**Epidemiology and Infection**

**Supplementary Material**

**Antimicrobial resistance, penicillin-binding protein sequences, and pilus islet carriage in relation to clonal evolution of *Streptococcus pneumoniae* serotype 19A in Russia, 2002-2013**

**N. Mayanskiy et al.**

**Supplementary Table S1.** Characterization of the serotype 19A pneumococcal isolates recovered in Russia, 2002-2013 (n=49)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Iso-late ID | Collection part  | City | CC | ST | PEN | AMX | CTX | ERY | CLI | SXT | CHL | TET | MDR | erm/mef | PI carriage |
| 186 | Eur'2003 | St.Petersburg | 663 | 663 | 4,00 | 1,50 | 3,00 | 256 | S | S | S | R | Yes | No erm/mef | PI1 |
| 183 | Eur'2003 | St.Petersburg | 663 | 663 | 3,00 | 0,75 | 2,00 | 128 | S | S | S | S | No | No erm/mef | PI1 |
| 176 | Eur'2003 | St.Petersburg | 663 | 663 | 3,00 | 1,50 | 3,00 | 128 | S | S | S | S | No | mef | PI1 |
| 175 | Eur'2003 | St.Petersburg | 663 | 663 | 4,00 | 0,50 | 2,00 | 128 | S | R | S | S | Yes | mef | PI1 |
| 188 | Eur'2003 | St.Petersburg | 663 | 663 | 8,00 | 1,50 | 2,00 | 256 | S | S | S | S | No | mef | PI1 |
| 58 | Eur'2010-13 | Moscow | 663 | 663 | 16,00 | 12,00 | 32,00 | 256 | R | R | S | S | Yes | erm | PI1 |
| 111 | Eur'2003 | Moscow | 663 | 10434 | 1,50 | 0,75 | 2,00 | 256 | R | R | R | R | Yes | erm | PI1 |
| 110 | Eur'2003 | Moscow | 663 | 10434 | 2,00 | 1,50 | 0,50 | 256 | R | S | R | R | Yes | erm | PI1 |
| 89 | Eur'2003 | Moscow | 663 | 10434 | 3,00 | 1,50 | 1,50 | 256 | R | S | R | R | Yes | erm | PI1 |
| 85a | Eur'2003 | Moscow | 663 | 10434 | 8,00 | 1,00 | 1,00 | 256 | R | S | R | R | Yes | erm/mef | PI1 |
| 242 | Eur'2010-13 | Moscow | 663 | 10434 | 3,00 | 3,00 | 8,00 | 256 | R | S | R | S | Yes | erm/mef | PI1 |
| 139 | Eur'2003 | Moscow | 663 | 10435 | 2,00 | 1,50 | 0,50 | 256 | R | S | S | S | Yes | erm | PI1 |
| 140 | Eur'2003 | Moscow | 663 | 10435 | 2,00 | 1,00 | 0,25 | 256 | R | S | R | S | Yes | erm | PI1 |
| 134 | Eur'2003 | Moscow | 663 | 10515 | 1,00 | 1,00 | 1,50 | 256 | R | S | R | R | Yes | erm/mef | PI1 |
| 657 | Eur'2010-13 | Moscow | 230 | 230 | 0,38 | 0,09 | 0,25 | 0,13 | S | R | S | R | No | ERY\_S | No PI1/PI2 |
| 270 | Eur'2010-13 | Moscow | 230 | 230 | 0,25 | 0,19 | 0,06 | 0,09 | S | R | S | S | No | ERY\_S | No PI1/PI2 |
| 6 | Asian'2002-8 | Anadyr | 230 | 230 | 0,38 | 0,09 | 0,06 | 0,13 | S | R | S | S | No | ERY\_S | No PI1/PI2 |
| 582 | Eur'2010-13 | Moscow | 230 | 276 | 0,50 | 0,50 | 0,50 | 256 | R | R | S | S | Yes | erm/mef | No PI1/PI2 |
| 500 | Eur'2010-13 | Moscow | 230 | 1611 | 0,09 | 0,09 | 0,13 | 0,02 | S | R | S | S | No | ERY\_S | No PI1/PI2 |
| 838 | Eur'2010-13 | Moscow | 230 | 2013 | 0,19 | 0,25 | 0,13 | 0,09 | S | R | S | S | No | ERY\_S | No PI1/PI2 |
| 10 | Asian'2002-8 | Anadyr | 230 | 5369 | 0,25 | 0,06 | 0,06 | 0,09 | S | R | S | S | No | ERY\_S | No PI1/PI2 |
| 640 | Eur'2010-13 | Moscow | 230 | 5539 | 0,38 | 0,19 | 0,13 | 6 | S | R | S | S | Yes | mef | No PI1/PI2 |
| 203 | Eur'2010-13 | Moscow | 230 | 10431 | 0,25 | 0,19 | 0,13 | 2 | S | R | S | S | Yes | mef | No PI1/PI2 |
| 67 | Asian'2002-8 | Irkutsk | 230 | 10431 | 0,19 | 0,05 | 0,13 | 6 | S | R | R | S | Yes | mef | No PI1/PI2 |
| 609 | Eur'2010-13 | Moscow | 230 | 10431 | 0,19 | 0,02 | 0,13 | 12 | R | R | S | S | Yes | erm/mef | No PI1/PI2 |
| 783 | Eur'2010-13 | Moscow | 230 | 10432 | 0,09 | 0,09 | 0,13 | 0,13 | S | R | S | R | No | ERY\_S | No PI1/PI2 |
| 253 | Eur'2010-13 | Moscow | 156 | 143 | 1,00 | 1,50 | 1,00 | 256 | R | S | S | R | Yes | erm | PI1 |

**Supplementary Table S1** *(Continued)*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Iso-late ID | Collection part | City | CC | ST | PEN | AMX | CTX | ERY | CLI | SXT | CHL | TET | MDR | erm/mef | PI carriage |
| 201 | Eur'2003 | Smolensk | 156 | 10437 | 1,50 | 4,00 | 0,50 | 0,03 | S | R | S | S | No | ERY\_S | PI1 |
| 196 | Eur'2003 | Smolensk | 156 | 10437 | 2,00 | 4,00 | 1,00 | 0,03 | S | R | S | S | No | ERY\_S | PI1 |
| 194 | Eur'2003 | Smolensk | 156 | 10437 | 3,00 | 8,00 | 1,00 | 0,03 | S | R | S | S | No | ERY\_S | PI1 |
| 203s | Eur'2003 | Smolensk | 156 | 10437 | 4,00 | 8,00 | 0,50 | 0,03 | S | R | S | S | No | ERY\_S | PI1 |
| 202 | Eur'2003 | Smolensk | 156 | 10438 | 2,00 | 6,00 | 0,50 | 0,03 | S | R | S | S | No | ERY\_S | PI1 |
| 200 | Eur'2003 | Smolensk | 156 | 10514 | 2,00 | 8,00 | 1,00 | 0,03 | S | R | S | S | No | ERY\_S | PI1 |
| 169 | Eur'2010-13 | Moscow | 320 | 320 | 1,00 | 3,00 | 1,00 | 3 | S | R | S | R | Yes | mef | PI1/PI2 |
| 1021 | Eur'2010-13 | Moscow | 320 | 320 | 1,50 | 4,00 | 1,50 | 256 | R | R | S | S | Yes | erm/mef | PI1/PI2 |
| 547 | Eur'2010-13 | Moscow | 320 | 320 | 1,50 | 3,00 | 1,00 | 256 | R | R | S | S | Yes | erm/mef | PI1/PI2 |
| 1039 | Eur'2010-13 | Moscow | 320 | 9656 | 1,50 | 3,00 | 1,00 | 256 | R | R | S | R | Yes | erm/mef | PI1/PI2 |
| 636 | Eur'2010-13 | Moscow | 320 | 9656 | 2,00 | 3,00 | 1,50 | 256 | R | R | S | S | Yes | erm/mef | PI1/PI2 |
| 615 | Eur'2010-13 | Moscow | 320 | 9656 | 2,00 | 1,00 | 1,50 | 256 | R | R | S | S | Yes | erm/mef | PI1/PI2 |
| 1020 | Eur'2010-13 | Moscow | 320 | 9656 | 2,00 | 4,00 | 1,50 | 256 | R | R | S | S | Yes | erm/mef | PI1/PI2 |
| 160 | Asian'2002-8 | Novokuznetsk | Singl. | 10433 | 0,50 | 0,50 | 0,25 | 256 | R | S | S | S | Yes | erm | No PI1/PI2 |
| 40 | Asian'2002-8 | Yekaterinburg | Singl. | 10436 | 2,00 | 2,00 | 1,50 | 0,06 | S | R | S | S | No | ERY\_S | PI1 |
| 56-1 | Asian'2002-8 | Irkutsk | Singl. | 10512 | 0,01 | 0,02 | 0,02 | 0,06 | S | R | S | R | No | ERY\_S | No PI1/PI2 |
| 42 | Asian'2002-8 | Irkutsk | Singl. | 10512 | 0,01 | 0,02 | 0,02 | 0,13 | S | S | S | S | No | ERY\_S | No PI1/PI2 |
| 45 | Asian'2002-8 | Irkutsk | Singl. | 10512 | 0,02 | 0,02 | 0,02 | 0,05 | S | R | S | S | No | ERY\_S | No PI1/PI2 |
| 768 | Eur'2010-13 | Moscow | Miscel | 63 | 0,13 | 0,05 | 0,25 | 32 | R | S | S | R | No | erm | No PI1/PI2 |
| 59 | Asian'2002-8 | Irkutsk | Miscel | 5954 | 0,01 | 0,03 | 0,03 | 0,02 | S | R | S | S | No | ERY\_S | No PI1/PI2 |
| 1045 | Eur'2010-13 | Moscow | Miscel | 10430 | 0,01 | 0,02 | 0,06 | 0,06 | S | R | S | S | No | ERY\_S | No PI1/PI2 |
| 204m | Eur'2010-13 | Moscow | Miscel | 10511 | 0,02 | 0,01 | 0,08 | 0,03 | S | S | S | S | No | ERY\_S | No PI1/PI2 |

**Note.** Isolates arranged by CC. CC, clonal complex; ST, sequence type; Miscel, Miscellaneous; Singl., Singleton; AMX, amoxicillin; CHL, chloramphenicol; CLI, clindamycin; CTX, ceftriaxone; ERY, erythromycin; PEN, penicillin; SXT, trimethoprim/sulfamethoxazole; TET, tetracycline; MDR, multidrug resistant. For PEN, AMX, CTX, ERY MICs (mg/L) are indicated. S, susceptible R, resistant. ERY\_S: macrolide resistance genotype was determined only in ERY-resistant isolates. PI, pilus islet.

**Supplementary Table S2**. Changes in amino acid sequences of the three conserved motifs and adjacent sequences of PBP1a, 2b, and 2x comparing to those of the R6 *S. pneumoniae* reference strain

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Isolate ID** | **Collection part** | **CC** | **ST** | **PBP1a** | **PBP2b** | **PBP2x** |
| **No. of AA altered between 341-582** | **Conserved motif** | **Other** | **No. of AA altered between 357-652** | **Conserved motif** | **Other** | **No. of AA altered between 337-611** | **Conserved motif** | **Other** |
| **STMK 370–373** | **SRNVP 428–432** | **KTG 557–559** | **L539** | **TSQF 574–577** | **SVVK 385–388** | **SSNT 442–445** | **KTGTA 614–618** | **E475** | **T488** | **STMK 337–340** | **HSSN 394–397** | **LKSG 546–549** | **I371** | **R384** | **Q552** | **Y595** | **N605** |
| **PEN-susceptible (MIC <= 0.06 mg/L)** |
| 1045 | Eur’2010-13 | M | 10430 | 1 | ---- | ----- | --- | - | ---- | 0 | ---- | ---- | ----- | - | - | 0 | ---- | ---- | ---- | - | - | - | - | - |
| 204m | Eur’2010-13 | M | 10511 | 1 | ---- | ----- | --- | - | ---- | 0 | ---- | ---- | ----- | - | - | 0 | ---- | ---- | ---- | - | - | - | - | - |
| 59 | Asian’2002-8 | M | 5954 | 1 | ---- | ----- | --- | - | ---- | 0 | ---- | ---- | ----- | - | - | 0 | ---- | ---- | ---- | - | - | - | - | - |
| 42 | Asian’2002-8 | S | 10512 | 1 | ---- | ----- | --- | - | ---- | 0 | ---- | ---- | ----- | - | - | 0 | ---- | ---- | ---- | - | - | - | - | - |
| 45 | Asian’2002-8 | S | 10512 | 1 | ---- | ----- | --- | - | ---- | 0 | ---- | ---- | ----- | - | - | 0 | ---- | ---- | ---- | - | - | - | - | - |
| 56-1 | Asian’2002-8 | S | 10512 | 1 | ---- | ----- | --- | - | ---- | 0 | ---- | ---- | ----- | - | - | 0 | ---- | ---- | ---- | - | - | - | - | - |
| **PEN-intermediate (MIC >0.06; <=2 mg/L)** |
| 253 | Eur’2010-13 | 156 | 143 | 25 | -A-- | ----T | --- | - | NTGY | 12 | ---- | ---A | ----- | G | A | 34 | -A-- | ---- | V--- | T | G | - | - | T |
| 196 | Eur’2003 | 156 | 10437 | 38 | -S-- | ----T | --- | - | NTGY | 33 | ---- | ---A | ----G | G | A | 34 | -A-- | ---- | V--- | T | G | - | - | T |
| 201s | Eur’2003 | 156 | 10437 | 38 | -A-- | ----T | --- | - | NTGY | 33 | ---- | ---A | ----G | G | A | 34 | -P-- | ---- | V--- | T | G | - | - | T |
| 202s | Eur’2003 | 156 | 10438 | 38 | -S-- | ----T | --- | - | NTGY | 33 | ---- | ---A | ----G | G | A | 34 | -A-- | ---- | V--- | T | G | - | - | T |
| 200s | Eur’2003 | 156 | 10514 | 38 | -S-- | ----T | --- | - | NTGY | 33 | ---- | ---A | ----G | G | A | 34 | -A-- | ---- | V--- | T | G | - | - | T |
| 270 | Eur’2010-13 | 230 | 230 | 36 | -A-- | ----T | --- | - | NTGY | 12 | ---- | ---A | ----- | G | S | 15 | ---- | L--- | ---- | - | - | E | - | - |
| 657 | Eur’2010-13 | 230 | 230 | 36 | -A-- | ----T | --- | - | NTGY | 12 | ---- | ---A | ----- | G | S | 20 | ---- | ---- | ---- | - | G | E | - | - |
| 6 | Asian’2002-8 | 230 | 230 | 37 | -A-- | ----T | --- | - | NTGY | 12 | ---- | ---A | ----- | G | S | 20 | ---- | ---- | ---- | - | G | E | - | - |
| 582 | Eur’2010-13 | 230 | 276 | 36 | -A-- | ----T | --- | - | NTGY | 12 | ---- | ---A | ----- | G | S | 17 | -P-- | ---- | ---- | T | G | - | F | - |
| 500 | Eur’2010-13 | 230 | 1611 | 24 | ---- | ----- | --- | - | NTGY | 12 | ---- | ---A | ----- | G | S | 20 | ---- | ---- | ---- | - | G | E | - | - |
| 838 | Eur’2010-13 | 230 | 2013 | 36 | -A-- | ----T | --- | - | NTGY | 12 | ---- | ---A | ----- | G | S | 10 | ---- | L--- | ---- | - | - | - | - | - |
| 10 | Asian’2002-8 | 230 | 5369 | 37 | -A-- | ----T | --- | - | NTGY | 12 | ---- | ---A | ----- | G | S | 20 | ---- | ---- | ---- | - | G | E | - | - |
| 640 | Eur’2010-13 | 230 | 5539 | 36 | -A-- | ----T | --- | - | NTGY | 12 | ---- | ---A | ----- | G | S | 20 | ---- | ---- | ---- | - | G | E | - | - |
| 203 | Eur’2010-13 | 230 | 10431 | 36 | -A-- | ----T | --- | - | NTGY | 12 | ---- | ---A | ----- | G | S | 20 | ---- | ---- | ---- | - | G | E | - | - |
| 609 | Eur’2010-13 | 230 | 10431 | 36 | -A-- | ----T | --- | - | NTGY | 12 | ---- | ---A | ----- | G | S | 20 | ---- | ---- | ---- | - | G | E | - | - |
| 67 | Asian’2002-8 | 230 | 10431 | 36 | -A-- | ----T | --- | - | NTGY | 12 | ---- | ---A | ----- | G | S | 20 | ---- | ---- | ---- | - | G | E | - | - |
| 783 | Eur’2010-13 | 230 | 10432 | 24 | ---- | ----- | --- | - | NTGY | 12 | ---- | ---A | ----- | G | S | 20 | ---- | ---- | ---- | - | G | E | - | - |
| 169 | Eur’2010-13 | 320 | 320 | 32 | -A-- | ----T | --- | - | NTGY | 31 | ---- | ---A | ----G | G | A | 33 | -A-- | ---- | V--- | T | G | - | - | T |
| 547 | Eur’2010-13 | 320 | 320 | 32 | -A-- | ----T | --- | - | NTGY | 31 | ---- | ---A | ----G | G | A | 33 | -A-- | ---- | V--- | T | G | - | - | T |
| 1021 | Eur’2010-13 | 320 | 320 | 38 | -A-- | ----T | --- | - | NTGY | 31 | ---- | ---A | ----G | G | A | 33 | -A-- | ---- | V--- | T | G | - | - | T |
| 615 | Eur’2010-13 | 320 | 9656 | 38 | -S-- | ----T | --- | - | NTGY | 31 | ---- | ---A | ----G | G | A | 33 | -A-- | ---- | V--- | T | G | - | - | T |
| 636 | Eur’2010-13 | 320 | 9656 | 32 | -S-- | ----T | --- | - | NTGY | 31 | ---- | ---A | ----G | G | A | 33 | -A-- | ---- | V--- | T | G | - | - | T |
| 1020 | Eur’2010-13 | 320 | 9656 | 32 | -S-- | ----T | --- | - | NTGY | 31 | ---- | ---A | ----G | G | A | 33 | -A-- | ---- | V--- | T | G | - | - | T |
| 1039 | Eur’2010-13 | 320 | 9656 | 32 | -A-- | ----T | --- | - | NTGY | 33 | ---- | ---A | ----G | G | A | 34 | -A-- | ---- | V--- | T | G | - | - | T |
| 110 | Eur’2003 | 663 | 10434 | 31 | ---- | ----- | --- | W | NTGY | 14 | ---- | ---A | ----- | G | S | 17 | -P-- | ---- | ---- | T | G | E | - | - |
| 111 | Eur’2003 | 663 | 10434 | 32 | ---- | ----- | --- | W | NTGY | 14 | ---- | ---A | ----- | G | S | 17 | -P-- | ---- | ---- | T | G | E | - | - |
| 139 | Eur’2003 | 663 | 10435 | 31 | ---- | ----- | --- | W | NTGY | 14 | ---- | ---A | ----- | G | S | 17 | -P-- | ---- | ---- | T | G | E | - | - |
| 140 | Eur’2003 | 663 | 10435 | 31 | ---- | ----- | --- | W | NTGY | 14 | ---- | ---A | ----- | G | S | 17 | -P-- | ---- | ---- | T | G | E | - | - |
| 134 | Eur’2003 | 663 | 10515 | 31 | ---- | ----- | --- | W | NTGY | 14 | ---- | ---A | ----- | G | S | 17 | -P-- | ---- | ---- | T | G | E | - | - |
| 768 | Eur’2010-13 | M | 63 | 23 | ---- | ----- | --- | - | ---- | 10 | ---- | ---A | ----- | G | S | 31 | ---- | L--- | V--- | - | - | - | - | - |
| 40 | Asian’2002-8 | S | 10436 | 34 | -S-- | ----T | --- | - | NTGY | 26 | ---- | ---A | ----- | G | A | 36 | -A-- | ---- | V--- | T | G | - | - | T |
| 160 | Asian’2002-8 | S | 10433 | 34 | -A-- | ----T | --- | - | NTGY | 18 | ---- | ---A | ----- | G | S | 18 | -P-- | ---- | ---- | T | G | - | - | - |
| **PEN-resistant (MIC >2 mg/L)** |
| 194 | Eur’2003 | 156 | 10437 | 38 | -S-- | ----T | --- | - | NTGY | 33 | ---- | ---A | ----G | G | A | 34 | -A-- | ---- | V--- | T | G | - | - | T |
| 203s | Eur’2003 | 156 | 10437 | 38 | -S-- | ----T | --- | - | NTGY | 33 | ---- | ---A | ----G | G | A | 34 | -A-- | ---- | V--- | T | G | - | - | T |
| 175 | Eur’2003 | 663 | 663 | 34 | -S-- | ----T | --- | - | NTGY | 17 | ---- | ---A | ----- | G | S | 17 | -P-- | ---- | ---- | T | G | E | - | - |
| 176 | Eur’2003 | 663 | 663 | 34 | -S-- | ----T | --- | - | NTGY | 17 | ---- | ---A | ----- | G | S | 18 | -P-- | ---- | ---- | T | G | E | - | - |
| 183 | Eur’2003 | 663 | 663 | 34 | -S-- | ----T | --- | - | NTGY | 17 | ---- | ---A | ----- | G | S | 18 | -P-- | ---- | ---- | T | G | E | - | - |
| 186 | Eur’2003 | 663 | 663 | 34 | -S-- | ----T | --- | - | NTGY | 17 | ---- | ---A | ----- | G | S | 18 | -P-- | ---- | ---- | T | G | E | - | - |
| 188 | Eur’2003 | 663 | 663 | 34 | -S-- | ----T | --- | - | NTGY | 17 | ---- | ---A | ----- | G | S | 18 | -P-- | ---- | ---- | T | G | E | - | - |
| 58 | Eur’2010-13 | 663 | 663 | 38 | -S-- | ----T | --- | - | NTGY | 34 | ---- | ---A | ----G | G | A | 23 | -P-- | ---- | ---- | T | G | - | F | T |
| 85a | Eur’2003 | 663 | 10434 | 31 | ---- | ----- | --- | W | NTGY | 14 | ---- | ---A | ----- | G | S | 17 | -P-- | ---- | ---- | T | G | E | - | - |
| 89 | Eur’2003 | 663 | 10434 | 31 | ---- | ----- | --- | W | NTGY | 14 | ---- | ---A | ----- | G | S | 17 | -P-- | ---- | ---- | T | G | E | - | - |
| 242 | Eur’2010-13 | 663 | 10434 | 32 | -S-- | ----T | --- | - | NTGY | 14 | ---- | ---A | ----- | G | S | 22 | -P-- | ---- | ---- | T | G | - | F | - |

**Note.** In the table heading under PBP1a, PBP2b, PBP2x, reference amino acid sequences of the corresponding PBP of *S. pneumoniae* R6 strain are shown. For study isolates, letters indicate amino acid substitutions comparing to those of *S. pneumoniae* R6 strain; dash indicates no change. AA, amino acid. Collection parts: Eur’2003 and Eur’2010-13, collected in the European Russia in 2003 and 2010-2013, respectively; Asian’2002-8, collected in the Asian Russia in 2002-2008. In the column CC (clonal complex): M, miscellaneous; S, singleton.