



HAL
open science

Study of 109 *Achromobacter* spp. isolates from 9 French CF centres reveals the circulation of a multiresistant clone of *A. xylosoxidans* belonging to ST 137

Lucie Amoureux, Juliette Sauge, Benoit Sarret, Matthieu Lhoumeau, Audrey Bajard, Jennifer Tetu, Julien Bador, Catherine Neuwirth, Jocelyne Caillon, Emilie Cardot-Martin, et al.

► To cite this version:

Lucie Amoureux, Juliette Sauge, Benoit Sarret, Matthieu Lhoumeau, Audrey Bajard, et al.. Study of 109 *Achromobacter* spp. isolates from 9 French CF centres reveals the circulation of a multiresistant clone of *A. xylosoxidans* belonging to ST 137. *Journal of Cystic Fibrosis*, 2019, 18 (6), pp.804-807. 10.1016/j.jcf.2019.04.005 . hal-03372509

HAL Id: hal-03372509

<https://hal.science/hal-03372509v1>

Submitted on 21 Jul 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

1 **Title**

2 Study of 109 *Achromobacter* spp. isolates from 9 French CF centres reveals the circulation of
3 a multiresistant clone of *A. xylosoxidans* belonging to ST 137.

4
5 **Authors**

6 Lucie Amoureux*^{1,2}, Juliette Sauge¹, Benoit Sarret¹, Matthieu Lhoumeau¹, Audrey Bajard¹,
7 Jennifer Tetu¹, Julien Bador^{1,2}, Catherine Neuwirth^{1,2} ; MucoMicrobes group³

8
9 ³Collaborators, MucoMicrobes group

10 Jocelyne Caillon, Emilie Cardot-Martin, Vincent Cattoir; Anne Doléans-Jordheim ; Agnès
11 Ferroni, Hélène Guet-Revillet, Geneviève Héry-Arnaud, Christine Segonds, Elise Thomas,
12 Patrick Plésiat, Hoang Vu-Thien.

13
14 ¹Department of Bacteriology, University Hospital of Dijon, BP 37013, 21070 DIJON CEDEX
15 FRANCE

16 ²UMR/CNRS 6249 Chrono-environnement, University of Franche-Comté, Besançon, France

17
18 * Corresponding author.

19 Mailing address : Laboratoire de Bactériologie, Hôpital Universitaire, Plateau Technique de
20 Biologie, BP 37013, 21070 DIJON CEDEX FRANCE

21 Phone : +33-3 80 29 56 86

22 Fax : +33-3 80 29 32 80

23 E-mail : lucie.amoureux@chu-dijon.fr

24
25 **Keywords:** *Achromobacter*, *nrdA*, MLST, identification, resistance, cystic fibrosis, ST 137.

26
27
28
29

30 **Abstract**

31 We previously reported the distribution of *Achromobacter* spp (species and Sequence Types
32 (ST)) in our French Cystic Fibrosis (CF) centre. In the present study we collected 109
33 *Achromobacter* isolates (1/patient) from 9 other French CF Centres for species identification,
34 antimicrobial susceptibility testings and Multilocus-Sequence-Typing (MLST) analysis. Ten
35 species were detected, *A. xylosoxidans* being the most predominant one (73.4% of the
36 isolates). Piperacillin-tazobactam, ceftazidime, imipenem, meropenem and ciprofloxacin were
37 respectively active against 88, 70, 79, 72 and 23% of the isolates. Among the 79 *A.*
38 *xylosoxidans* isolates, 46 STs were detected. Interestingly, ST 137, recovered in 4 centres (5
39 patients), was previously detected in our centre (2 patients). The strains from the 7 patients
40 belonged to the same pulsotype (pulsed-field-gel-electrophoresis analysis) and harboured
41 acquired resistance to meropenem, ceftazidime, ciprofloxacin, and except for 2 isolates, to
42 imipenem and piperacillin-tazobactam. This is the first description in France of a circulating
43 multiresistant *A. xylosoxidans* strain.

44

45 **Manuscript**

46 *Achromobacter* spp. are increasingly isolated from cystic fibrosis (CF) patients respiratory
47 samples (1-4). In France the prevalence of *Achromobacter* spp. in CF patients raised from 2.7
48 % in 2001 to 6.3% in 2016 (Registre Français de la Mucoviscidose, www.vaincrelamuco.org).
49 The pathogenicity of these bacteria is not well established yet, but chronic colonization has
50 recently been associated with more greater rates of mortality and transplantation among CF
51 patients (5). To date 18 species have been described within the genus (6). However it is not
52 known yet, whether particular species or Sequence Types (STs) are linked with more
53 pathogenicity or chronic colonisation. Therefore it is important to describe the distribution of
54 the species and STs identified among CF patients.

55 Biochemical systems (API 20 NE) or mass spectrometry (MALDI-TOF-MS) are reliable in
56 identifying the isolates to the genus level. However the identification to the species-level
57 requires specific techniques that are not commonly performed by routine diagnostic
58 laboratories. These techniques are based on housekeeping genes sequencing: *nrdA* (765 bp
59 fragment) (7) or Multilocus Sequence Typing (7 genes sequencing) (8).

60 Few studies have described the distribution of *Achromobacter* species among CF patients (1-
61 4, 7, 9-11) but the distribution of STs within CF centres has only been reported in a Spanish
62 centre, two Brazilian centres, in a British multicentric study and in our centre (University
63 Hospital of Dijon, France) (4, 9-11).

64 The present study is the first French multicentric study to report identification, resistance and
65 MLST typing of *Achromobacter* detected from CF patients sputum.

66

67 In 2014, a total of 109 isolates of *Achromobacter* spp. were collected among 9 French CF
68 centres belonging to the French group MucoMicrobes (Besançon, Caen, Lyon, Nantes, Paris-
69 Trousseau, Paris-Necker, Roscoff, Suresnes and Toulouse) (Figure 1). We included the first
70 isolate of 2014 for each patient that previously presented at least one positive culture.

71 Identification was performed by *nrdA* sequencing, and genotyping of the isolates belonging to
72 *A. xylosoxidans* was performed by MLST, as described previously (7, 8). The results are
73 presented in Table 1. Antimicrobial susceptibilities to piperacillin-tazobactam, ceftazidime,
74 imipenem, meropenem, ciprofloxacin and aminoglycosides (AG) (tobramycin, amikacin,
75 gentamicin) were determined in accordance with the methodological recommendations of
76 CA-SFM-EUCAST (2014).

77 Among these 109 isolates, a total of 10 species were identified. As reported previously, *A.*
78 *xylosoxidans* was the most predominant species in the study and in each centre with 73.4 %
79 (n=80 /109) of the isolates. The other species included *A. insuavis* (9.2 % ; n=10), *A. dolens*
80 (3.7 % ; n=4), *A. mucicolens* (3.7 %, n=4), *A. marplatensis* (2.8 %, n=3), *A. aegrifaciens* (2.8
81 %, n=3), *A. insolitus* (1.8 % ; n=2), *A. pulmonis* (0.9 % ; n=1), *A. deleyi* (0.9 % ; n=1) and *A.*
82 *genogroup 3* (0.9 % ; n=1). Interestingly and as reported previously in our centre (9), we did
83 not detect any isolate belonging to *A. ruhlmannii* in this study although this species is
84 widespread in Denmark, in the US, (3, 7) and in a Brazilian centre (4).

85

86 As expected, a large majority of the isolates were resistant to AG (92%). This resistance is
87 linked to the production of the constitutive AxyXY-OprZ efflux system expressed by the
88 species *A. xylosoxidans*, *A. insuavis*, *A. dolens*, *A. insolitus*, *A. aegrifaciens*, *A. deleyi*, *A.*
89 *pulmonis* and *A. genogroup 3* (12, 13).

90

91 Piperacillin-tazobactam was the most active antibiotic (88% of susceptibility). Acquired
92 resistance to this beta-lactam was only observed for the species *A. xylosoxidans*. Meropenem
93 was less active than imipenem (respectively 72 versus 79% of susceptibility). It is noteworthy
94 that 12 isolates were resistant to meropenem but not to imipenem. This phenotype had already
95 been noticed in our centre. This resistance could be mediated by over-expression of efflux
96 system (14). Resistance to ceftazidime was observed for 30% of the strains, which is
97 consistent with data from CF studies (10, 15). Resistance to ciprofloxacin was high (77%), as

98 often described among CF, non CF and environmental isolates (16). It was observed for 94 %
99 of *A. xylosoxidans* isolates but only for 39 % of the isolates belonging to the other species.

100

101 MLST analysis was performed for 79 isolates identified as *A. xylosoxidans*. They were
102 classified into 46 STs. Twenty-five STs were already referenced in the PubMLST database
103 (Table 2) which contained 181 ST on the 18th January 2019
104 (<https://pubmlst.org/achromobacter/>). Twenty-one were new undescribed STs (29 isolates)
105 that we submitted to the PubMLST database for number assignments (ST 433 to 453).

106

107 Despite this diversity, 21 STs (52 isolates) were detected at least twice in the study, and
108 surprisingly, in most of the cases, the isolates originated from patients not attending the same
109 centre. Pulsed field gel electrophoresis analysis (PFGE) was performed on the 52 isolates as
110 already described (14) (Table 1). Restriction patterns were interpreted according to Tenover's
111 criteria (17).

112 Some STs included isolates that all shared « indistinguishable » or « closely related » profiles.
113 This suggested a circulation of some clonal strains in France. For example, ST 153 was
114 detected from 5 patients of the study originating from 3 distinct centres and previously from
115 one patient of our centre. This ST had already been reported from a chronically colonized
116 patient in Spain (10).

117 ST 2 was detected in the present study from 4 patients (4 centres), but also in our hospital
118 from 1 CF, 2 non CF patients and environmental samples (16). In PubMLST database, this ST
119 is recorded for isolates from CF patients in the US, in France, and from non CF patients in
120 Belgium. The 4 isolates were categorized as “possibly related” by PFGE analysis, suggesting
121 that the isolates derived from a common parent.

122 Interestingly for 3 patients originating from Caen, Suresnes and Roscoff, the isolates belonged
123 to ST 290, already detected from a patient of our centre that was colonized for 19 years with
124 the same strain before and after lung transplant.

125

126 Finally, the major finding of our study is the detection of ST 137 from 5 patients originating
127 from 4 centres (Besançon, Roscoff, Nantes and Suresnes). Two chronically colonized patients
128 from our CF centre harboured isolates belonging to this ST. PFGE profiles of the 7 isolates
129 were indistinguishable, which suggests an epidemic strain. Moreover, all the isolates were
130 multiresistant: all isolates acquired resistance to meropenem, ceftazidime and ciprofloxacin,
131 and 5/7 to piperacillin-tazobactam and imipenem. A common source of contamination or

132 cross-contamination are unlikely, as the 5 centres are geographically distant. Strains
133 belonging to ST 137 have also been recorded in Belgium among CF patients
134 (<http://pubmlst/achromobacter>) and in Montpellier (France) but their resistance phenotypes
135 are not reported. One might wonder whether the strains belonging to this ST are presenting
136 more virulence factors, or a selective advantage.

137

138 In conclusion, this first multicentric study confirmed the diversity of *Achromobacter* species
139 recovered from CF patients sputum in France, and the predominance of *A. xylosoxidans* as
140 reported previously. We also observed a large variety of STs, but MLST and PFGE analysis
141 indicated the circulation of several clones among CF centres. Particular attention should be
142 paid to ST 137 that is linked with multiresistance to antibiotics, seems to have an
143 epidemiogenic potential, and might be linked with chronic colonization, as already described
144 with the mutiresistant Danish Epidemic Strain (3). More epidemiological data are needed to
145 help determine which strains might be of clinical importance, to guide the virulence studies,
146 and to propose guidelines for therapeutic or prophylaxis management of the patients.

147

148

149 **Acknowledgments**

150 The authors gratefully acknowledge Theodore Spilker for his contribution in *nrdA* sequences
151 analysis and ST assignments.

152

153 **Conflict of interest statement**

154 The authors have no conflict of interest related to this work.

155

156 **Funding sources**

157 This work has been partly supported by Vaincre la mucoviscidose Grant number
158 RF20150501371.

159

160 **Reference list**

161 1. Cools P, Ho E, Vranckx K, Schelstraete P, Wurth B, Franckx H, et al. Epidemic
162 *Achromobacter xylosoxidans* strain among Belgian cystic fibrosis patients and review of
163 literature. BMC Microbiol. 2016;16(1):122.

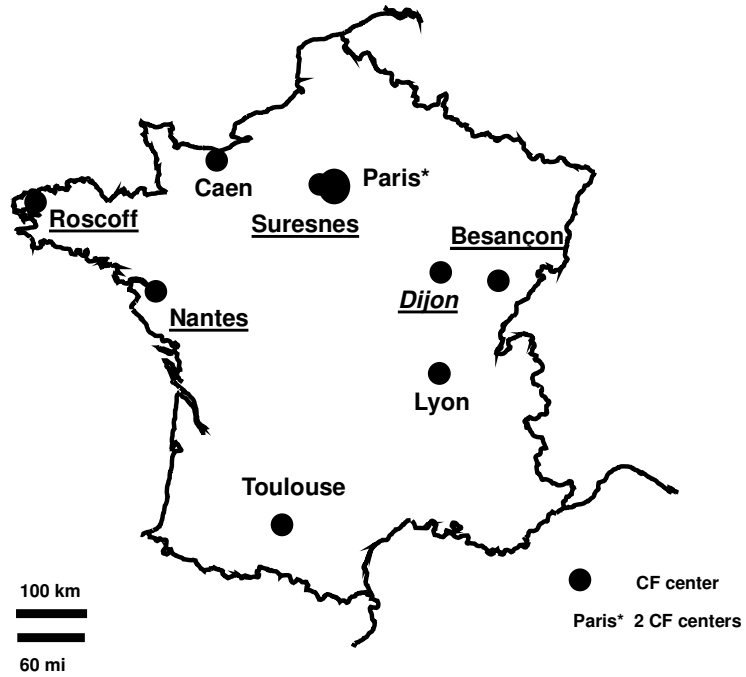
- 164 2. Edwards BD, Greysso-Wong J, Somayaji R, Waddell B, Whelan FJ, Storey DG, et
165 al. Prevalence and Outcomes of *Achromobacter* Species Infections in Adults with Cystic
166 Fibrosis: a North American Cohort Study. *J Clin Microbiol.* 2017;55(7):2074-85.
- 167 3. Gade SS, Norskov-Lauritsen N, Ridderberg W. Prevalence and species distribution of
168 *Achromobacter* sp. cultured from cystic fibrosis patients attending the Aarhus centre in
169 Denmark. *J Med Microbiol.* 2017;66(5):686-9.
- 170 4. Pereira RH, Leao RS, Carvalho-Assef AP, Albano RM, Rodrigues ER, Firmida MC,
171 et al. Patterns of virulence factor expression and antimicrobial resistance in *Achromobacter*
172 *xylosoxidans* and *Achromobacter ruhlandii* isolates from patients with cystic fibrosis.
173 *Epidemiol Infect.* 2017;145(3):600-6.
- 174 5. Somayaji R, Stanojevic S, Tullis DE, Stephenson AL, Ratjen F, Waters V. Clinical
175 Outcomes Associated with *Achromobacter* Species Infection in Patients with Cystic Fibrosis.
176 *Ann Am Thorac Soc.* 2017;14(9):1412-8.
- 177 6. Vandamme PA, Peeters C, Inganas E, Cnockaert M, Houf K, Spilker T, et al.
178 Taxonomic dissection of *Achromobacter denitrificans* Coenye *et al.* 2003 and proposal of
179 *Achromobacter agilis* sp. nov., nom. rev., *Achromobacter pestifer* sp. nov., nom. rev.,
180 *Achromobacter kerstersii* sp. nov. and *Achromobacter deleyi* sp. nov. *Int J Syst Evol*
181 *Microbiol.* 2016.
- 182 7. Spilker T, Vandamme P, Lipuma JJ. Identification and distribution of *Achromobacter*
183 species in cystic fibrosis. *J Cyst Fibros.* 2013;12(3):298-301.
- 184 8. Spilker T, Vandamme P, Lipuma JJ. A multilocus sequence typing scheme implies
185 population structure and reveals several putative novel *Achromobacter* species. *J Clin*
186 *Microbiol.* 2012;50(9):3010-5.
- 187 9. Amoureux L, Bador J, Bounoua Zouak F, Chapuis A, de Curraize C, Neuwirth C.
188 Distribution of the species of *Achromobacter* in a French Cystic Fibrosis Centre and
189 multilocus sequence typing analysis reveal the predominance of *A. xylosoxidans* and clonal
190 relationships between some clinical and environmental isolates. *J Cyst Fibros.* 2016.
- 191 10. Barrado L, Branas P, Orellana MA, Martinez MT, Garcia G, Otero JR, et al.
192 Molecular characterization of *Achromobacter* isolates from cystic fibrosis and non-cystic
193 fibrosis patients in Madrid, Spain. *J Clin Microbiol.* 2013;51(6):1927-30.
- 194 11. Coward A, Kenna DT, Perry C, Martin K, Doumith M, Turton JF. Use of *nrdA* gene
195 sequence clustering to estimate the prevalence of different *Achromobacter* species among
196 Cystic Fibrosis patients in the UK. *J Cyst Fibros.* 2016;15(4):479-85.
- 197 12. Bador J, Amoureux L, Blanc E, Neuwirth C. Innate Aminoglycoside Resistance of
198 *Achromobacter xylosoxidans* is due to AxyXY-OprZ, an RND-Type Multidrug Efflux Pump.
199 *Antimicrob Agents Chemother.* 2013;57(1):603-5.
- 200 13. Bador J, Neuwirth C, Liszczyński P, Mézier MC, Chrétiennot M, Grenot E, et al.
201 Distribution of innate efflux-mediated aminoglycosides resistance among the different
202 *Achromobacter* species. *New Microbes and New Infections.* 2015;10:1-5.

- 203 14. Amoureux L, Bador J, Siebor E, Taillefumier N, Fanton A, Neuwirth C. Epidemiology
204 and resistance of *Achromobacter xylosoxidans* from cystic fibrosis patients in Dijon,
205 Burgundy: First French data. J Cyst Fibros. 2013;12(2):170-6.
- 206 15. Wang M, Ridderberg W, Hansen CR, Hoiby N, Jensen-Fangel S, Olesen HV, et al.
207 Early treatment with inhaled antibiotics postpones next occurrence of *Achromobacter* in
208 cystic fibrosis. J Cyst Fibros. 2013;12(6):638-43.
- 209 16. Amoureux L, Bador J, Fardeheb S, Mabilille C, Couchot C, Massip C, et al. Detection
210 of *Achromobacter xylosoxidans* in hospital, domestic, and outdoor environmental samples and
211 comparison with human clinical isolates. Appl Environ Microbiol. 2013;79(23):7142-9.
- 212 17. Tenover FC, Arbeit RD, Goering RV, Mickelsen PA, Murray BE, Persing DH, et al.
213 Interpreting chromosomal DNA restriction patterns produced by pulsed-field gel
214 electrophoresis: criteria for bacterial strain typing. J Clin Microbiol. 1995;33(9):2233-9.
215
216
217
218
219
220
221

Figure 1 : Location of the 9 French CF centres of the study and Dijon.

Paris* : 2 CF centers (Paris-Trousseau and Paris-Necker)

Underlined : CF centers where ST 137 was detected.



Isolate	CF center	Species	ST	PFGE	Antimicrobial acquired resistance
116b	Lyon	<i>A. xylosoxidans</i>	1	/	IPM, MEM, CIP
102b	Toulouse	<i>A. xylosoxidans</i>	2	A1	CIP
44b	Paris-Trousseau	<i>A. xylosoxidans</i>	2	A2	CIP
28b	Roscoff	<i>A. xylosoxidans</i>	2	A3	CIP
83b	Nantes	<i>A. xylosoxidans</i>	2	A1	CIP
15b	Roscoff	<i>A. xylosoxidans</i>	15	B	PTZ, CAZ, IPM, MEM, CIP
90b	Nantes	<i>A. xylosoxidans</i>	15	B	PTZ, CAZ, MEM, CIP
3b	Roscoff	<i>A. xylosoxidans</i>	15	B	PTZ, CAZ, MEM, CIP
48b	Suresnes	<i>A. xylosoxidans</i>	19	/	CAZ, MEM, CIP
14b	Roscoff	<i>A. xylosoxidans</i>	22	/	CAZ, IPM, MEM, CIP
37b	Caen	<i>A. xylosoxidans</i>	27	C	CIP, IPM
52b	Suresnes	<i>A. xylosoxidans</i>	27	C	IPM, MEM, CIP
56b	Suresnes	<i>A. xylosoxidans</i>	28	D1	CIP, IPM
79b	Nantes	<i>A. xylosoxidans</i>	28	D2	PTZ, CAZ, IPM, MEM, CIP
5b	Besançon	<i>A. xylosoxidans</i>	137	E	CAZ, IPM, MEM, CIP
8b	Roscoff	<i>A. xylosoxidans</i>	137	E	PTZ, CAZ, IPM, MEM, CIP
47b	Suresnes	<i>A. xylosoxidans</i>	137	E	PTZ, CAZ, IPM, MEM, CIP
59b	Suresnes	<i>A. xylosoxidans</i>	137	E	PTZ, CAZ, MEM, CIP
76b	Nantes	<i>A. xylosoxidans</i>	137	E	PTZ, CAZ, IPM, MEM, CIP
53b	Suresnes	<i>A. xylosoxidans</i>	153	F	CIP
94b	Toulouse	<i>A. xylosoxidans</i>	153	F	CIP
104b	Toulouse	<i>A. xylosoxidans</i>	153	F	CIP
122b	Lyon	<i>A. xylosoxidans</i>	153	F	CIP
123b	Lyon	<i>A. xylosoxidans</i>	153	F	CIP
42b	Paris-Trousseau	<i>A. xylosoxidans</i>	175	/	CIP
71b	Necker	<i>A. xylosoxidans</i>	176	/	CAZ, CIP
46b	Suresnes	<i>A. xylosoxidans</i>	179	G1	PTZ, CAZ, MEM, CIP
49b	Suresnes	<i>A. xylosoxidans</i>	179	G2	PTZ, CAZ, CIP
60b	Suresnes	<i>A. xylosoxidans</i>	179	G3	CIP
108b	Lyon	<i>A. xylosoxidans</i>	180	/	CIP
109b	Lyon	<i>A. xylosoxidans</i>	184	/	None
74b	Nantes	<i>A. xylosoxidans</i>	202	/	CIP
100b	Toulouse	<i>A. xylosoxidans</i>	211	/	CAZ, CIP
10b	Roscoff	<i>A. xylosoxidans</i>	226	H	PTZ, CAZ, IPM, MEM
13b	Roscoff	<i>A. xylosoxidans</i>	226	H	CAZ, CIP
32b	Roscoff	<i>A. xylosoxidans</i>	226	H	PTZ, CAZ, IPM, MEM, CIP
117b	Lyon	<i>A. xylosoxidans</i>	234	I	CIP
65b	Paris-Necker	<i>A. xylosoxidans</i>	234	I	CIP
81b	Nantes	<i>A. xylosoxidans</i>	248	Un.	PTZ, CAZ, IPM, MEM, CIP
73b	Nantes	<i>A. xylosoxidans</i>	248	Un.	CIP
96b	Toulouse	<i>A. xylosoxidans</i>	273	J	CAZ, CIP
98b	Toulouse	<i>A. xylosoxidans</i>	273	J	CIP
24b	Roscoff	<i>A. xylosoxidans</i>	290	K1	CIP
38b	Caen	<i>A. xylosoxidans</i>	290	K2	MEM, CIP
57b	Suresnes	<i>A. xylosoxidans</i>	290	K1	CIP
58b	Suresnes	<i>A. xylosoxidans</i>	292	/	CAZ, MEM, CIP

20b	Roscoff	<i>A. xylosoxidans</i>	314	Un.	CAZ, IPM, MEM, CIP
55b	Suresnes	<i>A. xylosoxidans</i>	314	Un.	CAZ, IPM, MEM, CIP
111b	Lyon	<i>A. xylosoxidans</i>	315	/	CAZ, CIP
105b	Toulouse	<i>A. xylosoxidans</i>	424	/	CIP
2b	Roscoff	<i>A. xylosoxidans</i>	433	L	IPM, CIP
18b	Roscoff	<i>A. xylosoxidans</i>	433	L	CIP
11b	Roscoff	<i>A. xylosoxidans</i>	434	/	IPM, CIP
12b	Roscoff	<i>A. xylosoxidans</i>	435	M	CIP
84b	Nantes	<i>A. xylosoxidans</i>	435	M	CIP
25b	Roscoff	<i>A. xylosoxidans</i>	436	/	None
45b	Suresnes	<i>A. xylosoxidans</i>	437	/	CIP
61b	Suresnes	<i>A. xylosoxidans</i>	438	N1	CIP
95b	Toulouse	<i>A. xylosoxidans</i>	438	N2	MEM, CIP
62b	Suresnes	<i>A. xylosoxidans</i>	439	/	CAZ, MEM, CIP
63b	Paris-Necker	<i>A. xylosoxidans</i>	440	/	CIP
77b	Nantes	<i>A. xylosoxidans</i>	441	/	CIP
93b	Toulouse	<i>A. xylosoxidans</i>	442	/	CIP
23b	Roscoff	<i>A. xylosoxidans</i>	443	/	IPM
67b	Paris-Necker	<i>A. xylosoxidans</i>	444	O	CAZ
39b	Paris-Trousseau	<i>A. xylosoxidans</i>	444	O	CAZ
51b	Suresnes	<i>A. xylosoxidans</i>	445	P	IPM, CIP
72b	Paris-Necker	<i>A. xylosoxidans</i>	445	P	IPM, MEM, CIP
66b	Paris-Necker	<i>A. xylosoxidans</i>	446	/	CIP
70b	Paris-Necker	<i>A. xylosoxidans</i>	447	/	CIP
80b	Nantes	<i>A. xylosoxidans</i>	448	Q	CIP
87b	Nantes	<i>A. xylosoxidans</i>	448	Q	CIP
86b	Nantes	<i>A. xylosoxidans</i>	449	/	CAZ, CIP
113b	Lyon	<i>A. xylosoxidans</i>	450	R	None
114b	Lyon	<i>A. xylosoxidans</i>	450	R	CIP
120b	Lyon	<i>A. xylosoxidans</i>	451	S	MEM, CIP
121b	Lyon	<i>A. xylosoxidans</i>	451	S	MEM, CIP
82b	Nantes	<i>A. xylosoxidans</i>	452	/	CAZ, CIP
119b	Lyon	<i>A. xylosoxidans</i>	453	/	CIP
43b	Paris-Trousseau	<i>A. xylosoxidans</i>	/	/	CIP, IPM
54b	Suresnes	<i>A. pulmonis</i>	/	/	CAZ, MEM, CIP
64b	Paris-Necker	<i>A. mucicolens</i>	/	/	
99b	Toulouse	<i>A. mucicolens</i>	/	/	
112b	Lyon	<i>A. mucicolens</i>	/	/	
115b	Lyon	<i>A. mucicolens</i>	/	/	
6b	Roscoff	<i>A. marplatensis</i>	/	/	CIP
9b	Roscoff	<i>A. marplatensis</i>	/	/	
91b	Toulouse	<i>A. marplatensis</i>	/	/	
1b	Roscoff	<i>A. insuavis</i>	/	/	MEM
4b	Roscoff	<i>A. insuavis</i>	/	/	CIP
35b	Roscoff	<i>A. insuavis</i>	/	/	
41b	Paris-Trousseau	<i>A. insuavis</i>	/	/	CIP
50b	Suresnes	<i>A. insuavis</i>	/	/	CIP
78b	Nantes	<i>A. insuavis</i>	/	/	

92b	Toulouse	<i>A. insuavis</i>	/	/	
101b	Toulouse	<i>A. insuavis</i>	/	/	CIP
107b	Toulouse	<i>A. insuavis</i>	/	/	
118b	Lyon	<i>A. insuavis</i>	/	/	CIP
36b	Caen	<i>A. insolitus</i>	/	/	
68b	Paris-Necker	<i>A. insolitus</i>	/	/	
103b	Toulouse	<i>A. genogroup 3</i>	/	/	
7b	Roscoff	<i>A. dolens</i>	/	/	CAZ, CIP
85b	Nantes	<i>A. dolens</i>	/	/	
106b	Toulouse	<i>A. dolens</i>	/	/	CIP
110b	Lyon	<i>A. dolens</i>	/	/	
97b	Toulouse	<i>A. deleyi</i>	/	/	MEM, CIP
16b	Besançon	<i>A. aegrifaciens</i>	/	/	
69b	Paris-Necker	<i>A. aegrifaciens</i>	/	/	
75b	Nantes	<i>A. aegrifaciens</i>	/	/	CAZ, IPM, MEM, CIP

Table 1 : Origin, species identification, ST , PFGE results and antimicrobial acquired resistance for the 109 *Achromobacter* spp. isolates.

CAZ : ceftazidime ; PTZ : piperacillin/ tazobactam ; IPM : imipenem ; MEM : meropenem ; CIP : ciprofloxacin
ST in bold were already detected in our CF center in previous studies.

*PFGE profiles were interpreted according to Tenover's criteria (16)

Isolates categorized as « indistinguishable or « closely related » were assigned the same letter and number.
i.e. : isolates 102 and 83 (pulsotype A1).

For isolates categorized as « possibly related » (profiles differing by four to six fragments) a number was added to the letter. i.e. : isolates 102 , 44, 28, 83 (pulsotypes A1, A2, A3, A4).

« Un. » refers to unique profiles

ST	This study no. of patients (no. of centers)	PubMLST database (outside France)	Previous studies in our CF center (Dijon, France)
1	1 patient (1)	USA (CF)	-
2	4 patients (4)	Belgium (non CF patients), USA (CF patients)	1 CF patient, 2 non CF patients, hospital environment
15	3 patients (2)	USA (CF)	-
19	1 patient (1)	USA, Spain (non CF), Belgium (CF)	-
22	1 patient (1)	Sweden, Italy, Belgium (CF)	-
27	2 patients (2)	USA, Spain (CC*), Thailand (non CF)	1 CF patient, hospital environment
28	2 patients (2)	UK, USA (non CF)	-
137	5 patients (4)	Belgium (CF)	2 CF patients (CC**)
153	5 patients (3)	Spain (CF, CC*)	1 CF patient
175	1 patient (1)	UK, Belgium (CF) UK (non CF)	3 CF patients , hospital and river
176	1 patient (1)	UK (non CF)	-
179	3 patients (1)	UK, India (non CF)	-
180	1 patient (1)	UK (CF), UK, Belgium, Thailand (non CF)	-
184	1 patient (1)	Belgium (CF), Thailand (non CF)	hospital environment
202	1 patient (1)	Brazil (CF)	-
211	1 patient (1)	Belgium, Russia (CF)	-
226	3 patients (1)	Belgium (CF)	-
234	2 patients (2)	Belgium (CF)	-
248	2 patients (1)	Belgium (CF)	-
273	2 patients (1)	Belgium (CF)	-
290	3 patients (3)	-	1 CF patient (CC**), river
292	1 patient (1)	-	1 CF patient (CC**), domestic environment
314	2 patients (2)	China (non CF)	-
315	1 patient (1)	China (non CF)	-
424	1 patient (1)	Belgium	-

Table 2 : ST detected in the 9 CF centers already recorded in the pubMLST database (<http://pubmlst/achromobacter>).

CF : cystic fibrosis patient

CC : chronic colonization

* Amoureux *et al.*, 2016 (10)

**Barrado *et al.*, 2013 (9)