750G>A	missense	22
Kafkas-SARSCoV2-002			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	22
Kafkas-SARSCoV2-002			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-002			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	22
Kafkas-SARSCoV2-002			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-002			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	22
Kafkas-SARSCoV2-002			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	22
Kafkas-SARSCoV2-002			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	22
Kafkas-SARSCoV2-002			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	22
Kafkas-SARSCoV2-002			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	22
Kafkas-SARSCoV2-003			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-003			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47

Kafkas-SARSCoV2-003	MT786865	EPI_ISL_495413	14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-003			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-003			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	2
Kafkas-SARSCoV2-003			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	2
Kafkas-SARSCoV2-003			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	28
Kafkas-SARSCoV2-003			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	28
Kafkas-SARSCoV2-003			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	28
Kafkas-SARSCoV2-004	MT786329	EPI_ISL_495414	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-004			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-004			7765	ORF1ab	nsp3	p.(Ser2500=)	c.7500C>T	synonymous	14
Kafkas-SARSCoV2-004			8326	ORF1ab	nsp3	p.(Asp2687=)	c.8061C>T	synonymous	44
Kafkas-SARSCoV2-004			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-004			17690	ORF1ab	helicase	p.(Ser5809Leu)	c.17425C>T	missense	47
Kafkas-SARSCoV2-004			18877	ORF1ab	3'-to-5' exonuclease	p.(Leu6205=)	c.18612C>T	synonymous	47
Kafkas-SARSCoV2-004			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-004			25563	ORF3a	NA	p.(Gln57His)	c.171G>T	missense	47
Kafkas-SARSCoV2-005			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-005	MT786797	EPI_ISL_495415	313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	47
Kafkas-SARSCoV2-005			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	47
Kafkas-SARSCoV2-005			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-005			5015	ORF1ab	nsp3	p.(Val1584Met)	c.4750G>A	missense	47
Kafkas-SARSCoV2-005			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	47
Kafkas-SARSCoV2-005			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-005			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	22
Kafkas-SARSCoV2-005			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-005			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	2
Kafkas-SARSCoV2-005			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	2
Kafkas-SARSCoV2-005			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	28
Kafkas-SARSCoV2-005			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	28
Kafkas-SARSCoV2-005			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	28
Kafkas-SARSCoV2-006			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-006			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	22
Kafkas-SARSCoV2-006			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	22

Kafkas-SARSCoV2-006	MT786331	EPI_ISL_495416	3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-006			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	2
Kafkas-SARSCoV2-006			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-006			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	22
Kafkas-SARSCoV2-006			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-006			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	23
Kafkas-SARSCoV2-006			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	23
Kafkas-SARSCoV2-006			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	28
Kafkas-SARSCoV2-006			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	28
Kafkas-SARSCoV2-006			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	28
Kafkas-SARSCoV2-007	MT786334	EPI_ISL_495417	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-007			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-007			6317	ORF1ab	nsp3	p.(Pro2018Ser)	c.6052C>T	missense	47
Kafkas-SARSCoV2-007			7765	ORF1ab	nsp3	p.(Ser2500=)	c.7500C>T	synonymous	47
Kafkas-SARSCoV2-007			8326	ORF1ab	nsp3	p.(Asp2687=)	c.8061C>T	synonymous	47
Kafkas-SARSCoV2-007			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-007			17690	ORF1ab	helicase	p.(Ser5809Leu)	c.17425C>T	missense	47
Kafkas-SARSCoV2-007			18877	ORF1ab	3'-to-5' exonuclease	p.(Leu6205=)	c.18612C>T	synonymous	47
Kafkas-SARSCoV2-007			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-007			25563	ORF3a	NA	p.(Gln57His)	c.171G>T	missense	47
Kafkas-SARSCoV2-008	MT786859	EPI_ISL_495418	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-008			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	23
Kafkas-SARSCoV2-008			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	23
Kafkas-SARSCoV2-008			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-008			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	2
Kafkas-SARSCoV2-008			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-008			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	22
Kafkas-SARSCoV2-008			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-008			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	23
Kafkas-SARSCoV2-008			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	23
Kafkas-SARSCoV2-008			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	28
Kafkas-SARSCoV2-008			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	28
Kafkas-SARSCoV2-008			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	28

Kafkas-SARSCoV2-009	MT786860	EPI_ISL_495419	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-009			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-009			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-009			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-010	MT786335	EPI_ISL_49542	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-010			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	22
Kafkas-SARSCoV2-010			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	22
Kafkas-SARSCoV2-010			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-010			4465	ORF1ab	nsp3	p.(Ser1400=)	c.4200A>G	synonymous	1
Kafkas-SARSCoV2-010			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	2
Kafkas-SARSCoV2-010			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	4
Kafkas-SARSCoV2-010			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	4
Kafkas-SARSCoV2-010			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-010			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	47
Kafkas-SARSCoV2-010			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	23
Kafkas-SARSCoV2-010			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	28
Kafkas-SARSCoV2-010			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	28
Kafkas-SARSCoV2-010			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	28
Kafkas-SARSCoV2-011			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-011			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	22
Kafkas-SARSCoV2-011			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	22
Kafkas-SARSCoV2-011			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-011			4148	ORF1ab	nsp3	p.(Val1295Phe)	c.3883G>T	missense	1
Kafkas-SARSCoV2-011			5015	ORF1ab	nsp3	p.(Val1584Met)	c.4750G>A	missense	1
Kafkas-SARSCoV2-011			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	2
Kafkas-SARSCoV2-011	MT786868	EPI_ISL_495421	14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-011			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	22
Kafkas-SARSCoV2-011			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-011			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	22
Kafkas-SARSCoV2-011			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	23
Kafkas-SARSCoV2-011			28166	ORF8	NA	p.(Gln91=)	c.273G>A	synonymous	28
Kafkas-SARSCoV2-011			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	28
Kafkas-SARSCoV2-011			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	28

Kafkas-SARSCoV2-011	MT787647	EPI_ISL_495422	28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	28
Kafkas-SARSCoV2-012			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-012			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	22
Kafkas-SARSCoV2-012			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	22
Kafkas-SARSCoV2-012			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-012			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	21
Kafkas-SARSCoV2-012			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-012			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	22
Kafkas-SARSCoV2-012			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-012			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	28
Kafkas-SARSCoV2-012			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	47
Kafkas-SARSCoV2-012			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	28
Kafkas-SARSCoV2-012			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	28
Kafkas-SARSCoV2-012			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	28
Kafkas-SARSCoV2-013	MT787564	EPI_ISL_495423	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-013			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-013			4795	ORF1ab	nsp3	p.(Ser1510=)	c.4530C>T	synonymous	28
Kafkas-SARSCoV2-013			11083	ORF1ab	nsp6	p.(Leu3606Phe)	c.10818G>T	missense	28
Kafkas-SARSCoV2-013			12809	ORF1ab	nsp9	p.(Leu4182Phe)	c.12544C>T	missense	28
Kafkas-SARSCoV2-013			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-013			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-013			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	28
Kafkas-SARSCoV2-013			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	28
Kafkas-SARSCoV2-013			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	28
Kafkas-SARSCoV2-013			29171	N	NA	p.(His300Tyr)	c.898C>T	missense	28
Kafkas-SARSCoV2-014	MT786866	EPI_ISL_495424	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-014			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	22
Kafkas-SARSCoV2-014			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	22
Kafkas-SARSCoV2-014			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-014			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	21
Kafkas-SARSCoV2-014			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-014			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	22
Kafkas-SARSCoV2-014			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47

Kafkas-SARSCoV2-014	MT787648	EPI_ISL_495425	24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	2
Kafkas-SARSCoV2-014			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	2
Kafkas-SARSCoV2-014			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	2
Kafkas-SARSCoV2-014			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	2
Kafkas-SARSCoV2-014			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	2
Kafkas-SARSCoV2-015			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	4
Kafkas-SARSCoV2-015			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	2
Kafkas-SARSCoV2-015			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	2
Kafkas-SARSCoV2-015			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	4
Kafkas-SARSCoV2-015			5015	ORF1ab	nsp3	p.(Val1584Met)	c.4750G>A	missense	1
Kafkas-SARSCoV2-015			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	2
Kafkas-SARSCoV2-015			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	7
Kafkas-SARSCoV2-015			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	2
Kafkas-SARSCoV2-015			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	2
Kafkas-SARSCoV2-015			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	2
Kafkas-SARSCoV2-015			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	2
Kafkas-SARSCoV2-015			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	2
Kafkas-SARSCoV2-015			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	2
Kafkas-SARSCoV2-015			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	2
Kafkas-SARSCoV2-016	MT787650	EPI_ISL_495426	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	4
Kafkas-SARSCoV2-016			1059	ORF1ab	nsp2	p.(Thr265Ile)	c.794C>T	missense	3
Kafkas-SARSCoV2-016			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	1
Kafkas-SARSCoV2-016			4886	ORF1ab	nsp3	p.(Pro1541Ser)	c.4621C>T	missense	3
Kafkas-SARSCoV2-016			11083	ORF1ab	nsp6	p.(Leu3606Phe)	c.10818G>T	missense	3
Kafkas-SARSCoV2-016			13326	ORF1ab	nsp10	p.(Thr4354Ile)	c.13061C>T	missense	1
Kafkas-SARSCoV2-016			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	4
Kafkas-SARSCoV2-016			14937	ORF1ab	RNA-dep RNA-pol	p.(Asp4891=)	c.14672C>T	synonymous	1
Kafkas-SARSCoV2-016			16914	ORF1ab	helicase	p.(Val5550=)	c.16649G>T	synonymous	1
Kafkas-SARSCoV2-016			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	4
Kafkas-SARSCoV2-016			25563	ORF3a	NA	p.(Gln57His)	c.171G>T	missense	1
Kafkas-SARSCoV2-016			26814	M	NA	p.(Ala98Ser)	c.292G>T	missense	1
Kafkas-SARSCoV2-017	MT787578	EPI_ISL_495427	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	4
Kafkas-SARSCoV2-017			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	4

Kafkas-SARSCoV2-017	MT787645	EPI_ISL_495428	14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-017			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-018			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-018			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-018			7765	ORF1ab	nsp3	p.(Ser2500=)	c.7500C>T	synonymous	14
Kafkas-SARSCoV2-018			8326	ORF1ab	nsp3	p.(Asp2687=)	c.8061C>T	synonymous	14
Kafkas-SARSCoV2-018			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-018			17690	ORF1ab	helicase	p.(Ser5809Leu)	c.17425C>T	missense	14
Kafkas-SARSCoV2-018			18877	ORF1ab	3'-to-5' exonuclease	p.(Leu6205=)	c.18612C>T	synonymous	15
Kafkas-SARSCoV2-018			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-018			25563	ORF3a	NA	p.(Gln57His)	c.171G>T	missense	47
Kafkas-SARSCoV2-019	MT787577	EPI_ISL_495429	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-019			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-019			7765	ORF1ab	nsp3	p.(Ser2500=)	c.7500C>T	synonymous	47
Kafkas-SARSCoV2-019			8326	ORF1ab	nsp3	p.(Asp2687=)	c.8061C>T	synonymous	47
Kafkas-SARSCoV2-019			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-019			17690	ORF1ab	helicase	p.(Ser5809Leu)	c.17425C>T	missense	47
Kafkas-SARSCoV2-019			18877	ORF1ab	3'-to-5' exonuclease	p.(Leu6205=)	c.18612C>T	synonymous	47
Kafkas-SARSCoV2-019			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-019			25563	ORF3a	NA	p.(Gln57His)	c.171G>T	missense	47
Kafkas-SARSCoV2-020	MT787646	EPI_ISL_495430	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-020			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-020			7765	ORF1ab	nsp3	p.(Ser2500=)	c.7500C>T	synonymous	47
Kafkas-SARSCoV2-020			8326	ORF1ab	nsp3	p.(Asp2687=)	c.8061C>T	synonymous	14
Kafkas-SARSCoV2-020			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-020			16428	ORF1ab	helicase	p.(Tyr5388=)	c.16163C>T	synonymous	6
Kafkas-SARSCoV2-020			17690	ORF1ab	helicase	p.(Ser5809Leu)	c.17425C>T	missense	14
Kafkas-SARSCoV2-020			18877	ORF1ab	3'-to-5' exonuclease	p.(Leu6205=)	c.18612C>T	synonymous	15
Kafkas-SARSCoV2-020			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-020			25563	ORF3a	NA	p.(Gln57His)	c.171G>T	missense	16
Kafkas-SARSCoV2-020			28857	N	NA	p.(Arg195Ile)	c.584G>T	missense	6
Kafkas-SARSCoV2-021	MT787582	EPI_ISL_495431	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-021			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	22

Kafkas-SARSCoV2-021	MT787581	EPI_ISL_495432	2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	21
Kafkas-SARSCoV2-021			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-021			5015	ORF1ab	nsp3	p.(Val1584Met)	c.4750G>A	missense	1
Kafkas-SARSCoV2-021			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	2
Kafkas-SARSCoV2-021			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-021			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	2
Kafkas-SARSCoV2-021			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-021			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	2
Kafkas-SARSCoV2-021			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	2
Kafkas-SARSCoV2-021			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	2
Kafkas-SARSCoV2-021			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	2
Kafkas-SARSCoV2-021			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	2
Kafkas-SARSCoV2-022			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-022			3037	ORF1ab	leader protein	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-022	MT786336	EPI_ISL_495433	5301	ORF1ab	nsp2	p.(Ala1679Val)	c.5036C>T	missense	2
Kafkas-SARSCoV2-022			12809	ORF1ab	nsp3	p.(Leu4182Phe)	c.12544C>T	missense	2
Kafkas-SARSCoV2-022			14408	ORF1ab	nsp3	p.(Pro4715Leu)	c.14143C>T	missense	2
Kafkas-SARSCoV2-022			23403	S	nsp6	p.(Asp614Gly)	c.1841A>G	missense	2
Kafkas-SARSCoV2-022			28881	N	RNA-dep RNA-pol	p.(Arg203Lys)	c.608G>A	missense	2
Kafkas-SARSCoV2-022			28882	N	RNA-dep RNA-pol	p.(Arg203=)	c.609G>A	synonymous	2
Kafkas-SARSCoV2-022			28883	N	RNA-dep RNA-pol	p.(Gly204Arg)	c.610G>C	missense	2
Kafkas-SARSCoV2-023			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-023			313	ORF1ab	NA	p.(Leu16=)	c.48C>T	synonymous	2
Kafkas-SARSCoV2-023			2509	ORF1ab	NA	p.(Pro748=)	c.2244C>T	synonymous	2
Kafkas-SARSCoV2-023			3037	ORF1ab	NA	p.(Phe924=)	c.2772C>T	synonymous	2
Kafkas-SARSCoV2-023			5015	ORF1ab	NA	p.(Val1584Met)	c.4750G>A	missense	2
Kafkas-SARSCoV2-023			11083	ORF1ab	NA	p.(Leu3606Phe)	c.10818G>T	missense	2
Kafkas-SARSCoV2-023			13620	ORF1ab	NA	p.(Asp4452=)	c.13355C>T	synonymous	47
Kafkas-SARSCoV2-023	MT786336	EPI_ISL_495433	14408	ORF1ab	nsp3	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-023			14724	ORF1ab	nsp3	p.(Phe4820=)	c.14459C>T	synonymous	1
Kafkas-SARSCoV2-023			23403	S	nsp9	p.(Asp614Gly)	c.1841A>G	missense	3
Kafkas-SARSCoV2-023			24262	S	RNA-dep RNA-pol	p.(Met900Ile)	c.2700G>T	missense	47
Kafkas-SARSCoV2-023			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	47

Kafkas-SARSCoV2-023	MT786337	EPI_ISL_495434	28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	28
Kafkas-SARSCoV2-023			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	28
Kafkas-SARSCoV2-023			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	28
Kafkas-SARSCoV2-024			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-024			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-024			7765	ORF1ab	nsp3	p.(Ser2500=)	c.7500C>T	synonymous	14
Kafkas-SARSCoV2-024			8326	ORF1ab	nsp3	p.(Asp2687=)	c.8061C>T	synonymous	14
Kafkas-SARSCoV2-024			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-024			16428	ORF1ab	helicase	p.(Tyr5388=)	c.16163C>T	synonymous	6
Kafkas-SARSCoV2-024			17690	ORF1ab	helicase	p.(Ser5809Leu)	c.17425C>T	missense	14
Kafkas-SARSCoV2-024			18877	ORF1ab	3'-to-5' exonuclease	p.(Leu6205=)	c.18612C>T	synonymous	47
Kafkas-SARSCoV2-024			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	7
Kafkas-SARSCoV2-024			25563	ORF3a	NA	p.(Gln57His)	c.171G>T	missense	4
Kafkas-SARSCoV2-024			28857	N	NA	p.(Arg195Ile)	c.584G>T	missense	4
Kafkas-SARSCoV2-025	MT787580	EPI_ISL_495435	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-025			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-025			13720	ORF1ab	RNA-dep RNA-pol	p.(Pro4486Ser)	c.13455C>T	missense	47
Kafkas-SARSCoV2-025			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-025			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	7
Kafkas-SARSCoV2-025			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	4
Kafkas-SARSCoV2-025			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	4
Kafkas-SARSCoV2-025			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	4
Kafkas-SARSCoV2-026			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-026			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	22
Kafkas-SARSCoV2-026			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	22
Kafkas-SARSCoV2-026			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-026			4148	ORF1ab	nsp3	p.(Val1295Phe)	c.3883G>T	missense	2
Kafkas-SARSCoV2-026			5015	ORF1ab	nsp3	p.(Val1584Met)	c.4750G>A	missense	1
Kafkas-SARSCoV2-026			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	2
Kafkas-SARSCoV2-026	MT789689	EPI_ISL_495436	14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-026			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	2
Kafkas-SARSCoV2-026			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	4
Kafkas-SARSCoV2-026			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	23

Kafkas-SARSCoV2-026	MT787500	EPI_ISL_495437	27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	28
Kafkas-SARSCoV2-026			28166	ORF8	NA	p.(Gln91=)	c.273G>A	synonymous	28
Kafkas-SARSCoV2-026			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	28
Kafkas-SARSCoV2-026			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	28
Kafkas-SARSCoV2-026			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	28
Kafkas-SARSCoV2-027			210	5'UTR	NA	NA	c.1-56G>T	Non-coding	47
Kafkas-SARSCoV2-027			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-027			2086	ORF1ab	nsp2	p.(Gln607His)	c.1821G>T	missense	14
Kafkas-SARSCoV2-027			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-027			7765	ORF1ab	nsp3	p.(Ser2500=)	c.7500C>T	synonymous	14
Kafkas-SARSCoV2-027			8326	ORF1ab	nsp3	p.(Asp2687=)	c.8061C>T	synonymous	44
Kafkas-SARSCoV2-027			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	28
Kafkas-SARSCoV2-027			16428	ORF1ab	helicase	p.(Tyr5388=)	c.16163C>T	synonymous	28
Kafkas-SARSCoV2-027			17690	ORF1ab	helicase	p.(Ser5809Leu)	c.17425C>T	missense	28
Kafkas-SARSCoV2-027			18877	ORF1ab	3'-to-5' exonuclease	p.(Leu6205=)	c.18612C>T	synonymous	28
Kafkas-SARSCoV2-027			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-027			25563	ORF3a	NA	p.(Gln57His)	c.171G>T	missense	28
Kafkas-SARSCoV2-027			28857	N	NA	p.(Arg195Ile)	c.584G>T	missense	28
Kafkas-SARSCoV2-028			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-028			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	28
Kafkas-SARSCoV2-028			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	28
Kafkas-SARSCoV2-028			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	28
Kafkas-SARSCoV2-028	MT787749	EPI_ISL_495438	5015	ORF1ab	nsp3	p.(Val1584Met)	c.4750G>A	missense	28
Kafkas-SARSCoV2-028			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	28
Kafkas-SARSCoV2-028			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-028			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	22
Kafkas-SARSCoV2-028			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-028			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	28
Kafkas-SARSCoV2-028			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	28
Kafkas-SARSCoV2-028			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	28
Kafkas-SARSCoV2-028			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	28
Kafkas-SARSCoV2-028			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	28
Kafkas-SARSCoV2-029	MT787745	EPI_ISL_495439	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47

Kafkas-SARSCoV2-029			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-029			7765	ORF1ab	nsp3	p.(Ser2500=)	c.7500C>T	synonymous	14
Kafkas-SARSCoV2-029			8326	ORF1ab	nsp3	p.(Asp2687=)	c.8061C>T	synonymous	14
Kafkas-SARSCoV2-029			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-029			16428	ORF1ab	helicase	p.(Tyr5388=)	c.16163C>T	synonymous	6
Kafkas-SARSCoV2-029			17690	ORF1ab	helicase	p.(Ser5809Leu)	c.17425C>T	missense	14
Kafkas-SARSCoV2-029			18877	ORF1ab	3'-to-5' exonuclease	p.(Leu6205=)	c.18612C>T	synonymous	15
Kafkas-SARSCoV2-029			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-029			25563	ORF3a	NA	p.(Gln57His)	c.171G>T	missense	16
Kafkas-SARSCoV2-029			28857	N	NA	p.(Arg195Ile)	c.584G>T	missense	6
Kafkas-SARSCoV2-030	MT787748	EPI_ISL_495440	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	4
Kafkas-SARSCoV2-030			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-030			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-030			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-031	MT787742	EPI_ISL_495441	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-031			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-031			4504	ORF1ab	nsp3	p.(Glu1413Asp)	c.4239G>T	missense	47
Kafkas-SARSCoV2-031			12809	ORF1ab	nsp9	p.(Leu4182Phe)	c.12544C>T	missense	47
Kafkas-SARSCoV2-031			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-031			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-031			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	47
Kafkas-SARSCoV2-031			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	47
Kafkas-SARSCoV2-031			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	47
Kafkas-SARSCoV2-031			29171	N	NA	p.(His300Tyr)	c.898C>T	missense	2
Kafkas-SARSCoV2-032	MT787486	EPI_ISL_495442	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-032			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-032			7765	ORF1ab	nsp3	p.(Ser2500=)	c.7500C>T	synonymous	14
Kafkas-SARSCoV2-032			8326	ORF1ab	nsp3	p.(Asp2687=)	c.8061C>T	synonymous	14
Kafkas-SARSCoV2-032			13517	ORF1ab	RNA-dep RNA-pol	p.(Thr4418Ile)	c.13252C>T	missense	1
Kafkas-SARSCoV2-032			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-032			17690	ORF1ab	helicase	p.(Ser5809Leu)	c.17425C>T	missense	14
Kafkas-SARSCoV2-032			18877	ORF1ab	3'-to-5' exonuclease	p.(Leu6205=)	c.18612C>T	synonymous	15
Kafkas-SARSCoV2-032			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47

Kafkas-SARSCoV2-032	MT787553	EPI_ISL_495443	25563	ORF3a	NA	p.(Gln57His)	c.171G>T	missense	10
Kafkas-SARSCoV2-033			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-033			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-033			7765	ORF1ab	nsp3	p.(Ser2500=)	c.7500C>T	synonymous	14
Kafkas-SARSCoV2-033			8326	ORF1ab	nsp3	p.(Asp2687=)	c.8061C>T	synonymous	14
Kafkas-SARSCoV2-033			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-033			17690	ORF1ab	helicase	p.(Ser5809Leu)	c.17425C>T	missense	14
Kafkas-SARSCoV2-033			18877	ORF1ab	3'-to-5' exonuclease	p.(Leu6205=)	c.18612C>T	synonymous	10
Kafkas-SARSCoV2-033			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-033			25563	ORF3a	NA	p.(Gln57His)	c.171G>T	missense	10
Kafkas-SARSCoV2-034	MT787473	EPI_ISL_495444	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-034			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	47
Kafkas-SARSCoV2-034			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	47
Kafkas-SARSCoV2-034			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-034			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	47
Kafkas-SARSCoV2-034			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-034			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	47
Kafkas-SARSCoV2-034			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-034			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	47
Kafkas-SARSCoV2-034			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	47
Kafkas-SARSCoV2-034			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	47
Kafkas-SARSCoV2-034			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	47
Kafkas-SARSCoV2-034			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	47
Kafkas-SARSCoV2-035			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-035	MT787747	EPI_ISL_495445	3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-035			7765	ORF1ab	nsp3	p.(Ser2500=)	c.7500C>T	synonymous	14
Kafkas-SARSCoV2-035			8326	ORF1ab	nsp3	p.(Asp2687=)	c.8061C>T	synonymous	14
Kafkas-SARSCoV2-035			12111	ORF1ab	nsp8	p.(Ser3949Asn)	c.11846G>A	missense	10
Kafkas-SARSCoV2-035			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-035			16428	ORF1ab	helicase	p.(Tyr5388=)	c.16163C>T	synonymous	6
Kafkas-SARSCoV2-035			17690	ORF1ab	helicase	p.(Ser5809Leu)	c.17425C>T	missense	14
Kafkas-SARSCoV2-035			18877	ORF1ab	3'-to-5' exonuclease	p.(Leu6205=)	c.18612C>T	synonymous	10
Kafkas-SARSCoV2-035			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47

Kafkas-SARSCoV2-035	MT787743	EPI_ISL_495446	25563	ORF3a	NA	p.(Gln57His)	c.171G>T	missense	1
Kafkas-SARSCoV2-035			28857	N	NA	p.(Arg195Ile)	c.584G>T	missense	6
Kafkas-SARSCoV2-036			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	4
Kafkas-SARSCoV2-036			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	2
Kafkas-SARSCoV2-036			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	2
Kafkas-SARSCoV2-036			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	4
Kafkas-SARSCoV2-036			5015	ORF1ab	nsp3	p.(Val1584Met)	c.4750G>A	missense	1
Kafkas-SARSCoV2-036			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	4
Kafkas-SARSCoV2-036			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	2
Kafkas-SARSCoV2-036			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	4
Kafkas-SARSCoV2-036			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	2
Kafkas-SARSCoV2-036			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	2
Kafkas-SARSCoV2-036			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	2
Kafkas-SARSCoV2-036			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	2
Kafkas-SARSCoV2-036			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	2
Kafkas-SARSCoV2-037	MT787506	EPI_ISL_495447	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	4
Kafkas-SARSCoV2-037			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	2
Kafkas-SARSCoV2-037			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	2
Kafkas-SARSCoV2-037			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	4
Kafkas-SARSCoV2-037			5015	ORF1ab	nsp3	p.(Val1584Met)	c.4750G>A	missense	1
Kafkas-SARSCoV2-037			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	2
Kafkas-SARSCoV2-037			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	4
Kafkas-SARSCoV2-037			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	2
Kafkas-SARSCoV2-037			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	4
Kafkas-SARSCoV2-037			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	2
Kafkas-SARSCoV2-037			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	2
Kafkas-SARSCoV2-037			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	2
Kafkas-SARSCoV2-037			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	2
Kafkas-SARSCoV2-037			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	2
Kafkas-SARSCoV2-038	MT789691	EPI_ISL_495448	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	4
Kafkas-SARSCoV2-038			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	4
Kafkas-SARSCoV2-038			7765	ORF1ab	nsp3	p.(Ser2500=)	c.7500C>T	synonymous	1
Kafkas-SARSCoV2-038			8326	ORF1ab	nsp3	p.(Asp2687=)	c.8061C>T	synonymous	1

Kafkas-SARSCoV2-038	MT787744	EPI_ISL_495449	14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-038			17690	ORF1ab	helicase	p.(Ser5809Leu)	c.17425C>T	missense	14
Kafkas-SARSCoV2-038			18877	ORF1ab	3'-to-5' exonuclease	p.(Leu6205=)	c.18612C>T	synonymous	16
Kafkas-SARSCoV2-038			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-038			25563	ORF3a	NA	p.(Gln57His)	c.171G>T	missense	16
Kafkas-SARSCoV2-039			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-039			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	22
Kafkas-SARSCoV2-039			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	22
Kafkas-SARSCoV2-039			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-039			5015	ORF1ab	nsp3	p.(Val1584Met)	c.4750G>A	missense	16
Kafkas-SARSCoV2-039			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	22
Kafkas-SARSCoV2-039			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-039			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	22
Kafkas-SARSCoV2-039			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-039			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	22
Kafkas-SARSCoV2-039			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	22
Kafkas-SARSCoV2-039			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	28
Kafkas-SARSCoV2-039			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	28
Kafkas-SARSCoV2-039			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	28
Kafkas-SARSCoV2-040	MT787746	EPI_ISL_495450	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47
Kafkas-SARSCoV2-040			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	22
Kafkas-SARSCoV2-040			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	22
Kafkas-SARSCoV2-040			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	47
Kafkas-SARSCoV2-040			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	22
Kafkas-SARSCoV2-040			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	47
Kafkas-SARSCoV2-040			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	22
Kafkas-SARSCoV2-040			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	47
Kafkas-SARSCoV2-040			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	22
Kafkas-SARSCoV2-040			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	22
Kafkas-SARSCoV2-040			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	28
Kafkas-SARSCoV2-040			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	28
Kafkas-SARSCoV2-040			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	28
Kafkas-SARSCoV2-041	MT789690	EPI_ISL_495451	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	47

Kafkas-SARSCoV2-041	MT787503	EPI_ISL_495452	2584	ORF1ab	nsp2	p.(Ala773=)	c.2319T>A	synonymous	1
Kafkas-SARSCoV2-041			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	4
Kafkas-SARSCoV2-041			5365	ORF1ab	nsp3	p.(Tyr1700=)	c.5100C>T	synonymous	1
Kafkas-SARSCoV2-041			8296	ORF1ab	nsp3	p.(Tyr2677=)	c.8031T>C	synonymous	1
Kafkas-SARSCoV2-041			12076	ORF1ab	nsp7	p.(Asn3937=)	c.11811C>T	synonymous	1
Kafkas-SARSCoV2-041			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	4
Kafkas-SARSCoV2-041			16968	ORF1ab	helicase	p.(Glu5568Asp)	c.16703G>T	missense	1
Kafkas-SARSCoV2-041			18877	ORF1ab	3'-to-5' exonuclease	p.(Leu6205=)	c.18612C>T	synonymous	1
Kafkas-SARSCoV2-041			19586	ORF1ab	3'-to-5' exonuclease	p.(Thr6441Ile)	c.19321C>T	missense	1
Kafkas-SARSCoV2-041			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	4
Kafkas-SARSCoV2-041			25563	ORF3a	NA	p.(Gln57His)	c.171G>T	missense	1
Kafkas-SARSCoV2-041			26681	M	NA	p.(Phe53=)	c.159C>T	synonymous	1
Kafkas-SARSCoV2-041			28690	N	NA	p.(Leu139Phe)	c.417G>T	missense	1
Kafkas-SARSCoV2-041			28854	N	NA	p.(Ser194Leu)	c.581C>T	missense	1
Kafkas-SARSCoV2-042			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	4
Kafkas-SARSCoV2-042	MT789688	EPI_ISL_495453	313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	2
Kafkas-SARSCoV2-042			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	2
Kafkas-SARSCoV2-042			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	4
Kafkas-SARSCoV2-042			5015	ORF1ab	nsp3	p.(Val1584Met)	c.4750G>A	missense	1
Kafkas-SARSCoV2-042			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	1
Kafkas-SARSCoV2-042			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	4
Kafkas-SARSCoV2-042			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	1
Kafkas-SARSCoV2-042			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	4
Kafkas-SARSCoV2-042			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	2
Kafkas-SARSCoV2-042			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	2
Kafkas-SARSCoV2-042			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	2
Kafkas-SARSCoV2-042			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	2
Kafkas-SARSCoV2-042			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	2
Kafkas-SARSCoV2-043			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	4
Kafkas-SARSCoV2-043			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	2
Kafkas-SARSCoV2-043			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	2
Kafkas-SARSCoV2-043			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	4
Kafkas-SARSCoV2-043			5015	ORF1ab	nsp3	p.(Val1584Met)	c.4750G>A	missense	1

Kafkas-SARSCoV2-043	MT789692	EPI_ISL_495454	13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	2
Kafkas-SARSCoV2-043			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	4
Kafkas-SARSCoV2-043			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	2
Kafkas-SARSCoV2-043			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	4
Kafkas-SARSCoV2-043			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	2
Kafkas-SARSCoV2-043			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	2
Kafkas-SARSCoV2-043			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	2
Kafkas-SARSCoV2-043			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	2
Kafkas-SARSCoV2-043			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	2
Kafkas-SARSCoV2-044			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	4
Kafkas-SARSCoV2-044			313	ORF1ab	leader protein	p.(Leu16=)	c.48C>T	synonymous	2
Kafkas-SARSCoV2-044			2509	ORF1ab	nsp2	p.(Pro748=)	c.2244C>T	synonymous	4
Kafkas-SARSCoV2-044			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	4
Kafkas-SARSCoV2-044			13620	ORF1ab	RNA-dep RNA-pol	p.(Asp4452=)	c.13355C>T	synonymous	4
Kafkas-SARSCoV2-044			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	4
Kafkas-SARSCoV2-044			14724	ORF1ab	RNA-dep RNA-pol	p.(Phe4820=)	c.14459C>T	synonymous	4
Kafkas-SARSCoV2-044			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	4
Kafkas-SARSCoV2-044			24262	S	NA	p.(Met900Ile)	c.2700G>T	missense	4
Kafkas-SARSCoV2-044			27703	ORF7a	NA	p.(Val104Phe)	c.310G>T	missense	4
Kafkas-SARSCoV2-044			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	4
Kafkas-SARSCoV2-044			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	4
Kafkas-SARSCoV2-044			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	4
Kafkas-SARSCoV2-045	MT787558	EPI_ISL_495455	241	5'UTR	NA	NA	c.1-25C>T	Non-coding	4
Kafkas-SARSCoV2-045			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	4
Kafkas-SARSCoV2-045			7765	ORF1ab	nsp3	p.(Ser2500=)	c.7500C>T	synonymous	1
Kafkas-SARSCoV2-045			8326	ORF1ab	nsp3	p.(Asp2687=)	c.8061C>T	synonymous	1
Kafkas-SARSCoV2-045			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	4
Kafkas-SARSCoV2-045			17690	ORF1ab	helicase	p.(Ser5809Leu)	c.17425C>T	missense	1
Kafkas-SARSCoV2-045			18877	ORF1ab	3'-to-5' exonuclease	p.(Leu6205=)	c.18612C>T	synonymous	1
Kafkas-SARSCoV2-045			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	4
Kafkas-SARSCoV2-045			25563	ORF3a	NA	p.(Gln57His)	c.171G>T	missense	1
Kafkas-SARSCoV2-046	MT789694	EPI_ISL_495456	189	5'UTR	NA	NA	c.1-77G>T	Non-coding	1
Kafkas-SARSCoV2-046			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	4

Kafkas-SARSCoV2-046	MT787487	EPI_ISL_495457	1181	ORF1ab	nsp2	p.(Val306Phe)	c.916G>T	missense	1
Kafkas-SARSCoV2-046			2040	ORF1ab	nsp2	p.(Thr592Ile)	c.1775C>T	missense	1
Kafkas-SARSCoV2-046			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	4
Kafkas-SARSCoV2-046			4422	ORF1ab	nsp3	p.(Arg1386His)	c.4157G>A	missense	1
Kafkas-SARSCoV2-046			5017	ORF1ab	nsp3	p.(Val1584=)	c.4752G>A	synonymous	1
Kafkas-SARSCoV2-046			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	4
Kafkas-SARSCoV2-046			15738	ORF1ab	RNA-dep RNA-pol	p.(Phe5158=)	c.15473C>T	synonymous	1
Kafkas-SARSCoV2-046			19839	ORF1ab	endoRNase	p.(Asn6525=)	c.19574T>C	synonymous	1
Kafkas-SARSCoV2-046			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	4
Kafkas-SARSCoV2-046			25471	ORF3a	NA	p.(Asp27Tyr)	c.79G>T	missense	1
Kafkas-SARSCoV2-046			28881	N	NA	p.(Arg203Lys)	c.608G>A	missense	1
Kafkas-SARSCoV2-046			28882	N	NA	p.(Arg203=)	c.609G>A	synonymous	1
Kafkas-SARSCoV2-046			28883	N	NA	p.(Gly204Arg)	c.610G>C	missense	1
Kafkas-SARSCoV2-047			241	5'UTR	NA	NA	c.1-25C>T	Non-coding	1
Kafkas-SARSCoV2-047			3037	ORF1ab	nsp3	p.(Phe924=)	c.2772C>T	synonymous	4
Kafkas-SARSCoV2-047			7765	ORF1ab	nsp3	p.(Ser2500=)	c.7500C>T	synonymous	1
Kafkas-SARSCoV2-047			8326	ORF1ab	nsp3	p.(Asp2687=)	c.8061C>T	synonymous	1
Kafkas-SARSCoV2-047			14408	ORF1ab	RNA-dep RNA-pol	p.(Pro4715Leu)	c.14143C>T	missense	1
Kafkas-SARSCoV2-047			16428	ORF1ab	helicase	p.(Tyr5388=)	c.16163C>T	synonymous	1
Kafkas-SARSCoV2-047			17690	ORF1ab	helicase	p.(Ser5809Leu)	c.17425C>T	missense	1
Kafkas-SARSCoV2-047			18877	ORF1ab	3'-to-5' exonuclease	p.(Leu6205=)	c.18612C>T	synonymous	1
Kafkas-SARSCoV2-047			23403	S	NA	p.(Asp614Gly)	c.1841A>G	missense	1
Kafkas-SARSCoV2-047			25563	ORF3a	NA	p.(Gln57His)	c.171G>T	missense	1
Kafkas-SARSCoV2-047			28857	N	NA	p.(Arg195Ile)	c.584G>T	missense	6

Discussion

The analysis of complete genome sequencing of new viruses is an important tool for epidemiology of infectious diseases, updating diagnostics and assessing viral evolution (7, 8). Complete genome data of a virus makes visible some epidemiological parameters including doubling time of an outbreak, reconstruction of transmission routes and the identification of possible sources and animal reservoirs. It can also help the study on drug and vaccine design. In our study, we described 47 SARS-CoV-2 genomes and compared them with a dataset of 68 available SARS-CoV-2 genomes from different countries obtained from GISAID (9).

After the phylogenetic analysis, it has been detected that all our SARS-CoV-2 genomes are similar with the European strains. According to GISAID lineage, 47 in 47 of our SARS-CoV-2 genomes are in lineage B that mostly consists of European strains. According to the marker mutations, those were placed in G, GR and GH clades. Moreover, most of European isolates have been placed in G, GR and GH clades in GISAID (9).

In current literature, there are some studies that investigate the first isolates of their country to find the originate of those (3, 11-15). A study contains two complete genomes of a Chinese patient visiting Rome and an Italian patient reported that Italian patient's sequence clustered with European sequences and Chinese patient's sequence clustered with Wuhan sequence (NC_045512) (16). The same researchers compared the two genomes regarding concurrent evolution and accumulation of mutations and reported that four mutations were detected in Italian sequence. Another study reported that because of the variations the first isolates of India were not showed high identity with Wuhan sequence (NC_045512) (15). Moreover, Bal et al. reported that the first three French sequences were located in European clade instead of reference Wuhan clade because of the three-nucleotide deletion in Orf1a at positions 1607-1609 (11). On the other hand, some European isolates that are generally the first isolates of related country are belonging to non-European clades. A German sequence was evaluated in a study performed by Zehender et al. (17) and reported that it belonged to lineage A because of a travelling to Shanghai between 20-24 January.

So far, there are 138 SARS-Cov-2 complete genome sequence data except our 47 isolates in GISAID database from Turkey (9). It can be seen that all those genomes are belonging to lineage B including the first case (lineage B.4) in Turkey. Our all sequences (n=47) are belonging to lineage B as similar with all other Turkish sequences. However, the first cases in Turkey is belonging to L clade according to GISAID classification whereas ours are belonging to G, GR and GH clades.

On the other hand, the length of SARS-CoV-2 genome is approximately 30 Kb including 5'UTR and 3'UTR non-coding sequence, Orf1ab, S, Orf3a, E, M, Orf6a, Orf7a, Orf7b, Orf8, N, and Orf10 genes. In this study, we aimed to detect the variations of our SARS-CoV-2 isolates.

According to the current literature, ORF genes have crucial role during COVID-19 (18). So in our study, 549 total and 53 unique variants were detected from 47 SARS-CoV-2 isolates (Table X). A study performed by Khailany et al. (19) reported that 156 total and 116 unique variants were found in 95 SARS-CoV-2 isolates. The same study also pointed out that the most frequently observed base changes was C>T same as our study.

The most observed variations are found in position 3036, 11083 and 13402 belonging to Orf1ab gene; 28854 belonging to N gene; 21707 and 21575 belonging to S gene; 28077 and 28144 belonging to Orf8 gene (4, 17, 20, 21). Our variations in related positions are same with those. We mostly detected variations in position 3037 and 11083 in Orf1ab gene; 28166 in Orf8 gene; 28854 in N gene; and 24262 in S gene. According to the global frequency of variations, most of our variants are novel; however, the studies on this issue in ongoing and more detailed information will be presented in near future. The Orf1ab is the longest and most important gene among coronaviruses (18). Most of the scientist detected the variations in Orf1ab gene. Thus, the mutations in this region may be significant concerning clinical features.

Our study have some limitations; (I) the number of national genomes available at the time of analysis; and (II) the number of detected variations. These limitations should be eliminated for further studies.

In conclusion, the results of present study indicated that the SARS-CoV-2 sequences of our isolates have great similarity with all Turkish and European sequences. Further studies should be performed for better comparison of strains, after more complete genome sequences will be released; however, these data may be useful to understand the dynamics of virus spread and may help the further vaccine and treatment studies.

On the other hand, the increase of SARS-CoV-2 cases all over the world is giving more genomes that may present some visibility of populace structure. This study showed the common and new variations in SARS-CoV-2 isolates. The fight against COVID-19 will last long time until the effective vaccine or drug will be developed. However, we believe that collecting and sharing any data about SARS-CoV-2 virus and COVID-19 will be effective and may help the related studies. At that point, we should carry on detecting the new variations.

Declarations

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Conflict of interest: The authors have no conflict of interest

Availability of data and material: The data that support the findings of this study are openly available in NCBI GenBank and GISAID at <https://submit.ncbi.nlm.nih.gov/subs/> and <https://www.gisaid.org/>.

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