



JOINT NOTIFICATION SUMMARY

Prolonged multi-country outbreak of *Salmonella* Strathcona ST2559 possibly linked to consumption of tomatoes

Working document, restricted distribution, 4 July 2024

Disclaimer: *The Joint ECDC-EFSA Notification Summary (JNS) is a joint document aiming at informing public health and food safety authorities of a cross-border foodborne threat to health by collating the information extracted from the RASFF (Rapid Alert System for Food and Feed) and the EpiPulse (European surveillance portal for infectious diseases) or reported directly by public health institutes to ECDC. EFSA and ECDC may not be held liable for errors, inaccuracies or inconsistencies with regard to information extracted from RASFF and EpiPulse. This document shall not be further shared outside the respective authorities or published. Maps and figures depicted in this JNS do not represent a statement on the part of ECDC, EFSA or its partners on the legal or border status of the countries and territories shown.*

Event background

On 27 October 2023, Germany reported to the European Centre for Disease Prevention and Control (ECDC) 46 cases with *Salmonella* Strathcona ST2559 infection since August 2023 (event ID 2023-FWD-00090 in EpiPulse, the European surveillance portal for infectious diseases). Of these cases, 28 were confirmed by whole genome sequencing (WGS). The cases occurred across multiple federal states in Germany. All age groups were affected with a median age of 35 and cases were equally distributed between genders. This was a re-emergence of the *S.* Strathcona ST2559 strain, which was previously reported causing outbreaks in Germany in 2022 (n=22), 2020 (linked to an outbreak reported by Denmark in 2020, see below), and 2019 (n=7).

On the same day of the alert, Austria, Denmark, France, and Norway reported cases with genetically close *S.* Strathcona ST2559 isolates confirming an ongoing multi-country outbreak. Since then, cases have been identified in at least 10 countries in the European Union/European Economic Area (EU/EEA) and recent cases reported in Germany in 2024. In 2024, the RASFF News 2024.0384 was issued by the food safety authority in Austria, linked to the Epi-Pulse event 2023-FWD-00090.

In the past, this *S.* Strathcona ST2559 strain has caused multi-country outbreaks as was notified by Denmark in 2011 (event ID in EpiPulse 2011-FWD-00034 and RASFF 2011.1630) and in 2020, event ID 2020-FWD-00032 opened by Denmark. Based on case interviews and related national investigations, suspected vehicles in 2011 outbreak were tomatoes.

Due to a long-term and ongoing risk of infections with this *S.* Strathcona strain in multiple EU/EEA countries and a possible common source in the food chain, ECDC and EFSA agreed to produce a Joint Notification Summary (JNS) for risk managers to take informative decisions and trigger further public health and food safety investigations.

Outbreak strain characterisation

Salmonella enterica serovar Strathcona

- 7-gene sequence type (ST) 2559
- SeqSphere complex type CT3910 (Enterobase scheme in SeqSphere+)
- Enterobase hierarchical cluster HC5_26490

A representative German strain is available in Enterobase: 23-05042 (SAL_ED2423AA_AS)

A representative historical Danish strain from 2020 is available in ENA with a code ERR4344279 OR in Enterobase with a code 2006F11891.

European outbreak case definition

The European outbreak case definition is as follows:

A confirmed outbreak case:

A laboratory-confirmed *Salmonella* Strathcona case with symptom onset on or after 1 July 2023 (date of sampling or date of receipt by the reference laboratory if date of onset is not available).

AND

Fulfilling at least one of the following laboratory criteria: a *S. Strathcona* ST2559 isolate by:

- the national cgMLST pipeline within seven cg-allelic differences (AD) from the representative German outbreak strain, OR
- clustering within seven cg-allelic differences in a centralised single-linkage analysis, OR
- belonging to the hierarchical HC5_26490 cluster (Enterobase scheme)

OR

Fulfilling the epidemiological criterion:

- Epidemiologically linked to a confirmed case based on a national outbreak case definition.

A historical outbreak case:

A laboratory-confirmed *S. Strathcona* case with symptom onset before 1 July 2023 (date of sampling or date of receipt by the reference laboratory if date of onset is not available).

AND

Fulfilling at least one of the following laboratory criteria: a *S. Strathcona* ST2559 isolate by:

- the national cgMLST pipeline within seven cg-allelic differences (AD) from the representative German outbreak strain, OR
- clustering within seven cg-allelic differences in a centralised single-linkage analysis, OR
- belonging to the hierarchical HC5_26490 cluster (Enterobase scheme)

OR

Fulfilling the epidemiological criterion:

- Epidemiologically linked to a confirmed case based on a national outbreak case definition.

A confirmed 3AD-cluster of *S. Strathcona* ST2559

A *S. Strathcona* ST2559 isolate within three ADs to the German reference strain SAL_ED2423AA_AS (Enterobase scheme) in a centralised WGS single-linkage clustering analysis (ECDC-EFSA One Health WGS)

AND

Cases reported in more than one country.

The stricter laboratory criterion of three ADs is used since the majority of cases reported in 2023-24 fall into this cluster.

Epidemiological and microbiological investigations of human cases

Since 1 July 2023 and as of 25 June 2024, 174 confirmed cases of *S. Strathcona* ST2559 have been reported by 14 EU/EEA countries (Table 1). Available information on gender distribution shows significant difference with more females than males reported ($p < 0.01$, chi-square) and a female-to-male ratio of 1:1.6. Travel history was known for 34/42 cases with three countries most frequently visited; Italy (14), Croatia (9), and Montenegro (5) (Table 1). Two cases had visited more than one country before illness (one to Italy, Tunisia, and Spain, and another one to Croatia and Montenegro). Age of cases ranges from babies to elderly person, covering all age groups (Table 1).

In addition, five confirmed cases have been reported in **Canada** from September 2022 to May 2023. Four of the five Canadian cases had a travel history to Europe (Italy, Austria, Netherlands).

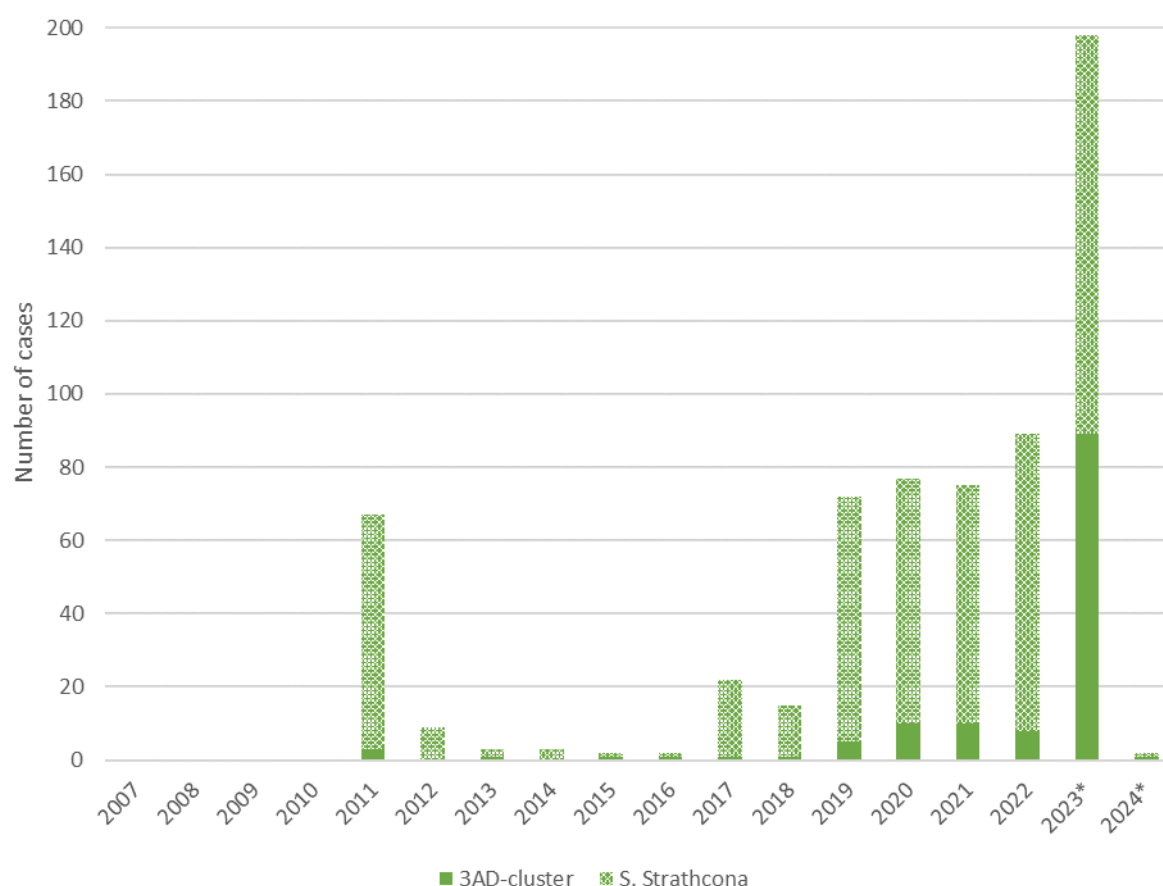
S. Strathcona is a rare serotype in the EU/EEA and it was first reported in 2011 when the first multi-country outbreak was identified (Figure 1). The preliminary data for 2023 indicates more than doubling of cases from 2022 (Figure 1). The 3AD-cluster of *S. Strathcona* spans from 2011 to 2023 (Figure 1).

Table 1. Confirmed *S. Strathcona* ST2559 cases by age, gender, and age range in 14 EU/EEA countries (n=174), 1 January 2023 – 25 June 2024

Country	No of confirmed cases	Male	Female	Age range (years)	Travel history prior to illness
Austria	24	8	16	14-77	Travel histories to Montenegro (2); Italy (1); and Croatia (1). For one case the country could not be determined.
Croatia	3	0	3	3 - 54	
Czechia	9	5	4	3 - 46	Travel history to Croatia (1)
Denmark	5	4	1	18 - 67	Travel histories to Italy (1) and Montenegro (1).
Germany	58	25	33	1 - 88	Travel histories to Croatia (n=8); Italy (n=6); Montenegro (n=3); Austria (n=1); and Egypt (n=1).
Finland	3	1	2		Travel history to Georgia (1)
France	24	8	16	0 - 82	Travel histories to Italy (5); Spain, Tunisia, and Italy (1); and Montenegro and Croatia (1).
Ireland	1	0	1	45 - 50	
Italy	34*	6	16	0-86	Six cases with travel history
Luxembourg	1	1	0	> 60	
Netherlands	2	0	2	26 - 37	Travel history unknown
Norway	1	0	1	60 - 70	Travel history unknown
Slovakia	4	1	3	2 - 74	
Sweden	5	3	2	5 - 85	One case had been to northern Italy (Lake Garda) three weeks prior to disease onset
Total	174*	62	100		

*Age and gender information not available for 12 cases.

Figure 1. Reported *S. Strathcona* cases (n=636) and among them, the distribution of human *S. Strathcona* ST2559 outbreak isolates of the 3AD-cluster by year (n=131), 2007-2024, as of 25 June 2024



*Preliminary data for 2023-24.

Sources for 2007-2022 data reported to TESSy¹: Austria, Belgium, Croatia, Czechia, Denmark, Germany, France, Italy, Luxembourg, Malta, the Netherlands, Norway, Slovakia, Slovenia, Spain, and Sweden

Austria has reported 24 outbreak cases by the end of December 2023. National outbreak investigation identified imported organic cherry tomatoes from one supermarket chain as suspected vehicle of infection. One of the outbreak cases who fell ill in November 2023, was still excreting *S. Strathcona* as of 30 April 2024. This individual operates a laying hen farm, sells eggs, and produces pasta.

In **Croatia**, three cases were reported in 2023. Two cases are children with diarrhoea reported in September and one is an adult female, an asymptomatic case, with isolation in November.

Czechia has reported 20 cases of *S. Strathcona* since 1 August 2023. Isolates from 13 cases were sequenced and nine of them matched the HC5_26490 cluster.

Denmark has reported five cases of *S. Strathcona*, four male and one female. Cases were reported between September and December 2023. Age range is 18 – 67 years. Two cases reported travel before illness; one to Italy and one to Montenegro. Three cases reported no travel. This outbreak is related to the historical event (ID 2020-

¹ TESSy = The European Surveillance System

FWD-00032), reported by Denmark with 27 cases recorded in 2020. In this outbreak, suspected vehicles were snack-tomatoes. Denmark noticed a smaller cluster of seven cases in 2022. A bigger outbreak occurred in 2011.

Germany has reported 58 outbreak cases since the beginning of August 2023 (median age 35 years; range 1-88 years; IQR 18-52 years; 33 female and 25 male). For 42 cases, the following information regarding the possible place of exposure is available: 23 cases with exposure in Germany, eight in Croatia; six in Italy; three in Montenegro; one in Austria and one in Egypt. Of the 58 cases, most occurred between August and November in 2023 (n=55). In February 2024, three cases were diagnosed: one of these was an asymptomatic case. Twenty-four isolates cluster together with 0 AD, further 12 samples show a distance of 1AD, a smaller second node out of seven isolates (with two 1 AD satellite isolates) is 2 AD from the main node, further six isolates show more than 4 AD distance. The maximum pairwise distance within the cluster is 10 AD (Enterobase cgMLST scheme in SeqSphere+). Isolates from 2023 are closely related to a reference sequence from Denmark from 2020-FWD-00032 (3 AD).

Finland has reported three cases with matching *S. Strathcona* isolates (3-5 AD) from September 2023; one male with unknown travel history, one female with domestically acquired infection and one female with travel history to Georgia.

France has reported 24 cases of *S. Strathcona*, of which 22 were diagnosed from the end of August and December 2023 (median age 21 years; range <1-82 years; 16 female and 8 male). For 15 cases, the following information regarding the possible place of exposure is available: eight cases with exposure in France, five in Italy; one single case reports a history of travel to Spain, Tunisia and Italy before the onset of symptoms, and one other case reports a history of travel to Montenegro and Croatia before the onset of symptoms. The genomes of all cases are at 2-4 AD to the reference strain, and belong to HC5_26490 by the Enterobase scheme.

Ireland has reported one case from January 2024, a female between 45 and 50 years with no known travel history. Two historical cases have been reported; one from 2021 and one from 2020.

Italy has reported 62 cases of *S. Strathcona* in 2023 - 30 female and 19 male (13 with unknown gender). Age distribution is 0-88 years. More than 90% of isolates showed sampling week between 24/07/2023 and 11/12/2023. Of 62 cases, one isolate is available in Enterobase with a code SAL00719 and it is from an 8-month-old child. In 2024, two human cases are reported: one case is a two-year-old child and another case is a young teenager (13 years old). Sequencing data of 38 *S. Strathcona* human isolates from 2023, are currently available; 34 isolates cluster within 7AD with the representative German strain, and four isolates show >7AD from German strain.

Luxembourg has reported one case of *S. Strathcona* in 2023 matching the representative German isolate (1 AD). The case is a male over 60 years with sampling date at end of September 2023. He did not report travelling before illness. Four historical cases have been reported; one case (3 AD) in 2022 and three cases (2-3 AD) in 2021.

The Netherlands has reported two female cases (4 AD and 7 AD) between 26-36 years of age from September 2022 and January 2024, respectively, with unknown travel history.

Norway has reported one case (0 AD) with sampling date in September 2023 and travel history unknown. *S. Strathcona* was isolated from faeces and blood. In addition, there are three historical cases (≤ 2 AD) with sampling dates in 2019-2021. Two of these had travel history to Italy and one travel history to Denmark.

In **Slovakia**, four cases were identified in 2023 (one each in May, September, October and November) with isolates matching the German representative outbreak strain. The cases reported no travel history.

Sweden has reported five cases of *S. Strathcona* with disease onsets in August-December 2023. All five cases are reported as domestically infected but one of them had been to northern Italy (Lake Garda) three weeks prior to disease onset. There is also a historical Swedish case with a clustering isolate and disease onset in September 2021. This case is reported as infected in Italy and fell ill while being in Sicily.

Information from patient interviews

In **Austria**, the first round of 14 case interviews revealed that 13/14 cases reported shopping at the same supermarket chain and eating small tomatoes (preferably with the vine). One case had received a food donation via a humanitarian organisation from the supermarket chain mentioned by the other cases. During the second round of interviews, all twelve cases mentioned the same packaging style preference for tomatoes (cardboard tray wrapped in plastic) indicating a foreign source as well as a purchasing preference for organic tomato products, while nine out of 12 cases mentioned that they purchase tomato products from countries outside of Austria and nine out of 12 cases mentioned purchasing and eating the "organic cherry tomatoes" specifically. In total, five out of 24 cases reported travel outside of Austria prior to illness and were not interviewed regarding consumption habits. In total, another five cases were never reached for an interview.

In **Czechia**, one case was interviewed. The case reported consumption of a ground beef hamburger, chicken meat, ham, pâté, scrambled eggs, ice cream, tomatoes, melons, apples, and chocolate products during a vacation in Croatia on Vis Island.

In **Denmark**, interviews of three cases with sample dates in 2023 showed that two cases had been travelling prior to disease onset, one to Montenegro and another one to Italy – both had consumed tomatoes there. One domestic case with sample date in December 2023 did not report eating tomatoes. Interviews were not available for the last two cases, but they were both reported as domestic cases.

In **Germany**, 26 cases were interviewed. Of these, 24 interviews were used for further analysis. The following food items were often mentioned: tomatoes (21/24) [large tomatoes (16/24); small tomatoes (14/24)]; eggs (17/24), cucumbers (16/23), apples (16/23), gouda cheese (15/23); leaf lettuce or leafy vegetables (15/23); iceberg lettuce (14/24); salami (12/21); pepper (13/23). A large proportion of the interviewed cases travelled in the three days before symptom onset: 8x to Croatia; 3x Italy; 3x Montenegro; 2x within Germany and 1x Egypt. Also eating out in a restaurant (19/24) or in a bakery (15/24) was often mentioned.

In **France**, case interviews were possible for 13 out of 24 cases (54%). All reported eating chicken, 10 reported eating cherry tomatoes, nine reported eating salad, and nine reported eating eggs.

In **Italy**, the case interview questionnaires are available for 21/61 cases (35%), of which six cases reported travel before illness. The following consumption habits were reported: 10 cases confirmed consuming meat, 10 cooked eggs and 12 raw vegetables. Of 12 consuming raw vegetables, seven referred to consumption of tomatoes and three salads. The analysis of data from questionnaires was difficult because there was not a standardized questionnaire administered to cases.

In **Luxembourg**, the case reported eating lots of vegetables from various sources, including homegrown, and bought from a market.

Historical outbreaks of *S. Strathcona* in 2011 (ID 2011-FWD-00034) and 2020 (ID 2020-FWD-00032)

On 27 September 2011, Denmark reported the first registered outbreak of *S. Strathcona* in EPIS platform (now called EpiPulse) (ID 2011-FWD-00034). The outbreak eventually included a total of 43 culture confirmed cases registered in the Danish National Laboratory Surveillance System. The cases, 26 females and 17 males, comprised children and grown-ups from all over the country. The first patient became ill on 4 September, and the last on 26 October 2011. During the same period, 17 cases of *S. Strathcona* were reported in Germany, one in Austria, two in Italy (the second case was reported to EU level through EWRSⁱ) and one case in Belgium. Small, elongated tomatoes of the type 'datterino', imported from Sicily, were found in the epidemiological investigation to be the source of the infections in Denmark, based on descriptive, analytical epidemiology and trace back investigations [1]. Intensified testing of tomatoes in countries and investigations in Sicily were carried out by the food safety authority in Italy but no isolations of *S. Strathcona* from tomatoes were detected and reported.

On 20 July 2020, Denmark notified a re-emergence of the same *S. Strathcona* strain. In total, 26 cases were reported in May-August 2020 (ID 2020-FWD-00034). Following this alert, cases were reported also in Belgium (1), Czechia (4), Ireland (1), Italy (16; cases isolated in 2019 and associated to an outbreak that occurred following the consumption of roast beef and roasted chicken at a restaurant), and Luxembourg (two cases in 2021, of which one had travel history to Sicily prior to illness). Several countries reported sporadic historical cases before 2020.

Microbiological and environmental investigations of food

This section summaries the results of the food investigations performed by the food safety authority in Austria and by the food safety authority in Italy in support to the national outbreak investigation in Austria. Specifically, traceability investigations on organic cherry tomatoes and the analytical results on irrigation water samples were shared by the Member States under the RASFF News 2024.0384 (10 follow-up, *fup*, as of 21 May 2024).

Austria

On 18 January 2024, the food safety authority in Austria opened a RASFF News (2024.0384) to request the assistance of the food safety authority in Italy due to a *Salmonella* Strathcona national outbreak under investigation that occurred in 2023. Indeed, based on the food exposure information from one single case, cherry tomatoes from Italy were suspected as vehicle of infections in the national outbreak. The food safety authority also informed that there was no microbiological analysis of the suspected tomatoes. Specifically, the case reported consumption of the organic cherry tomatoes Product A Batch A. The food safety authority linked the organic cherry tomatoes to the Italian Supplier A (traceability record not available from RASFF). The product was marked with a packing date of November 2023 and it was traced back to the Austrian Wholesaler A that received the product on 22 November 2023 (*fup1*, 2024.0384). The Austrian Wholesaler A distributed Product A Batch A on 23 and 24 November 2023 to the warehouse of the Austrian Retailer A.

The food safety authority identified a similar product of bio cherry tomatoes Product B Batch B, which was delivered on 20 November 2023 to Austrian Wholesaler A by the Italian Supplier A (traceability record available in RASFF) (*fup1*).

Italy

Soon after the request of collaboration, the food safety authority in Italy carried out an official control at the Italian Supplier A that had delivered Product B Batch B to Austria. The food safety authority informed that the Italian Supplier A received tomatoes from the primary producer Italian Producer A.

During the official inspection conducted at the Italian Producer A, the food safety authority reported to have not identified critical issues since the producer had and update organic certification and all the hygiene procedures in place, including the microbiological monitoring of water used for the vegetable cultivation. Microbiological analysis carried out on 17 February 2023 showed that fecal Streptococci, *E. coli*, and total coliforms tested less than 3 MPN/100 ml of water sample, and that total viable microorganisms (22°C and 36°C) tested less than 1 UFC/ml. In addition, the authority asked the Italian Producer A to perform a microbiological testing of the water used for the irrigation, and on 26 January 2024 no *Salmonella* sp. was detected from the tested samples of potable water, fecal Streptococci, *E. coli*, and *Clostridium perfringens* tested less than 1 UFC/100 ml; total coliforms tested 51 UFC/100 ml; and total viable microorganisms (22°C) tested at 1300 UFC/ml (*fup4*, 2024.0384).

At the Italian Producer A the automatic irrigation system is not hydroponic and the water drips directly onto the roots of the plant without contact with the fruits (*fup8*, 2024.0384).

On 20 and 21 November 2023, the Italian Supplier A distributed organic cherry tomatoes (other batches) within Italy and to Slovakia (at the Retailer via de the Italian Wholesaler B and the German Wholesaler C with cherry tomatoes harvested by the Italian Producer B).

On 5, 7, 10, and 12 February 2024, the Italian Supplier A distributed organic cherry tomatoes (other batches) within Italy, and to Poland and Germany (*fup4*, *fup6*, *fup9*, 2024.0384).

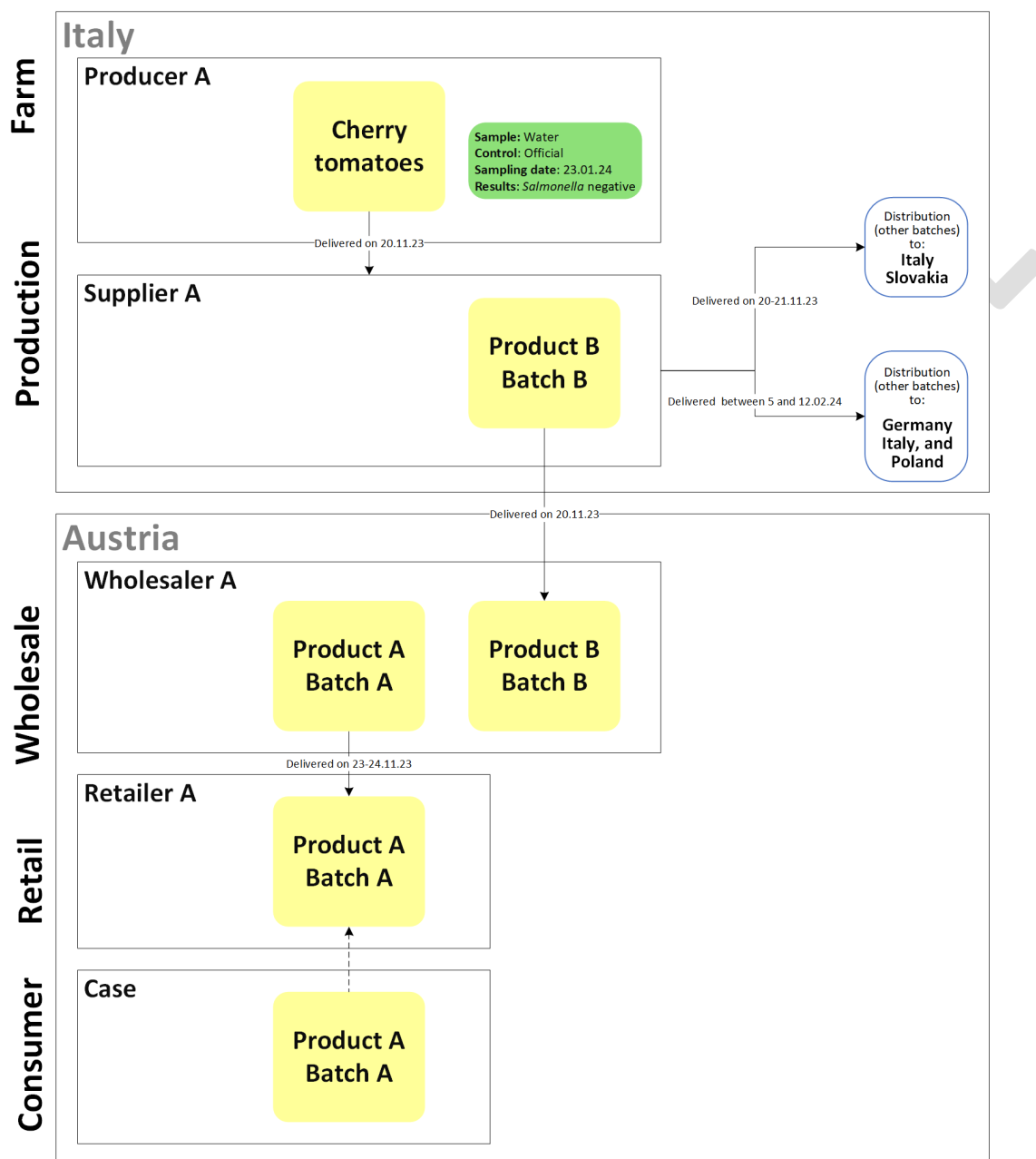
With regards to the historical outbreak investigated in Denmark in 2011, the food safety authority clarified that there was no epidemiological link between the supplier (Italian Supplier A) of organic cherry tomatoes under investigation in the 2023 Austrian outbreak and the supplier (the Italian Supplier B) of tomatoes investigated during 2011 outbreak in Denmark (RASFF 2011.1630) (*fup8*, 2024.0384).

Finally, the food safety authority informed in RASFF that a *Salmonella* Strathcona ST2559 matching isolate was collected from a surface river water sample (collected on 20 September 2023 in Northern Italy) (one isolate). The national investigation revealed that environmental isolate differs from reference strain by 5AD (cgMLST analysis by *Salmonella* INNUENDO, scheme 3,255 loci). There was another environmental isolate of *Salmonella* Strathcona collected in January 2023 from a region different from the previously mentioned area (*fup7*, 2024.0384) but the isolate was not available.

Germany

On 25 January 2023, the food safety authority in Germany informed in RASFF that organic cherry tomatoes (other batches) from the Italian Supplier were distributed to the Slovakian Retailer B by the German Wholesaler C and without handling of the goods (*fup3*, 2024.0384).

Figure 2. Graphical representation of the traceability of the suspected organic cherry tomatoes as reported by the involved countries under the RASFF News 2024.0384 (*fup10* as of 21 May 2024)



European whole genome sequencing analysis of human and non-human isolates

WGS data collection, cross-sectoral WGS analysis and results

The whole genome sequencing (WGS) data for representative isolates from humans were shared by countries in EpiPulse either as attached FASTA files, uploaded to the ECDC WGS database or as referrals to accession numbers to public repositories.

Regarding the sequences of the non-human isolates, on 21 May 2024, EFSA launched a call for data, inviting Member States to submit to the EFSA One Health WGS System genomic information of *S. Strathcona* ST2559. By 30 May 2024, a total of seven sequences of *Salmonella* Strathcona non-human isolates had been shared in the EFSA One Health WGS system by two EU countries (Italy=5; Germany=2). Five countries (Denmark, Estonia, Finland, France, and Netherlands) replied to not have *S. Strathcona* non-human isolates.

Of the seven, three isolates derived from two environmental samples collected in 2012 and 2018 (sludge, Germany), and one collected in 2023 (river water, Italy); two isolates derived from animal samples collected in 2022 (wild-boar organ, Italy), in 2023 (bovine feces, Italy); and two isolates derived from food samples collected in 2020 and 2023 (bivalve mollusks, Italy).

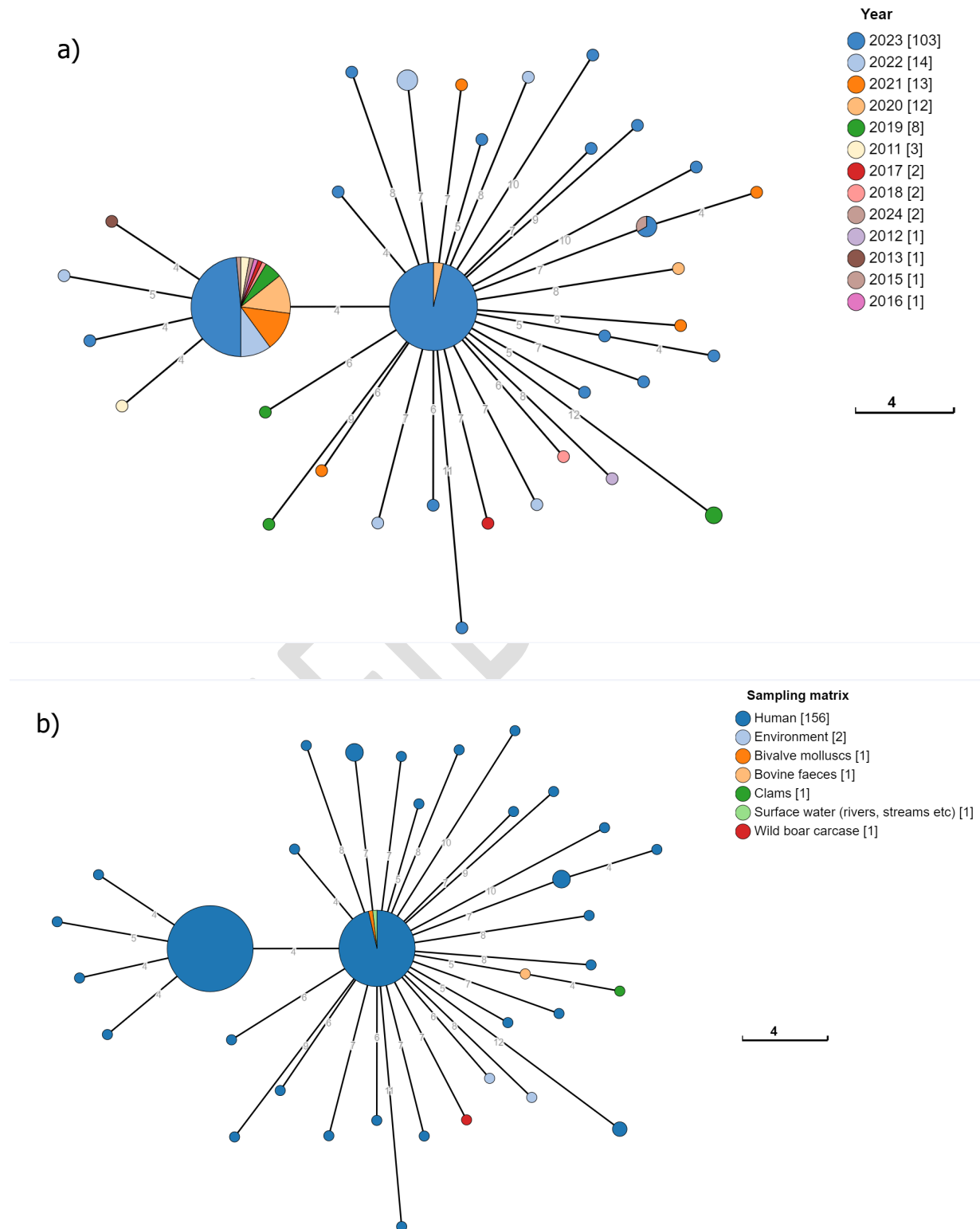
For cross-sectoral analysis, the cgMLST analysis was performed at both ECDC and EFSA, as previously described [2]. Briefly, genome profiles were calculated from assembled genomes using chewBBACA version 2.8.5 (<https://github.com/B-UMMI/chewBBACA>) using the schema described by Rossi et al. 2018 [3] for *Salmonella enterica*, made available by chewie Nomenclature Server [4]. Isolates with more than 10% of missing loci (325 from a total of 3 255 loci) were excluded from the analysis.

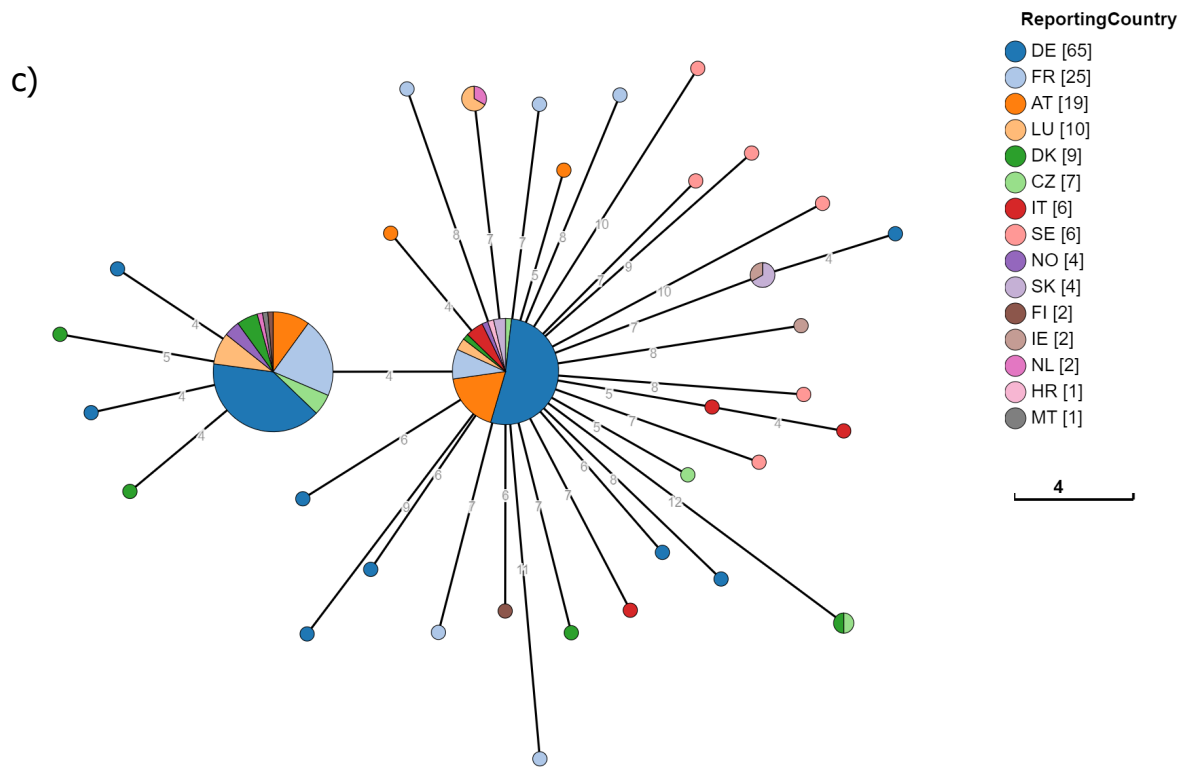
ECDC queried EFSA One Health WGS System on 26 June 2024 using the entire cluster of 156 *Salmonella* Strathcona as reference genomes and 10 ADs as threshold. As a result of the query, seven submitted profiles of *Salmonella* Strathcona non-human isolates clustered within seven ADs in a single-linkage cluster analysis with the human isolates, giving a total of 163 *Salmonella* Strathcona isolates in the joint dataset.

The minimum spanning trees (MSTs) of all 163 isolates are presented in Figure 3 a), b), and c) for year, sample matrix and reporting country, respectively. To make the interpretation of figures easier, single isolates within 3 AD have been collapsed. The cgMLST analysis showed low allelic diversity within core genes over 13 years, predominance of human isolates, and large geographical distribution to 15 EU/EEA countries (Figure 3).

The 3 AD-cluster involves 136 *S. Strathcona* isolates, of which 131 are human isolates from 14 EU/EEA countries between years 2011 and 2024. The five non-human isolates are from samples of environment (sludge, DE, 2018), surface water (river water, IT, 2023), bovine feces (IT, 2023), and two from seafood (IT, 2020 and 2023) (Figure 4).

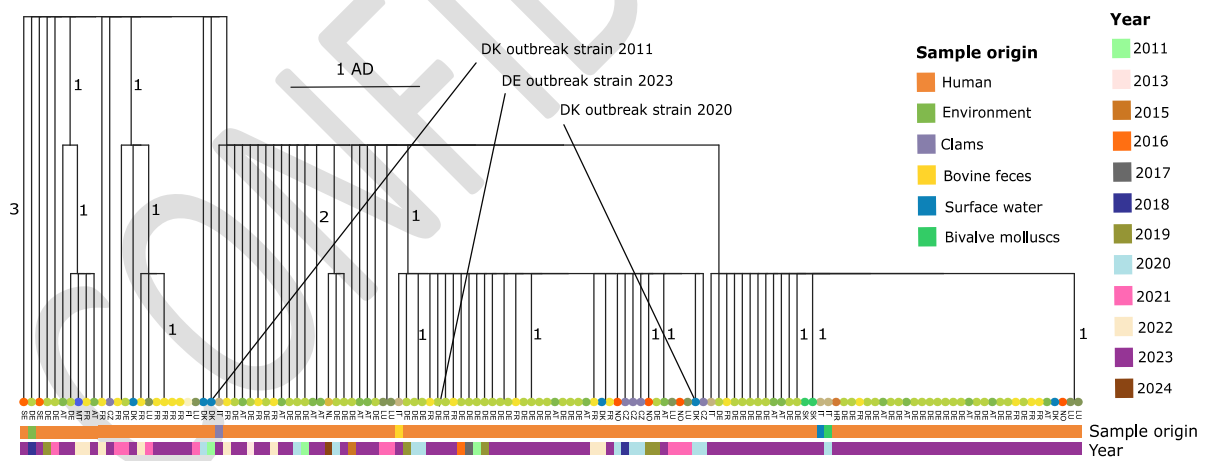
Figure 3. Minimum spanning tree* of 163 *S. Strathcona* ST2559 isolates including human (n=156), food (n=2), animal (n=2), and environmental (n=3) isolates from 14 EU/EEA countries by a) year, b) sampling matrix, and c) reporting country, 2011 – 26 June 2024





* Branches smaller or equal to 3 AD were collapsed

Figure 4. Single-linkage tree of 136 *S. Strathcona* isolates within 3 AD (131 human, two food, and three environmental isolates) in 14 EU/EEA countries, 2011 – 26 June 2024



ECDC and EFSA risk assessment for the EU/EEA

Since 1 July 2023 and as of 10 June 2024, 174 confirmed cases of *S. Strathcona* ST2559 have been identified in 14 EU/EEA countries; Austria (24), Croatia (3), Czechia (9), Denmark (5), Germany (58), Finland (3), France (24), Ireland (1), Italy (34), Luxembourg (1), the Netherlands (2), Norway (1), Slovakia (4), and Sweden (5). Among 162 cases with age and gender data available, females are more frequently reported than males ($p < 0.01$).

Available information from patient interviews from Austria, Czechia, Denmark, Germany and France revealed that 47/55 (85.5%) reported consumption of tomatoes and 40/55 (72.7%) mentioned small or cherry tomatoes specifically.

The outbreak strain has been circulating in the EU/EEA since 2011, when a large multi-country outbreak was reported [1]. Before 2011, the serotype of *S. Strathcona* had not been reported in the EU/EEA countries, suggesting that it entered the EU/EEA in 2011.

Following the national investigation and the food exposure information from one case among the 14 cases interviewed in Austria (Product A from the Austrian Wholesaler A), the food safety authority in Austria linked the national outbreak to the Italian Supplier A (traceability documentation not available). The subsequent investigation in Italy identified the Italian Producer A as one of the cherry tomatoes' providers of the Italian Supplier A. The official controls performed by the food safety authority in Italy (including the review of the 2023 hygiene and microbiological procedures and the additional microbiological testing of the irrigation water carried out at the Producer A in January 2024) revealed no critical issues and no *Salmonella* detection.

Cherry tomatoes from the Italian producer were considered the suspected vehicle of the infections in the national outbreak in Austria. The available epidemiological and microbiological data do not allow to hypothesize this producer as the source of infection for all the cases reported to be associated to this multi-country outbreak.

The previous cross-border outbreak strain detected in Denmark in 2011 is genetically close to this outbreak strain. In the 2011 outbreak, *S. Strathcona* was epidemiologically linked to tomatoes imported in Denmark from Italy. The national food traceability investigation carried out in 2024 by the food safety authority in Italy indicated no common cherry tomatoes producer between the 2011 and 2024 events. Therefore, the common facts between the historical Danish outbreak in 2011 and the Austrian outbreak in 2023 are the hypothesis of small tomatoes as vehicle of infection and the trace back of suspected tomatoes to the same region in Italy.

The comparison of the outbreak strains with the *S. Strathcona* isolates with matching genome profiles from animals (bovine feces), seafood (clams), and the environment (sludge and river water) (share done by Italy and Germany) suggests a wide spread of the outbreak strain in the animal population and in the environment, opening up a possibility for multi-source transmissions in connection to this outbreak.

The wide spread of *S. Strathcona* is also supported by a *S. Strathcona* detection from a wild deer sample (genomic profile not available) reported from Italy to EFSA zoonoses database in 2022 and by the occurrence of previous weak-evidence outbreaks linked to various food matrices (e.g. meat, dairy, and vegetables).

Salmonella contamination and survival in pre-harvest tomato production has been thoroughly investigated in the US in 2018 [5]. The study showed that prevalence of *Salmonella* in irrigation water from ponds had temporal differences by weeks and months over years, likely influenced by environmental factors such as temperature and run offs into the water source. The highest populations of *Salmonella* in the irrigation water ponds were detected in August and September [5].

Further investigations from the human and food sectors are needed to verify the hypothesis of organic cherry tomatoes as vehicle of the infections in the EU countries reporting cases in this multi-country outbreak, recognizing that other food types may also be involved in the transmission. Upon verification of the food hypothesis, food investigations are needed to identify the point of contamination with *Salmonella* in order to implement proper corrective measures and prevent a new seasonal wave of infections in the summer-autumn 2024.

Recommendations

Countries with historical outbreaks and national increases are encouraged to be prepared for a possible new wave of *S. Strathcona* infections starting during the summer-autumn.

Should new cases be identified, interviews of cases are recommended considering particularly the hypothesis of organic small tomatoes as a likely vehicle of infection. Simultaneously, isolates of *S. Strathcona* should be sequenced if possible. ECDC can offer sequencing support to countries with limited or no capacity for it.

Public health authorities are encouraged to work closely with the food safety authorities to foster rapid sampling and testing of suspected food items. Countries are invited to update the EpiPulse event 2023-FWD-00090 should new cases be reported.

Countries are invited to share the sequence of the *S. Strathcona* ST2559 food isolates linked to the present cluster either microbiologically (serotype or ST) or epidemiologically (e.g. suspected food items reported by human cases), to share in RASFF the traceability information related to those sequences, and to submit genomic data of *S. Strathcona* ST2559 isolates from any kind of food, feed, animal and related environment to the EFSA One Health WGS System.

Source and date of request

ECDC sent a request to EFSA on 15 May 2024 to produce a Joint Notification Summary (JNS). EFSA accepted the request on 17 May 2024.

Disease background

Surveillance of *Salmonella* Strathcona infections in the EU/EEA

Salmonellosis (non-typhoidal) is a notifiable disease in the EU. *S. Strathcona* is a rare serotype and in the EU/EEA countries, 436 cases of *S. Strathcona* have been reported between 2011 and 2022, with a notable increase of cases since 2019 (Figure 1). Majority of cases were attributed to Italy (42.0%) followed by Germany and Denmark with 19.3% and 19.0% of reported cases respectively. In 2022, 89 cases were reported by 12 EU/EEA countries.

Reporting of *S. Strathcona* follows strong seasonality with all cases reported over the years between July and December peaking in August-September (Figure 2). The cumulative monthly peaks in Denmark and Germany were in October, followed by a monthly peak in Italy in September (Figure 2). The reporting months are based on dates of statistics and there may be some delay between the true occurrence and reporting of cases. Of 212 cases, 26 (12.3%) were reported with travel history before illness and for 14 cases (53.9%), Italy was reported as probably country of infection.

Despite slightly more females than males reported, there were no statistically significant differences by gender in the age groups except for the age group 0-4 years, where female cases were more frequent than male (40 versus 20, $p < 0.01$) (Figure 3). No deaths due to or with *S. Strathcona* infection were reported in 2011-2022. Of 329 cases with available information, samples were positive from faeces (89.1%), blood (7.3%), urine (2.7%), and "other" sample (0.9%).

Figure 1. Number of *S. Strathcona* cases by year and country, EU/EEA countries (n=436), 2011-2022, as of 20 May 2024

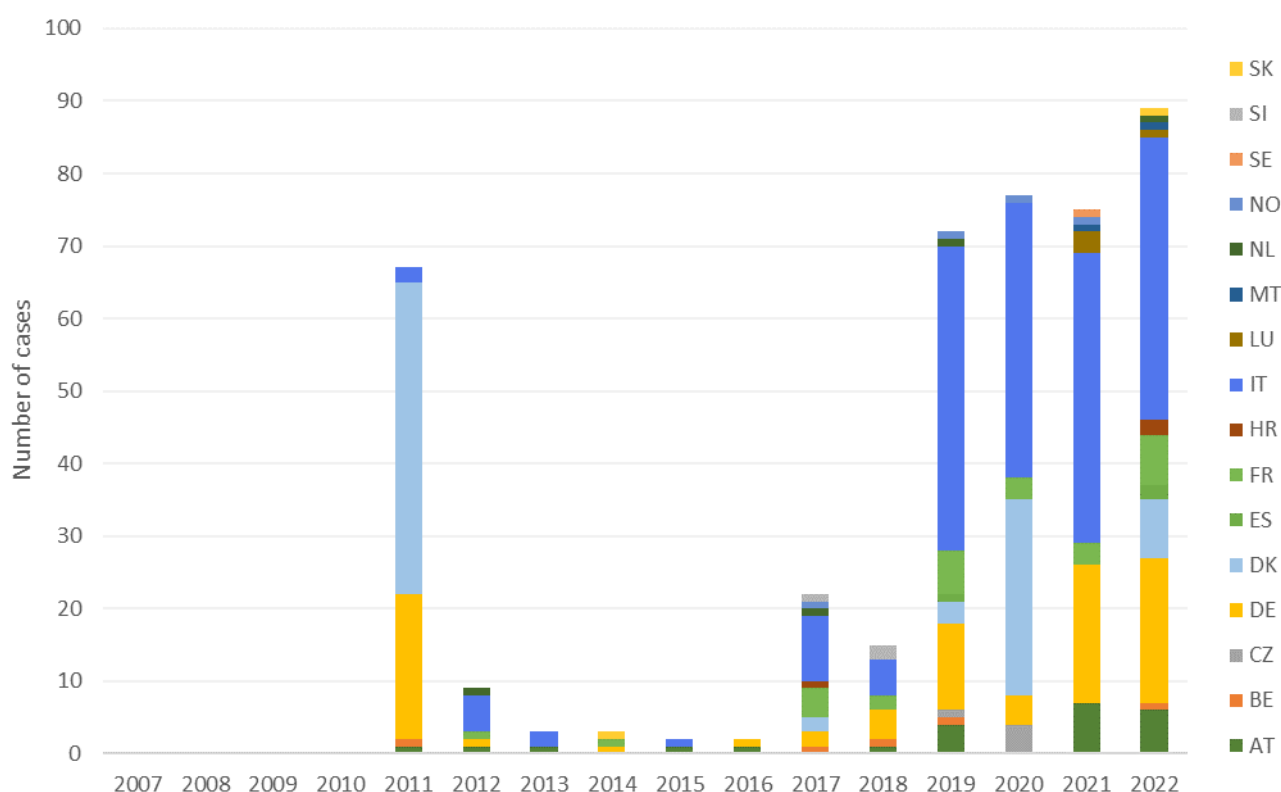
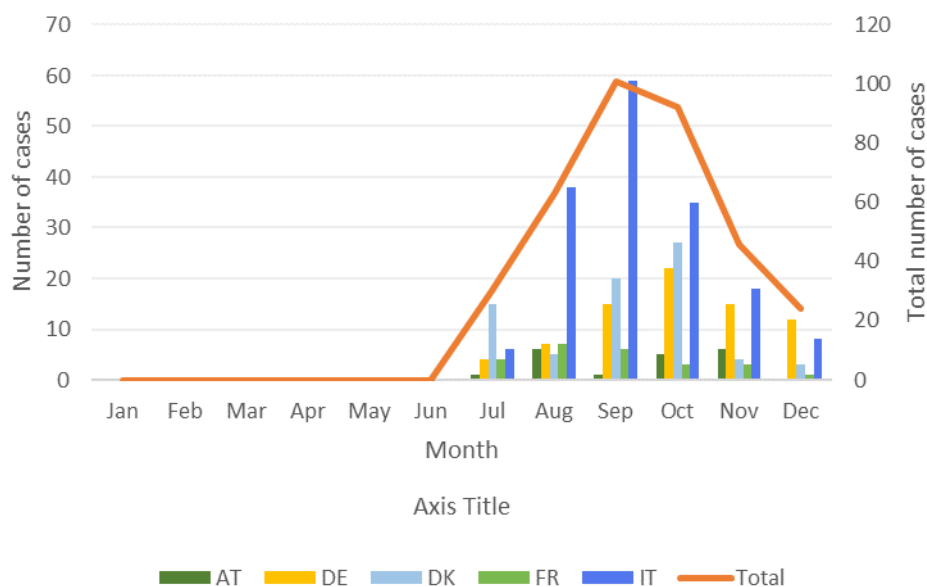
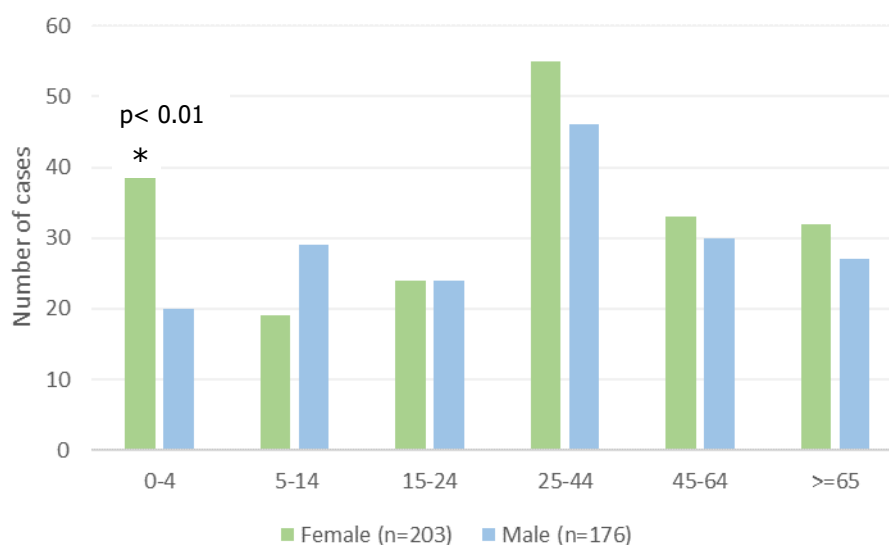


Figure 2. Pooled number of *S. Strathcona* cases in EU/EEA selected countries* by month (n=400), 2011-2022, as of 20 May 2024



*Countries with total number of cases ≥ 10 reported in years 2011-2022

Figure 3. Number of *S. Strathcona* cases by age group and gender (n=379), EU/EEA countries, 2011-2022, as of 20 May 2024



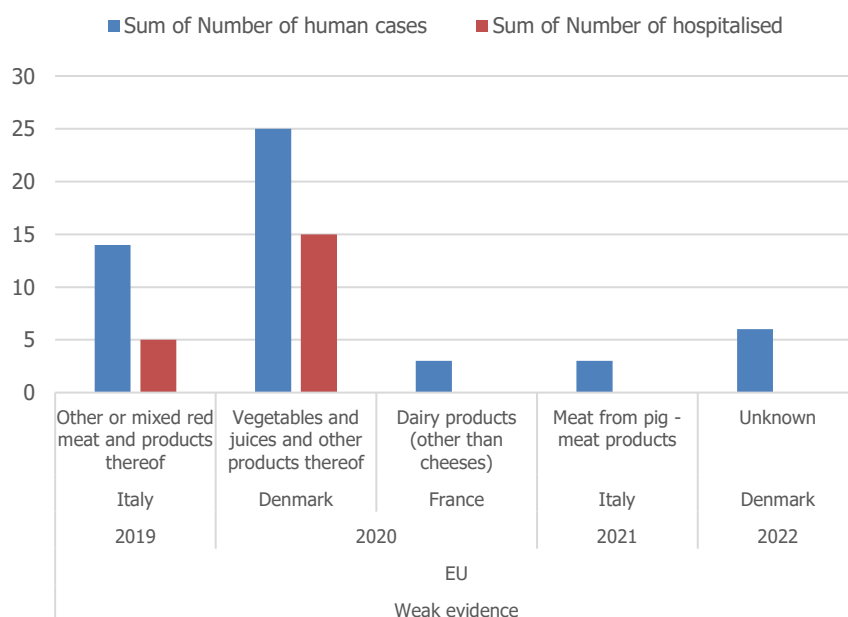
Further information on salmonellosis in the EU/EEA can be found in ECDC's Annual epidemiological report [6] and the online *Surveillance atlas of infectious diseases* [7].

Food-borne outbreaks caused by *S. Strathcona*

This section summarises country-specific data on food-borne outbreaks associated with *S. Strathcona*, as reported to EFSA by the EU countries in accordance with the Zoonoses Directive 2003/99/EC.

Overall, five weak evidence foodborne outbreaks caused by *S. Strathcona* were reported, with 51 human cases, 20 hospitalizations, and no deaths. The outbreaks were reported by three EU Member States, namely, Denmark (n=2), France (n=1), and Italy (n=2). The reported food vehicles were 'Foods of non-animal origin', 'Milk and milk products', and 'Meat and meat products' (Figure 4).

Figure 4. Overall distribution of the five reported foodborne outbreaks (all years) caused by *S. Strathcona*,



Blue bars represent the total number of human cases reported in each outbreak; red bars represent the number of hospitalizations out of the number of human cases reported in each outbreak.

Occurrence of *S. Strathcona* in food

This section summarises country-specific data on the occurrence of *S. Strathcona* for all matrices, as reported to EFSA by the EU countries in accordance with the Zoonoses Directive 2003/99/EC.

For all matrices (food, feed, and animals), one EU Member State (Italy) reported one total unit tested for the matrix **'Deer - wild - fallow deer'**, which resulted positive for *S. Strathcona* in 2022.

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