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Strategies to develop effective, innovative and practical approaches to protect major European fruit crops from pests and pathogens

Work package 1. Pathways of introduction of fruit pests and pathogens

Deliverable 1.3.

PART 3 - Methods for the preparation of alert lists of pests for individual fruit species

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DROPSA Methods for the preparation of alert lists of pests for individual fruit species

A review of recent literature (Steffen et al. 2015[1] and the associated Excel file Fruit_pest_list_review_final_xls[2]) showed that pests and pathogens have already been introduced into Europe with fruit trade. The next task of this Work Package was to produce an "alert list" of pests and pathogens likely to be introduced into Europe with the import of several fruit species from outside Europe. A priority list of fruits was established (see Part 2 *Analysis of fruit production and imports in the EU to select species for pathway studies* – thereafter *Selection of fruit*[3]) and the project was able to prepare Alert Lists for the first four: apple; *Vaccinium*; grapes; oranges and mandarins. Current legislation was checked to analyse how it covers the identified pathways.

The methods followed for the preparation of alert lists of pests for individual fruit species are presented. They were originally based on those of the EPPO Tomato study (EPPO, 2015), and adjusted to take account of the aims of Task 1.3, and of the experience gained during the EPPO Tomato Study and during Dropsa, from one fruit to the next. This experience is now used to develop an EPPO Standard on the elaboration of pest lists.

1. Initiation

For all selected fruit species/genera, the following parameters were defined:

Area at risk	EU Note: Azores, Canary Islands and Madeira (as well as other similar territories) were not considered part of the area at risk, because they are different in terms of biogeography.
Pathway	Fruit of the selected fruit species/genus
Origins	Worldwide (focusing on origins outside the EU)
Expected outcome	An Alert List for the selected fruit species/genus. The Alert list may be divided into several parts if relevant, to list first the pests with high current economic impact and more likely to transfer

[1] Steffen K, Grousset F, Schrader G, Petter F, Suffert M. 2015. Identification of pests and pathogens recorded in Europe with relation to fruit imports. *EPPO Bulletin*, 45: 223–239.
[2] Available at https://upload.eppo.int/download/89oc0736e019
[3] Available at https://upload.eppo.int/download/102o0eec69a8b

Prior to starting compiling lists, the characteristics of the pathway were described. This served the purpose of adjusting the process and criteria used when screening for pests, applying it consistently, and targeting searches. Elements relevant for each fruit species are summarized in the report for that species. Thoughts were given to:

- *Plant species constitutive of the commodity*:
  - If the fruit commodity covers several plant species, the different plant species that may be present in the commodity. This applied to all the fruit studied.
  - Taxonomy for each plant species: preferred scientific name and common synonyms; e.g. *Vaccinium macrocarpon*/*Oxycoccus macrocarpus*, common names in English. Common names in languages for relevant origins were also recorded for some fruits to facilitate searches.
  - Whether some pests will have gained their name from the plant, e.g. *vaccinii* for *Vaccinium* spp. (which helps searches in databases, where the fruit species may not be indicated on the host list or there is no host list, but it is clearly a host; the host status was verified in all cases).
- *Features of the fruit species at origin and in the EU*
  - At origin, is it produced from wild plants, semi-managed environment, in the field, in protected conditions, or several of those?
  - Specific features in the EU that may influence entry of pests (e.g. commodity commonly imported into or close to production sites).
- *Parts of plants that may be present in the fruit commodity*: this is critical to adjusting criteria. For example: for *Vaccinium*, only the fruit itself; for apple, the fruit itself, as well as the peduncles, but generally not leaf material).
- *Any general EU regulations influencing the association of pests with the pathway*: e.g. *Citrus* fruit from third countries should be free from leaves and peduncles, and consequently only pests associated to the fruit itself or the calyx need to be considered.
- *Any general EU regulations influencing consideration of pests:* e.g. 'non-European Tephritidae' and 'Cicadellidae (non-European) known to be vector of Pierce's disease (caused by *Xylella fastidiosa*)', 'viruses and virus-like organisms of *Cydonia*, *Fragaria*, *Malus*, *Prunus*, *Pyrus*, *Ribes*, *Rubus* and *Vitis*' are regulated in the EU.
- *Production processes that influence survival of pests on the commodity*, such as:
  - Is the commodity handled or packed in specific ways?
  - Life span of the fruit commodity, influencing whether it is likely to be stored for long periods.
  - Mode and duration of transport.

  These elements describe the commodity. They can be used to target criteria only if they apply to all origins. Otherwise possible variations between origins need to be taken into account.
- *Production and trade data for the plant species*. This is important for the assessors to get an overview of possible origins, and helps focusing searches (i.e. so that the lists contain pests of relevant producing and exporting countries for the fruit species considered).

<u>General considerations</u>

- Task 1.3 did not aim at establishing comprehensive lists of pests with complete information on each of them. The lists only provide the level of details needed to decide if a pest may present a risk or not, and should be retained for the next step. All steps are time-consuming and the procedures chosen aimed at identifying pest risks while avoiding searching for unnecessary information and wasting time recording superfluous data.
- The fact that a pest is not retained at the next step does not mean that it is not an important pest, or that it may not be transported on the commodity, and should not be interpreted as such.
- The process was elaborated in detail prior to starting listing pests. It was adjusted during the course of the project taking account of the experience gained, but only for subsequent fruit species (assessors did not come back to modify a completed step or list).
- Data in the compiled lists at early stages (Step 1 and Step 2) need to be used with caution. Only relevant information was sought, in a limited number of publications that are sometimes contradictory, and there may be uncertainties on whether the pest meets the basic criteria for the study.
- The task started with a limited time available (in terms of working days available as provided by the project). It was decided to study selected fruits one by one, in the order of the priority list (see *Selection of fruit*). It was not possible to determine in advance in a meaningful way the time necessary to complete the study for each fruit.

2. Process

For each fruit pathway, three steps were applied:

- **Step 1**. Establishing a list of organisms (worldwide, but focusing on origins outside the EU), including basic preliminary information, especially on distribution and whether they may be associated to the fruit commodity.
  →*Outcome*: "Step 1 list", a general list of pests, and identification of those needing to be considered further or not.
- **Step 2**. Screening the pests to be considered further according to Step 1 against a number of criteria. This step looked into more details at the pests, taking into account the criteria detailed in section 4 below. Each pest received an overall rating, thereby allocating pests to defined categories.
  →*Outcome*: "Step 2 Lists", with information, ratings against individual criteria and an overall rating, as well as identification of those not needing further consideration.
- **Step 3.** Selecting pests for an Alert List, among the pests to be considered further according to Step 2, based on the overall ratings.
  →*Outcome*: Alert List for the selected fruit species/genus.

3. Step 1: Listing pests worldwide for the fruit species considered

3.1 General considerations concerning Step 1

In Step 1, organisms associated with the fruit species were listed (worldwide, but focusing on origins outside the EU) (Step 1 List). Pathogen vectors were also included.

For apple and *Vaccinium* (as for the EPPO tomato study), pests were listed at Step 1 based on bibliographic searches. However, some limitations became clear following the EPPO Tomato study. Most notably, there may be very little published information about a pest (that would consequently not be retained on the Alert List), but it is considered important by experts. Experts of a crop may be able to readily name some pests that are not present in their country and present a risk. For *Citrus* and grapes, in parallel to the bibliographic study, a simple questionnaire intended to be circulated to experts was sent to EPPO NPPOs of EPPO countries. Answers were used to complete Step 1 Lists and to earmark pests that are important according to experts. All pests were then rated at Step 2. The assessors kept in mind experts' opinions, but screened all pests in the same manner.

In Step 1, basic information was gathered and used to determine whether the organisms should be considered further in Step 2. This step did not aim to gather complete information on each pest, and further data was gathered in Step 2 for the pests retained for further study and likely to be retained for the Alert List. This step also identified organisms associated with the fruit species, but not considered as pests; these were screened out, and only pests (based on the information available) remained at the end of this step.

3.2 Defining relevant categories/conclusions for the organisms on the Step 1 Lists

Prior to starting listing organisms, elements that maintained or excluded organisms from further consideration were decided upon. Organisms assigned to one of the categories in Table 1 were excluded from further consideration. Others were kept (without rating) for further consideration at Step 2.

3.3 Information collected

Table 2 presents information collected, and variations depending on fruit species. The information was collected following a certain order (outlined in 3.4) in order to avoid recording superfluous data. The information was collected as an xls spreadsheet (see 3.5). An extraction tool (EPPO webservices) was used to extract some PQR data on EPPO codes, taxonomic information, host plants, categorization for the EU and EPPO.

Table 1. Categories for which no further assessment is needed

	Description of the category	Pests NOT covered in this category for Dropsa
NO1	**Pest already regulated in the EU** Pests regulated in the EU Plant Health Directive 2000/29 (A1 or A2 Lists, whether on the fruit considered, or other commodities, or generally)	Pests recommended for regulation by EPPO, but not regulated in the EU were retained.
NO2	**No possibility for transport on the fruit pathway.** A conservative approach was taken. Whether a pest can be carried by a pathway generally requires a deeper analysis, except for specific cases where this is straightforward (e.g. soil pests or plants as pests in the case of fruit commodities). In other cases, it is not possible to decide whether fruit may be a pathway from only the few sources available at Step 1. The plant parts accompanying the fruit itself were studied for each fruit species, and are specified in the report for each fruit. Intercepted species were kept, provided they were pests (i.e. as long as they did not fall in the category NO5 below).	The following pests were retained at this stage, as. - pests that may be associated (any life stage) to any plant parts that may be in the commodity, e.g. larvae on leaves of a fruit species, where leaves may be associated to consignments of fruit, even if this is not a common case. - pests with life stages that may incidentally be associated to the commodity, e.g., for fruit, flying adults or larvae normally associated to leaves but likely to wander on fruit and end up in consignments - pests intercepted on the commodity, even if they are not a pest of the plant species (e.g. wheat pest in consignments of apple fruit) have the possibility to be transported on the pathway. Decision may be needed on whether to exclude pests intercepted only one or few times on the commodity.
NO3	**Pest present in the EU**. If a pest was already present in a certain number of EU countries, it was excluded from further consideration. The threshold depended on the fruit species, taking into account in particular the number of pests expected to be found (and screened). The threshold is indicated in the report for each selected fruit.	Presence in Madeira, Azores or Canary Islands (and similar territories) did not constitute a record of presence in the EU. Some pests recorded only indoors in a rrestricted part of the EU were also retained for some lists (oranges/mandarins and grapes).
NO4	**Fruit species studied is not a host.** This was used conservatively. For interceptions (i.e. pests found in consignments at import), pests were generally not excluded at this stage, although this depended on individual cases.	- any pest for which there was a doubt on whether the plant species is a host, or for which there are conflicting records was kept. In particular, any pest for which a specific publication relating to the plant species was found does not fall in this category, even if some broad sources (e.g. CABI CPC or PQR) do not mention the plant as host. - Pests intercepted on the commodity but that are not pests of the plant species were not automatically excluded. A judgement was made, for example very few interception records, and other sources provide convincing evidence that the plant species is a host. However, as Step 1 uses few sources, one should keep in mind that the number of interceptions has limited relevance.
NO5	**Other reasons.** For example if the organism is a natural enemy, not a pest of any crop, or pests mentioned at genus level in interceptions. This category also covers (rare) cases where an organism was listed in a publication, but it was impossible to find any reference. This relates mostly to serious cases of misspelling. It was decided to not spend much effort to guess spelling mistakes, or whether the name given is a (rare) synonym.	For interceptions at the genus level, a brief Internet search was made and individual pest species of the genus concerned for which an association to the fruit species was found were added to the list. The genus concerned was generally allocated to this category, except in a few justified cases, where it was kept until Step 2.

Table 2 – Information collected

The fields included in Step 1 Lists (and consequently remaining in Step 2 Lists) are listed below. Those marked with * were checked for each pest. The fields marked with # were added during the course of the project (they are not in the lists prepared for *Malus* and *Vaccinium*).

Fields included in Step 1 and Step 2 Lists		
Field name	**Content**	**Variations depending on the fruit studied**
Species*	Scientific name, i.e. species or genus as identified during the search. If the name in the publication is now a synonym, the preferred name was indicated here and the synonym in the relevant column (to avoid duplications). Uncertainties on synonymy could sometimes not be resolved easily and were recorded under 'other information' (to not spend time on organisms that would eventually not be considered at Step 2).	As described
Type*	As a code. See Table 3	As Table 3
Taxonomy*	See Table 3. Taxonomic levels proposed are not consistent across all groups of pests, in order to be more informative. For pests in PQR, this data was extracted automatically (with additional combination/formatting)	Some groups other than those covered in Table 3 were found associated to the fruit species in the literature. However, they were not considered relevant for the fruit pathway, and where not recorded in Step 1 Lists. This is for example the case for birds and plants, for all fruit species. For oranges/mandarins and grapes, this was extended to groups listed in Table 4.
Source*	PQR, CABI CPC, or Author (date or 'no date').	Depending on the fruit, this indicates either: a- the reference which led to adding the pest to the list, or b- all references used for that pest.
URL or citing	URL (e.g. web pages, articles posted on the web, databases etc.), complete reference or original publication (if the source was cited in another publication).	Depending on the fruit, this indicates either: a- other references than the ones which led to adding the pest to the list, including sometimes full reference. b- a URL when the publication listed in the 'source' field were found on the Internet. For internet references, URLs were recorded as far as possible (at least once in the Step 1 list for publications cited for several pests),
Location of life stages on plant parts#	Any information on the presence of different life stages on the different parts of the plant/commodity was indicated. This was used to conclude on the pathways below.	This column was added after the first two studies (apple and *Vaccinium*), and was used for oranges/mandarins. For apple, grapes and *Vaccinium*, this information was given under 'fruit pathway', 'other pathways' or 'other information'.
Fruit pathway	The possibility that fruit is a pathway was assessed based on one or few sources, in a conservative manner, based on the location of life stages on plant parts. Whether a pest may be transported on the commodity cannot always be determined unambiguously and requires detailed consideration of the biology of the pest (and is a detailed process within PRA). Sometimes there is also conflicting information about this in various publications. It is therefore not always possible at this stage to provide an answer. Uncertainties were also recorded. **A certain 'No' here excluded a pest from further consideration.**	Plant parts relevant to the fruit species, as recorded in the introduction to each commodity study, were considered. Further details and uncertainties were also recorded in this field. Where a fruit commodity may contain leaves, wordings such as 'leaf only', 'fruit only' have been used, as well as 'as contaminant', 'incidental', 'adults only' etc. For some fruit species, this field also contains information on the location of life stages on plant parts.
Other pathways	Preliminary assessment of other possible pathways the pest could be associated with, based on the location of life stages on plant parts. This may provide useful information for further analysis.	This was recorded when readily available. Note: this field was completed only for pests on the Alert List.
Hosts*	All listed pests have an association with one or several of the plant species composing the commodity. Complete host lists are not needed here until one is sure that the pest will remain at the next stage. Some organisms are listed because they are mentioned in a database recording all plant species on	The method varied depending on the fruit species and the assessor. The search at Step 1 focuses on whether the selected fruit was a host or not. Details on other host plants may be in the Step 1 or Step 2 List or Alert List. It was decided that consistency was not essential for this. This took account of whether the assessor prefers to assemble data at

Fields included in Step 1 and Step 2 Lists		
Field name	**Content**	**Variations depending on the fruit studied**
	which any life stage was found (hosts or not), or because they were intercepted on the commodity, or were obtained through datamining. The host status for the plants species is sometimes difficult to determine. In some cases, it is possible to exclude the pest; alternatively the pest can be retained to the next step if more extensive searches are required. Where the plant species considered is not included as a host in CABI CPC or PQR, a general search can be made to determine if other sources associate the pest to the plant species. Interception records are a special case. The intercepted organisms may have been hitchhikers on the commodity, and may not be a pest at all, or not a pest of that plant. Individual decisions were taken on which pests to keep. Latin names were used, to facilitate future searches in spreadsheets. If there is any ambiguity as to the species concerned, a phrasing such as 'Malus (as apple)' was used. For pests in PQR, this data was extracted automatically (with additional combination/formatting) **An answer showing that the plant studied is not a host always excludes a pest from further consideration (except for interceptions)**	this stage or later. In any case, detailed searches focused on pests that are likely to be retained to the next step. In some cases, only the fruit species studied may be indicated here. Efforts were made to list other fruit species studied in Dropsa, in order to facilitate the preparation of lists for other fruits. Some common names remained, especially in long host lists directly extracted from publications, or because of ambiguities in the species covered (for example 'blueberries' may cover different species). They were changed to Latin names at Step 2, if the pest was to be retained on the Alert List.
Other information	This relates in particular to information that is useful to further assess the pest, as well as records of interception, any element excluding the organism from further study. Such information should be noted when available in the publications reviewed, but not systematically searched for. The assessor needs to keep an eye for any essential information that may also be needed at subsequent steps.	For *Vaccinium*, this also contained the location of the life stages.
Distribution*	Based on CABI CPC or PQR, when available. It may be the case that one of them contains more up-to-date information, but they were not compared at this stage, and the other can be consulted at the next stage. When CABI CPC or PQR did not indicate a distribution, records as mentioned in other sources were used. If a source only relates to one country, this was also indicated in this field. It was decided to indicate broad regions where there was no doubt that the pest was present in a number of countries (in other cases, individual countries were listed). The following regions were used: Africa, Asia, Europe (also non-EU countries), Oceania, Caribbean, Central America (Guatemala to Panama), South America, North America (incl. Mexico). To name regions and not individual countries, a threshold of 5 countries was used for all regions except for North America (3: USA, Canada, Mexico).	Infranational distribution was recorded where considered necessary. Because detailed country information is necessary at Step 2 for rating the climatic similarity of pests, detailed distribution was indicated for pests that were certain to be retained at Step 2. Recording details as consistently as planned initially proved to be too time-consuming and not needed especially for pests that would clearly not be retained. General wordings were used, such as 'Americas', 'worldwide', 'widespread'.
Present in the EU*	The answers are: - Yes: if above the threshold defined (see Table 1, NO3) - country names if present in a number of countries below the threshold **A certain 'Yes' here excludes a pest from further consideration**	This field may sometimes include expressions such as 'widespread', or 'many EU countries'.
Categorization*	Two columns were created, one for the status of regulation in the EU Plant Health Directive 2000/29), one for EPPO lists. For the EU, the relevant status and Annex is indicated (e.g. I/A1), and where relevant the name under which the pest is regulated. For EPPO, the type of list was indicated (e.g. A1, A2, Alert List). For pests in PQR, the categorization status for the EU and EPPO were extracted automatically.	For pests in Annex II of EU Directive 2000/29, the commodities (incl. species) on which the pest is regulated were indicated in the lists for some fruit species

Fields included in Step 1 and Step 2 Lists		
Field name	**Content**	**Variations depending on the fruit studied**
	A categorization for the EU excluded a pest from further consideration	
Conclusion*	Conclusion of Step 1. This was left empty for pests retained, and contains one or several NO categories for others (as per Table 1)	As described
Synonyms	This does not record systematically all known synonyms, but only names under which a pest was mentioned in the reference concerned (to facilitate retrieval of information), or a synonym that is especially important for the further use of the information (i.e. where useful data may be found by searching for the synonym)	As described
Kind of damage	If it is available in a publication used to record other data, information on damage and damage potential was recorded in Step 1 because it is used at further steps. No specific searches were performed to find such information at Step 1.	As described
Optional column		
EPPO code*	This is useful to group organisms and identify possible synonymy between listed pests. EPPO codes are given in PQR for a large number of pests (incl. many for which no detailed data is available), and were extracted automatically based on preferred names or synonyms.	'none' was added for some fruits when no EPPO code was found.

Table 3. Codes and taxonomic details

Code	For type of pest	Taxonomic details given	Upper taxonomic levels (for reference)
Animals			
I	Insecta (Class)	Order: Family	Animalia (Kingdom), Arthropoda (Phyllum), Hexapoda (Sub-Phyllum)
A	Arachnida (Class)	Order: Family	Animalia (Kingdom), Arthropoda (Phyllum), Chelicerata (Sub-Phyllum)
N	Nematoda (Phyllum)	Order: Family	Animalia (Kingdom)
G	Gastropoda (Class)	Order: Family	Animalia (Kingdom), Mollusca (Phyllum)
Pathogens			
V	Viruses and viroids (Kingdom)	Family: genus	
B	Bacteria (Kingdom)	Order: Family	Note: this includes phytoplasma
F	Fungi (Kingdom)	Phyllum	-
C	Chromista (Kingdom)	Phyllum: Class	-

Table 4. Pest groups not included at Step 1

Aves
Plantae
Mammalia
Nematoda
Entognatha
Myriapoda

Insecta: Cerambycidae
Insecta: Scolytidae
Insecta: Cicadidae
Insecta: Orthoptera
Insecta: Isoptera

3.4 Process for collating information

A stepwise approach using various sources was used:

- A first list of organisms was prepared based on broad sources such as PQR and CABI CPC (and other exhaustive sources readily available for the commodity), extracting pests for which the plant species considered are listed as host, or species epithet reflecting the host species (see section 1).
  Groups of organisms (e.g. Orders, families) unlikely to be associated to the commodity considered (even when they are pests of the plant species) were deleted/not included on the lists (see Table 4).
- The list was completed progressively with other pests extracted from various sources. Table 5 provides a non-exhaustive list of the types of publications used at this stage. In parallel, any useful information relating to pests already on the list was recorded (i.e. complementing data in PQR and CABI CPC).
- In consulting other sources, a stepwise approach was useful, i.e. adding pest names to the list from a few publications at a time. This was to make sure that no time was spent unnecessarily on pests that could easily be shown to not meet basic criteria.

Searches focused on elements that exclude the organism from further consideration (see 3.1). It was not necessary to fill all fields, as long as the information collected allowed a conclusion. The order allowing to reach a conclusion in an effective way was generally:

- Whether the pest is regulated in the EU. This is the most readily available data for the area at risk.
- Whether the pest is present in the EU above the defined threshold of countries.
- Whether the organism is not a pest of the fruit species or whether the pest is not associated to the fruit commodity (depending on which comes first from the searches made).

Attention was paid to:

- The need to mention pests with their preferred names (to avoid multiple mentions of a pest at different places in the Step 1 and Step 2 Lists under different names)
- Carefully recording sources of information .

Table 5. Types of sources of information that were used

To start the list
PQR
CABI CPC
To complete the list
Lists from similar studies, e.g. Step 1 and Step 2 Lists for other fruits in Dropsa, Dropsa Review lists of the EPPO tomato study
Interception data, from EPPO countries or other sources
PRAs (from EPPO, EPPO countries, other countries)
Books and compendiums relating to pests of the crop or to a specific regions
Publications on groups of pests, in printed form, databases or internet sites
Sources on pests of the crop in a country or region, e.g. extension brochures, cropping advice, lists of pests present in a country, official lists of pests on the IPP (www.ippc.int)
Targeted searches for certain countries, for example important countries not covered in the general publications above
Regulations from countries regarding imports
EPPO Reporting Service articles and notifications of non-compliance

3.5 Format of Step 1 Lists

The Step 1 Lists contain all organisms considered, as well as information from the one or few sources. A number of additional pests were identified only in Step 2, but they do not need to be added retrospectively to the Step 1 List.

The format of Step 1 Lists was decided at the start of the project, but was improved during the course of the project. Consequently, there are minor variations between earlier lists (*Malus* and *Vaccinium*) and others.

There were variations in work methods between assessors. In particular, information for one pest is sometimes given in one row, or there can be one row per reference (i.e. several rows for one pest). Information may be in different cells.

The lists at Step 1 are working tools, because they are not complete, therefore they are not published.

3.6 Conclusion of Step 1: determination of pests to be considered in Step 2

At the end of Step 1, all listed pests not in a 'NO' category were retained for further consideration in Step 2. The number of organisms in the Step 1 List and the number of pests in different categories was summarized in the report for the specific fruit.

Although difficult, an attempt was made to give an idea of the broad geographic coverage of the study (apart from the CABI CPC and PQR), especially to record origins (relevant countries or regions) with a good coverage, or for which very little information was found.

4. Step 2: Identifying pests that may require further consideration

4.1 General considerations regarding Step 2

The aim of Step 2 was to establish priorities for further consideration amongst the pests retained at Step 1. This original list may be modified in Step 2 because additional pests are identified or because some pests appear to be synonyms. A criteria system is used in order to be able to evaluate the large number of pests in a consistent manner and against the same elements, in order to determine those that require further consideration. For each pest, further information is sought (4.1) in order to rate it against a number of criteria (4.2), and individual ratings are then combined in an category rating (4.3). A number of pests are then excluded from further consideration; others are considered further to select pests for an Alert List in Step3.

All information is presented in the form of a "Step 2 List" that, for each pest, gives information, ratings against the criteria, and the category rating with a conclusion where relevant.

4.2 Further information gathered

Step 2 first requires confirming that the pest may be transported on the fruit pathway, completing the distribution to ascertain that the pest is not present in the EU above the defined threshold, and verifying that the fruit species/genus studied is a host.

Data gathering in Step 2 aims only at finding information on these three elements and in relation to the criteria in 4.3. It does not aim to making an extensive bibliographic study for each pest. Complete information is given in the Step 2 List only for the pests eventually retained on the Alert List.

However, it was considered important that ratings at Step 2 are based on sufficient reliable information (i.e. relying on several publications to confirm the information as necessary), to make sure the pests are rated correctly compared to each other. Interesting additional information is also recorded where available. The information gathered at Step 2 is still preliminary, and in many cases it was not always possible to gather all the necessary information to evaluate the pests against the criteria. The information was collected following a certain order (outlined in 4.4) in order to avoid recording superfluous data. In particular, no further information was sought once a given rating excludes a pest from the Alert List.

- Parts of plants attacked according to the biology of the pest
Where needed, an additional search was made on the parts of plant that are likely to carry the pest. This is to confirm that the pest may be transported on the fruit commodity (considering the plant parts that compose it). This information was used for the criterion A 'whether the pest may be carried with fruit'. Where fruit is determined to not be a possible pathway, the assessment of the pest stops, and no other information is sought (category NO2, as in Step 1).

In many cases, the assessment that the pest may be carried in fruit consignments is still preliminary. Whether a pest is associated to the consignment normally requires detailed analysis in the framework of PRA. At this stage, a conservative approach is still recommended. For example, for a fruit commodity that may contain leaves, if a life stage of an insect is mainly found on leaves, but is in some cases found on fruit or wander onto fruit, it is reasonable to retain the pest. In-depth analysis may be needed, but this cannot be carried out in the framework of Dropsa.

- Relevant geographical distribution and presence in the EU
This second collection of distribution data aims at refining the distribution as defined in Step 1, which generally relied only on one source of information. The distribution is further completed only for pests retained for the Alert List. No additional search is needed for pests for which distribution data at Step 1 is considered to be complete enough (e.g. recent information in PQR, recent EPPO Alert List entry, recent and full data sheet in CABI CPC, etc.). Where an additional search is made, it sometimes shows that the pest already occurs in the EU above the defined threshold. In this case, the pest is not considered further (category NO3, as in Step 1). It is recommended that the search for information stops as soon as the threshold is reached (provided the information is reliable). The information on distribution is used for criterion B 'present (or not) in the EU above the defined threshold'.

- Host range
In Step 1, the information generally relied on one or a few sources, sometimes contradictory. Complementary information was needed in some cases to verify that the fruit species/genus studied is a host. This is not done for pests for which information at Step 1 seemed complete enough, consistently confirming the host status of the plant. If there is good evidence that the plant species is not a host, and there is no other reason to keep the pest (such as interception records), the pest is not considered further (category NO4, as in Step 1). In other cases, a more complete list of hosts is needed, which sometimes had not been gathered at Step 1, especially for fruit species for which the criterion C 'level of polyphagy' was used.

- Additional information
Other information useful at this stage (e.g. importance of the pest in order to rate the corresponding criteria, spread of the pest, quarantine status, interceptions etc.) was also recorded.

- References
All references used are cross-referred to in the list (PQR, CABI CPC or 'Author (year)). However, a complete list of references was not assembled at this stage.

4.3 Criteria used to prioritize pests

Seven criteria were documented for each pest and combined to prioritize them. Ratings were defined in order to better discriminate between pests, with the objective of producing Alert Lists by selecting few dozens of pests from very long lists (hundreds of pests). Sub-ratings were added to some criteria for better discrimination, while taking into account that the rating should be done with limited amounts of information (i.e. no detailed PRA considerations were added). In addition, a sub-rating 'u' (uncertain) was used for all criteria, where a specific rating could be given with a certain level of uncertainty.
It is important to remember that the rating of the criteria is not an assessment of the pest risk, but a way to prioritize the pests for further consideration by allocating each pest to a category (see 4.5). The answers are not always precise and there are a lot of unknown elements at this stage, but the ratings give an indication to assess the priority for further consideration. Where a criterion received a rating that excludes the pest from the Alert List, other criteria were not rated.

The criteria used in Dropsa were based on the EPPO tomato study, but substantially modified to apply to the EU, and to take account of the experience gained. A category 'unknown' was used for all criteria to cover cases where the information is insufficient to rate the criterion.

The criteria and sub-ratings were adjusted for each fruit studied, taking into account the characteristics of the pathway. Variations for different fruit studied are recorded in the report for each fruit.

A. Whether the pest may be carried with fruit [used for all selected fruit]

Assessing whether a pest may be carried with the fruit is not always easy based on basic information. Multiple rating was used here as a simple yes/no was not considered sufficient. The likelihood of association of the pest with the pathway fruit depends on whether some life stages are associated directly with the fruit or with other plant parts that may occur in the consignments. For some fruit species, consignments on fruit generally do not contain green parts (e.g. *Vaccinium*), while others may (e.g. peduncles for apple). This is specified in the report for each fruit species. The rating takes account of the association to different plant parts where relevant, and also whether the association as highly-mobile life stages (understood here to be flying or running, and not crawling).

A. Whether the pest may be carried with fruit

A1	Yes, in or on the fruit itself, in a non-highly mobile life stage (incl. crawling, but not running/flying), whether or not some stages may also be associated to green parts attached. A1* indicates where the pest needs a transmission means for transfer (i.e. for viruses and viroids, vector or other mechanism)
A2	Yes, on the fruit itself (whether or not some stages may also be associated to green parts attached), but in a highly mobile form (running/flying), i.e. it is difficult to judge if the life stages remain associated with the fruit at and after harvest. This includes pests whose larvae feed on green parts (or eggs are laid on leaves) and adults on fruit as highly mobile form (e.g. some Lepidoptera, Hemiptera), pests for which some life stages are associated to green parts but may wander on the fruit.
A3	Yes, in a non-mobile life stage if green parts are attached (non-running/flying, e.g. egg, larvae, pupae), with no life stage associated to fruit. This includes all pests that are exclusively living and feeding on leaves or stems. Note: For fruit species for which green parts are not generally associated to consignments of fruit, A3 excluded a pest from further consideration (category NO2).
A4	No evidence of possible association. The clearer cases are pests that live in or on the soil. Other cases covered in this category are: pest that can be associated if green parts are attached to the fruit, but only in a mobile life stage (and no life stage associated to fruit). Pests that clearly attack plants at a phenological stage where there would be no fruit (e.g. seedlings only) also belong to this category. Note: For all fruit, A4 excluded the pest from further consideration (category NO4).
AU	Unknown (insufficient information found to assess this)

The following sub-ratings were used (in addition to u – uncertain):

Sub-rating	Description	Reason and use
c (contaminant)	Pests recognized as major contaminants of consignments of the fruit studied (i.e. not pests of the crop studied, but often associated to consignments).	Such pests are associated with fruit in trade but were not retained on the Alert Lists as they are not pests of the species considered.
t (transfer possibilities	The pest has mobile life stages and is more likely to transfer to hosts at destination. This covers pests that have flying, running	To allow to discriminate pests with a higher likelihood of transfer because of their

through own mobility)	(but not crawling) life stages, and pathogens transferred by contact or vectors. Pests in some groups were always rated as 't' (e.g. Diptera, Coleoptera). Pests in others were rated as 't' only if there was specific information (e.g. airborne fungi, virus transmitted by a vector).	mobility, estimated very broadly.
w (wild)	The pest is associated with the fruit genus considered in nature, and there is no evidence that it is the pest of this genus in cultivated or managed conditions. It is less likely to become associated to fruit consignments.	To identify pests that are less likely to become associated to fruit consignments moving in trade. These pests were not retained on Alert Lists. This sub-rating was used for *Vaccinium*.
fp	For species of fruit-piercing noctuids for which the association with fruit is due to adults only (highly mobile, often large and nocturnal) (larvae are on other hosts)	To identify such pests that are not likely to become associated with fruit consignments. These pests were not retained on Alert Lists. This subrating was used for oranges/mandarins.

B. Present (or not) in the EU [used for all selected fruit]

The ratings take account of the number of EU countries defined as threshold for the selected fruit. This threshold was less than 3 EU countries for *Vaccinium*, and 0 for all others. Presence in the Canary Islands, Azores or Madeira (and similar territories) was not considered as a record for the EU. Some pests recorded only indoors in a limited part in the EU were also retained for some lists (oranges/mandarins and grapes).

The following ratings were used:

	Distribution in the EPPO region
B1	Complete absence from EU or presence in a number of EU countries below the defined threshold (not taking into account presence in the Canary Islands, Azores or Madeira, or similar territories) B1a. Absent from the EU B1b. Present in the EU below the defined threshold for the fruit considered. Where the threshold was 0, only 'B1' was used
B2	Present in the EU above the defined threshold (not taking into account presence in the Canary Islands, Azores or Madeira, or similar territories) Note: B2 always excluded a pest from further consideration (category NO3).
BU	Unknown. There is no good information on the distribution of the pest, and whether or how widely it occurs in the EU. This covers in particular pests that seem to be more widespread than indicated in the few references found, without evidence that this is the case.

C. Polyphagous or not [only some selected fruit]

In the EPPO Tomato study, this criterion proved to not be discriminative as most pests were polyphagous. An attempt was made to use it for *Vaccinium* and apple. It allowed a certain discrimination between pests for *Vaccinium* but not apple. Eventually it was decided to not use it to discriminate pests for the Alert List of *Vaccinium* or apple. Consequently, it was not used for other crops.

The following ratings were used:

	Polyphagy level
C1	Hosts in several families (without consideration of the number of hosts, which is reflected in the host list)
C2	Several hosts, but only in the family of the fruit species/genus considered
C3	Only the fruit species/genus considered
CU	Unknown. Information on hosts does not seem sufficient to answer this question (in particular, there is a presumption (but no evidence) that the pest may have more hosts than found).

The following sub-rating was also used (in addition to u – uncertain):

Sub-rating	**Description**	**Reason and use**
n (new host)	Applied for crops that are new in many areas of the world. It eventually was applied only for *Vaccinium*. There is evidence that the pest has moved from its other hosts to the new crop.	To take account of potential emerging pests. The pest may have a low or unknown economic importance, but it may be only because it has recently passed onto a new crop.-

D.Climatic similarity [only some selected fruit]

This rating aims at screening the level of climatic similarity outdoors between the EU and the known distribution of the pest. This can only be a rough estimate as a detailed study of climatic similarity would also take into account the precise distribution of the pest in a specific country, and under which climates the crop is grown. The assessment of climatic similarity was based on the outcome of the EU FP7 project PRATIQUE ("Rating Guidance for Climatic Suitability », deliverable 3.3, Annex 4) as adjusted in September 2014 (R. Baker, personal communication, 2014). Compared to PRATIQUE, some adjustments were made and the classification of Köppen-Geiger was used based on Rubel and Kottek (2010) (instead of Kottek et al., 2006 in PRATIQUE).

Using this data, there are 10 climate types in the EU (Map 1 in Annex 1). The 9 climates used for the evaluation are listed in Table 8.2a. The climate ET (toundra climate) was not taken into account, for reasons detailed in Table 8.2b. For each pest, assessors rated the number of common climate types between countries where the pest is present and the EU. The maximum number of common climate types is therefore 9.

For some fruit species, some of the 9 climates are not relevant for the rating, as they correspond to areas where the crop concerned is not grown; taking them into account would overestimate the number of common climate types. In such cases, very extreme climate types were excluded for the rating (therefore reducing the possible maximum number of climate types). This was not done for crops that grow in a wide variety of climates (e.g. apple, *Vaccinium*), but may be more relevant, for example, for oranges/mandarins.

The rating generally takes account of countries in their entirety, except if data on the distribution within a country is available (for example, there would be only 1 common climate with the EU for a pest present only in Florida, while if it is reported generally for the USA, there would be 9 common climates).

An overview map and tables of percentages summarize the climate types present in the EU with their occurrence worldwide (Map 2 and Table 1 in Annex 1 – R. Baker, personal communication, 2014). The rating was done either visually, looking in parallel at the pest distribution and map 2, or by comparing the pest distribution to the list of percentages of EU climate types in other countries (without taking into account the percentage of their territory for that climate, only the presence/absence of the climate type).

Table 8.2a. The 9 climates of the classification of Köppen Geiger that were taken into account in the screening for climatic similarity

Code	Description and comments
B	**Arid climates Pann < 10 Pth**
BSk	Steppe climate, cold arid
BSh	Steppe climate, hot arid
	These were kept as fruit might be grown outdoors under irrigation under these climatic conditions.
C	**Warm temperate climates −3◦C < Tmin < +18 ◦C**
Cfa	Warm temperate climate, fully humid (neither Cs nor Cw), hot summer
Cfb	Warm temperate climate, fully humid (neither Cs nor Cw), warm summer
Cfc	Warm temperate climate, fully humid (neither Cs nor Cw), cool summer
Csa	Warm temperate climate with dry and hot summer
Csb	Warm temperate climate with dry and warm summer
D	**Snow climates Tmin ≤ −3◦C**
Dfb	Snow climate, fully humid (neither Ds nor Dw) with warm summer
Dfc	Snow climate, fully humid (neither Ds nor Dw) with cool summer

Table 8.2b. Climates of the classification of Koppen Geiger that were not taken into account to screen the climatic similarity and reasons

Code	Description and comments
Climates that do not occur in the EU region	
A	**Equatorial climates Tmin ≥ +18 ◦C**
Af	Equatorial rainforest, fully humid
Am	Equatorial monsoon
As	Equatorial savannah with dry summer
Aw	Equatorial savannah with dry winter
B	**Arid climates Pann < 10 Pth**
BWk	Desert climate, cold arid
BWh	Desert climate, hot arid
C	**Warm temperate climates −3◦C < Tmin < +18 ◦C**
Cwb	Warm temperate climate with dry winter, warm summer
Cwa	Warm temperate climate with dry winter, hot summer
Climates that do not reflect appropriately the climatic similarity with the EPPO region	
D	**Snow climates Tmin ≤ −3◦C**
Dsa	Snow climate with dry and hot summer

Code	Description and comments
Dsb	Snow climate with dry and warm summer
Dsc	Snow climate with dry and cool summer.
Dsd	Snow climate with dry summer, extremely continental
Dwa	Snow climate with dry winter and hot summer
Dwb	Snow climate with dry winter and warm summer
Dwc	Snow climate with dry winter and cool summer
Dwd	Snow climate with dry winter, extremely continental
Dfa	Snow climate, fully humid (neither Ds nor Dw) with hot summer
Dfd	Snow climate, fully humid neither Ds nor Dw, extremely continental
E	**Polar climates Tmax < +10 ◦C**
EF	Frost climate Tmax < 0◦C. *Occurs only on Greenland, Northern Canada and Antarctica.* '
ET	Tundra climate 0 ◦C ≤ Tmax < +10 ◦C. *Occurs at the northern part of Canada and Alaska (USA), the Far-East, the very southern part of South America, as well as in mountains at higher altitude (e.g. Himalayas, Andes, Alps, Tien Shan).* *Although ET does occur in the EU, it was not taken into account, as it would increase the climatic similarity with some countries, while the fruit species considered, and their pests, are more likely to occur in other climatic areas of these countries.*

According to this system, some countries do not present any common climates with the EU, such as Guyana, Cameroon or Laos, while others include many of the climates considered, such as 9 for the USA, 6 for Argentina, South Africa and Australia. Some countries situated at the same latitude as that of the EU may have a small area for a climate, but these may also occur in large parts of the EU (for example Cfb in Canada). Others may have a few common climates, but present over their whole territory (e.g. New Zealand, Cfb and Cfc, with also ET) corresponding to a very large area of the EU.

It is recognized that this approach has limitations:

- This criterion is probably overestimating the climatic similarity in many cases, as climatic conditions may be considered as more similar as what they are in reality. For example, if a pest occurs in a country with many climatic types, the rating can be high while the pest may be present under only a few of these climates.
- Climatic similarity may not predict precisely where the pest will establish as a pest may establish in a different climate type from the one it is present in. Baker et al. (2011) note that the severity of winters, which differentiate some climates of the EU and in other countries, may not be important for the establishment of some pests. This aspect is normally taken into account when performing PRA, recognizing that some pests may adapt to climates different from those at origin.
- The fruit crop considered may not be grown in all climate types present in the EU (even if extreme climates were not taken into account for some fruit species), and the resulting similarity would be lowered by climates where the crop is not grown at all.
- When the rating was done visually, it may not be precise in some cases, for example where a climate occurs in a limited area of a country or at borders.
- It cannot take account of the detailed distribution of the pest within a country, i.e. if a pest if present in only climate Cfb at origin, the climatic similarity is low, but the climatic conditions correspond to a large part of the EU.

However, this criterion was used mostly to identify those pests whose distribution had a low similarity with the EU (0 common climates), for the purpose of screening (recognizing that pests that occur in a certain climatic conditions may adapt to other climatic conditions). Pests with a medium climatic similarity were not excluded. It is also not intended to use this criterion used on its own.

This criterion proved to be very little discriminative for apple and *Vaccinium* (as virtually no pests could be rated with a low climatic similarity), and it was decided to not use it for *Vitis*. For oranges/mandarins, the climatic similarity was not rated for all pests on the Step 2 List, but was verified for pests retained for the Alert List. A few pests had a low climatic similarity (0), but were retained on the Alert List (see report for oranges and mandarins).

The following ratings were initially proposed:

rating	Common climates between the countries where the pest is present and the EPPO region
8-9	High – 8-9 common climates
1-7	Medium 1-7 common climates
0	Low: 0

E. Recorded impact [used for all selected fruit]

This criterion was rated based on the information given in the publications considered, which is often qualitative. The following ratings were used:

	Recorded impact
E1	High (Some references refer to a major or serious pest, even if only at local level)
E2	Medium (Only occasional damage mentioned; no mention of serious damage)
E3	Low (mentioned as a minor pest, and no reference pointing to the above categories) Note: E3 generally excluded a pest from further consideration (except some vectors fulfilling other criteria).
EU	Unknown

Records such as "one of the most serious pests of 'the fruit under study' in country/province Z" were rated as E1, as well as records of serious damage on other hosts. The rating is not very precise, and it is hard to decide the appropriate rating in some cases, especially between 'high' and 'moderate'. However, it gives an indication especially for minor pests. Due to the need to discriminate between pests and identify a relatively short list of important pests for the Alert Lists, impact was generally rated as 'high' if supported by strong wording, multiple publications or figures showing severe losses.

The following sub-ratings were used (in addition to u – uncertain):

Sub-rating	**Description**	**Reason and use**
h ('historical', impact in the past)	Pests whose impact was higher in the past. The rating is given for the highest impact, i.e. in the past or currently. A 'h' is added only if the impact was higher in the past.	To not necessarily discard pests that are currently minor, but had a higher importance in the past.
v (vector)	Known vector. The direct damage is rated with E1/E2/E3/EU, and 'v' is added if the pest is a vector. A vector that causes damage only by vectoring a pathogen is rated as E3v. A pest in a group containing many vectors (e.g. Cicadellidae), but with no evidence of being a vector is not rated 'v'	To allow to take account of vectors, even if their direct damage is minor.
d (on a different plant species)	Impact rated for a different plant species than the fruit studied. The highest rating is given. For example, a pest that would be E3 for the species studied, but E1 for another is rated E1d. A pest that would beE2 for the species studied and E3 for others would be rated E2.	To show where the rating was given for other crops than the fruit studied.

F. Intercepted

This criterion is intended to identify pests that are known to have moved in trade, i.e. which have been found in consignments at import during phytosanitary inspections. Rating is based on EU interception data and on information from other sources (EPPO Reporting Service, mention of interceptions in individual articles, PRAs including from non-EU countries, etc.). The fact that there is no interception record does not mean that a pest does not move with fruit consignment, as it may have not been detected, in particular if the fruit species is not subject to phytosanitary inspections. Any interception is recorded (e.g. also on plants for planting) as the commodity is not always specified. This criterion was always combined with others (and not used on its own to exclude pests from further consideration). The following ratings were used:

	Known to have been intercepted
F1	Yes, there are one or several interception records
FU	Not known to have been intercepted (no interception record for this pest in the sources considered)

G. Pest has spread/emerging pests

This is based only on the sources consulted to find other data. This criterion was always combined with others (and not used on its own to exclude pests from further consideration). The following ratings were used:

	Is there evidence that the pest has spread or is emerging?
G1	Yes (this takes account of spread/emergence of the pest between countries or inside a country)
G2	No
GU	Not known from the information available

G1 was used when this was specifically indicated in the literature. G2 was little used, but sometimes applied where a pest is recorded in only 1 country, without specific indication of spread within that country.

4.4 Process for collating information at Step 2

A stepwise approach was followed. Information was first sought on the following elements to identify pests falling under NO categories: pests that may not be transported on the fruit pathway; pests present in the EU

above the defined threshold; or pest for which the fruit species/genus studied is not a host. A few pests were also identified only at this stage as being regulated in the EU.

Additional information was then sought, but only for pests likely to be retained for the Alert List as per the categories defined in 4.5, i.e. starting with pests rated as A1/A2. No additional information was searched where a rating excluded a pest from being considered further for the Alert List (e.g. A4).

It should be noted that different information may lead to different ratings. This also means that assessors working on different crops may have rated pests differently, if they found different sources of information. When the pests were retained in several Alert Lists, information was compared to ensure consistency (see 5) between the Alert Lists.

4.5 Category rating at Step 2

The ratings and sub-ratings of the different criteria were used to allocate each pest to a category.
- Pests that fell in one of the NO categories were labelled as such (i.e. no evidence of association with the pathway, or the plant species are not hosts, or the pest is present in the area at risk above the threshold defined).
- Other pests were allocated to a number of categories by combining the different ratings and sub-ratings for relevant criteria. These categories were used for all fruit species considered.

Pests for the Alert List were then selected using these categories (see section 5).

4.6 Format of Step 2 Lists

The Step 2 Lists contain all pests considered at Step 2, as well information from the few sources consulted for each pest. All information for one pest was given in one row, citing the sources of information. The Step 2 Lists used the same format as the Step 1 Lists, with columns added for the rating of the different criteria. A conclusion column was kept.

Step 2 Lists are intended as a working tool. They are not complete, not intended to be published. A 'deliverable' xls file is made available on the Dropsa website as complement to the report for each crop. It contains:
- a list of pests considered for the selection for Alert List at Step 2, with details (i.e. Step 2 List including alert list pests, but without any pests not considered for the Alert List)
- a list of pests excluded from further consideration (all pests falling in NO categories at Step 1 and Step 2).

A warning explaining the content of the spreadsheet and the limitations was included in each xls file.

The report for each fruit contains a simplified version of these two lists (without any details, as annexes).

4.7 Conclusion of Step 2

A conclusion was given in the report for each fruit species:
- indicating the number of pests in Step 2 (including those retained from Step 1 and those deleted or added in Step 2), as well as the number of pests retained or excluded from further consideration.
- describing adjustments to the methods made specifically for the selected fruit.

5. Step 3: selection of pests for the Alert List

The pests in the categories corresponding to the ratings below were retained for Alert Lists.

Combination of criteria ratings and sub-ratings:

Note that subratings are covered in the ratings below (e.g. E1 covers E1u, E1h, E1d) except if explicitely excluded.

Place on Alert List	Combination of ratings covered in each part	Description. <u>All pests below are associated with the fruit</u>
Part 1 - Pests with high economic importance and more likely to transfer	• A1t/A2t + E1 (except E1u, E1h) + any other	• pests able to transfer, with a high economic impact currently (not uncertain high impact or high impact in the past)
Part 2 - Pests with lesser economic importance and more likely to transfer, or with high economic importance but less likely to transfer	• A1/A2 or A1ut/A2ut + E1 + any other	• pests less able to transfer (or with an uncertainty on transfer), with a high economic impact currently
	• A1t/A2t + E1u or E1h + any other	• pests able to transfer, with a high economic impact (but either with an uncertainty, or in the past)
	• A1t/A2t + E2+ (F1 or G1 or Cn)	• pests able to transfer, with a moderate economic impact currently, but intercepted, spreading/invasive or newly recorded on the crop.
	• A1t + E2 + any other	• non-mobile life stage associated with the fruit, pest able to transfer, with a moderate recorded impact currently
	• A1t/A2t + E3v or EUv + (F1 or G1 or Cn)	• pests able to transfer, known vector, with a low or unknown recorded impact currently, and intercepted, spreading/invasive or newly recorded on the crop
	• A1t/A2t + EU+ (F1 or G1 or Cn)	• pests able to transfer, with an unknown recorded impact currently, but intercepted, spreading/invasive or newly recorded on the crop

Part 2 covers heterogeneous categories of pests with different characteristics. It was not thought possible to further rank them by their level of risk. In Alert Lists, the pests were ordered by type (pathogen, acari, insect) and then in alphabetical order.

Pests in categories not retained for the Alert List were carefully screened and handpicked if necessary. Only a few pests were handpicked. In particular, attention was given to:

- A3 pests if likely to be associated with the commodity (i.e. associated to peduncles of apple, or rachis of grapevine).
- Pathogens that were not rated as 't'. There is often little information on the mobility of such pests, which consequently would normally not be rated as 't'. Using only the categories above, these pests would be retained on Alert Lists only if they were rated E1 (high impact).
- Recently described pests with specific evidence of interest for Alert Lists.

The number of pests selected in each category is given in the report for each crop. For pests retained for the Alert List, data was reviewed to improve consistency and ensure an appropriate level of details.

Some Alert Lists had pests in common. They were retained on all the lists concerned, and the information written specifically for the crop concerned in each list. The information and ratings were cross-checked between lists to avoid inconsistencies. However, some ratings and information may differ depending on the fruit studied.

The Alert Lists are annexed to the report for each crop. As part of the dissemination activities within the project, the Alert Lists will be presented to relevant EPPO Panels and stakeholders.

Some pests of the fruit studied that were not retained for the Alert List are highlighted in the report for that crop, if they are interesting from another point of view (e.g. important pests more likely to be transported on other pathways, pests with a limited distribution in the EU etc.). A separate document was also produced for pests of interest for other crops than the ones studied.

Finally, the report for each fruit contains a list of pests considered for the selection for the Alert List at Step 2, as well as a list of pests not considered for the Alert List (without details, corresponding to the xls file made available, see 4.6).

It should be underlined that the selection of pests for the Alert Lists needs to be done on the basis of some available information. Some organisms are not known as pests in the area of origin (or are even not known to science) before they appear as pests in a new area. Pests for which limited information is available, and with many unknowns, may become important if introduced in new places (such as was the case for *Drosophila suzukii*), but there is no way to identify those pests amongst the large number of those for which little information is available. However, the minimal requirement of a phytosanitary certificate may allow to identify 'unknown' pests associated with fruit consignments and possibly act before they are introduced.

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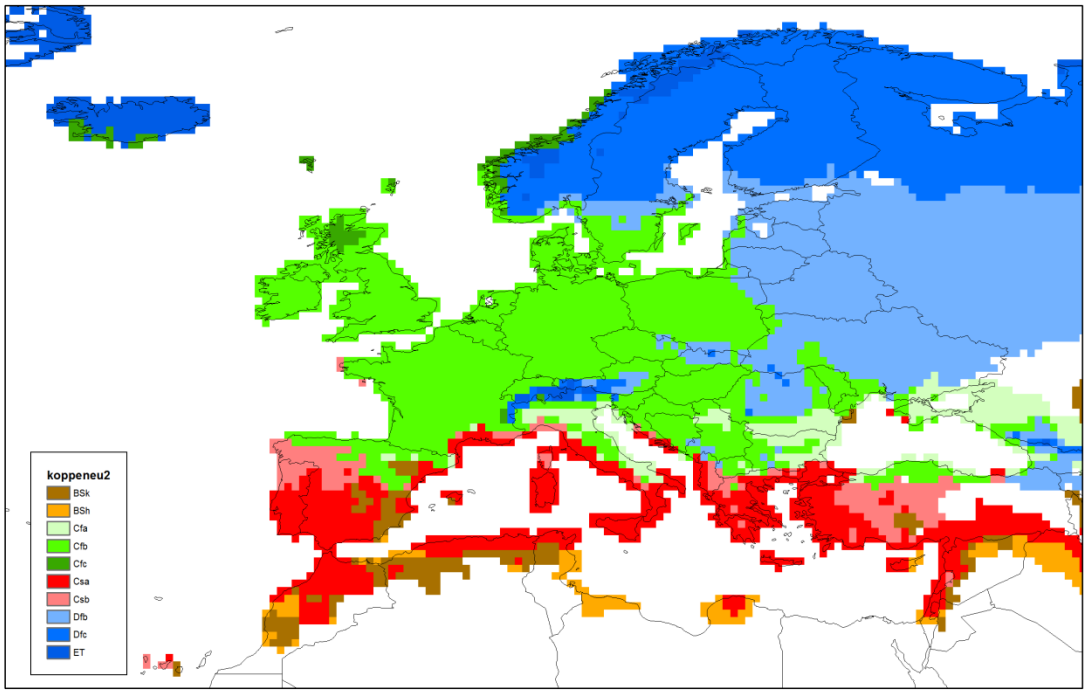
Rubel F, Kottek M. 2010. Observed and projected climate shifts 1901-2100 depicted by world maps of the Köppen-Geiger climate classification. Meteorol. Z., 19, 135-141.

Annex 1. Köppen Geiger climate types in the EU and the World 1976-2000 (provided by R. Baker, personal communication, 2014, based on Rubel, F., and M. Kottek, 2010).

Map 1. Europe



Map 2 World

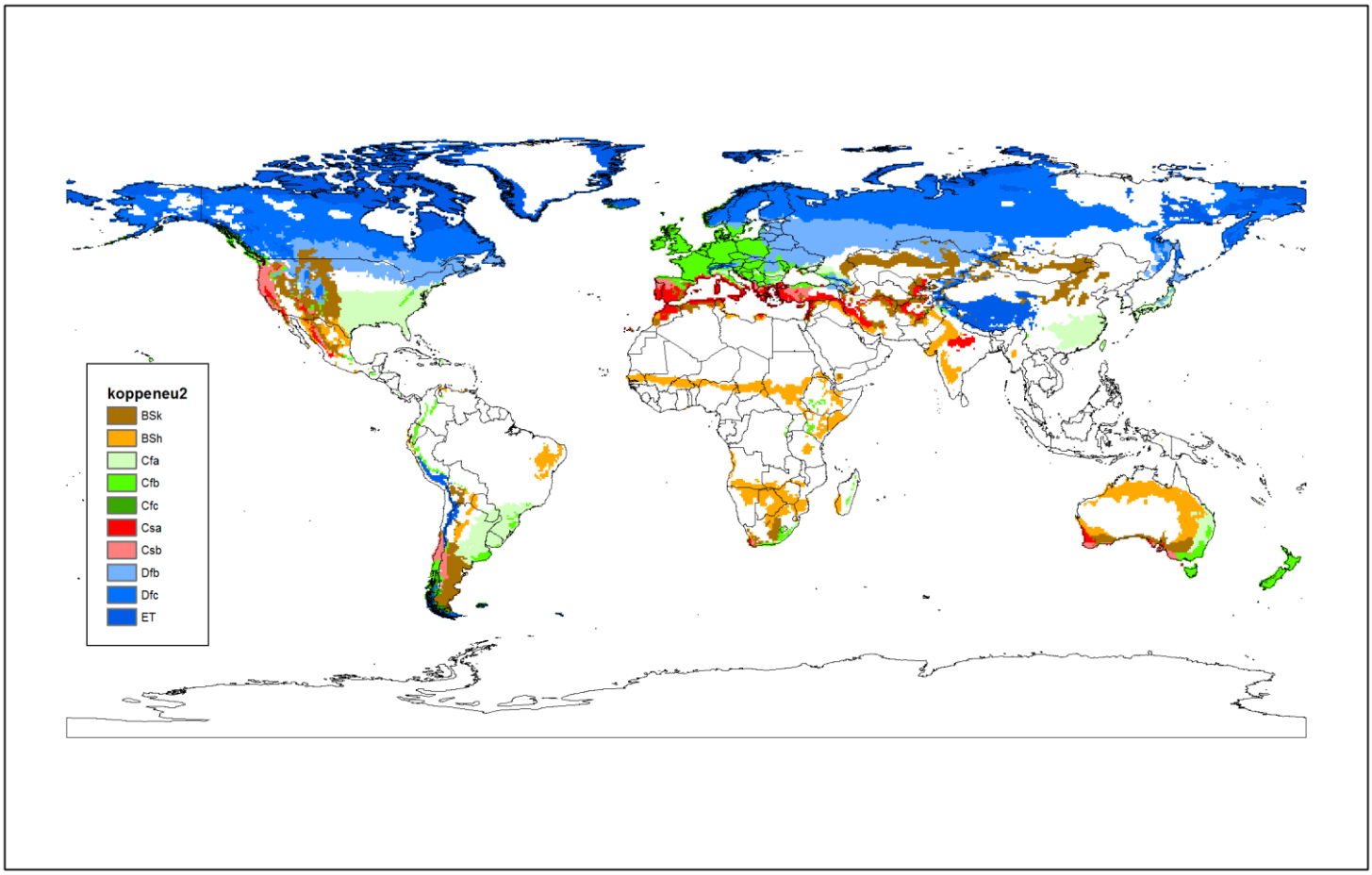


Table 1. Percentage in each country worldwide of the 10 climates present in the EU in countries (note: ET was excluded in the climatic similarity rating)

Country_name	BSk	BSh	Cfa	Cfb	Cfc	Csa	Csb	Dfb	Dfc	ET
Afghanistan	25.9%	6.0%	0%	0.8%	0%	19.5%	0.8%	0%	0%	2.0%
Albania	0%	0%	0%	8.3%	0%	41.7%	41.7%	8.3%	0%	0%
Algeria	5.5%	0.6%	0%	0%	0%	4.1%	0%	0%	0%	0%
Angola	0%	22.1%	0%	0%	0%	0%	0%	0%	0%	0%
Antarctica	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Argentina	28.5%	5.5%	28.5%	4.7%	1.7%	0.0%	5.7%	0.0%	0%	5.5%
Armenia	7.7%	0%	0%	0%	0%	0%	0%	76.9%	0%	0%
Australia	7.4%	28.2%	6.3%	4.7%	0%	1.4%	2.1%	0%	0%	0%
Austria	0%	0%	0%	48.7%	0%	0%	0%	28.2%	20.5%	2.6%
Azerbaijan	44.4%	0%	24.4%	2.2%	0%	11.1%	0%	13.3%	0%	0%
Bangladesh	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Belarus	0%	0%	0%	4.4%	0%	0%	0%	95.6%	0%	0%
Belgium	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%
Belize	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Benin	0%	7.7%	0%	0%	0%	0%	0%	0%	0%	0%
Bhutan	0%	0%	0%	0%	0%	0%	0%	0%	0%	15.4%
Bolivia	13.1%	3.0%	0.3%	1.6%	0%	0%	0%	0%	0%	3.6%
Bosnia & Herzegovina	0%	0%	4.5%	95.5%	0%	0%	0%	0%	0%	0%
Botswana	0%	67.5%	0%	0%	0%	0%	0%	0%	0%	0%
Brazil	0%	5.6%	8.4%	0.9%	0%	0%	0%	0%	0%	0%
Brunei	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bulgaria	0%	0%	51.1%	42.6%	0%	0%	0%	6.4%	0%	0%
Burkina Faso	0%	60.5%	0%	0%	0%	0%	0%	0%	0%	0%
Burundi	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cambodia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cameroon	0%	6.8%	0%	0%	0%	0%	0%	0%	0%	0%
Canada	0.8%	0%	0%	0.6%	0.1%	0%	0.1%	12.8%	43.9%	35.5%
Central African Rep.	0%	7.4%	0%	0%	0%	0%	0%	0%	0%	0%
Chad	0%	19.6%	0%	0%	0%	0%	0%	0%	0%	0%
Chile	2.6%	0%	0%	11.8%	18.3%	0%	17.3%	0%	0%	27.1%
China	10.1%	0%	11.9%	0.2%	0%	0%	0%	0.4%	0.6%	18.2%
Colombia	0%	0%	0%	8.3%	0%	0%	0.3%	0%	0%	0%
Comoros	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Congo	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Congo. DRC	0%	0%	0%	0.7%	0%	0%	0%	0%	0%	0%
Costa Rica	0%	0%	0%	6.7%	0%	0%	0%	0%	0%	0%
Cote d'Ivoire	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Croatia	0%	0%	3.6%	85.7%	0%	3.6%	7.1%	0%	0%	0%
Cuba	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cyprus	0%	25.0%	0%	0%	0%	75.0%	0%	0%	0%	0%
Czech Republic	0%	0%	0%	92.5%	0%	0%	0%	7.5%	0%	0%
Denmark	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%
Djibouti	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Dominican Republic	0%	0%	0%	12.5%	0%	0%	0%	0%	0%	0%
Ecuador	0%	3.6%	0%	26.5%	0%	0%	1.2%	0%	0%	0%

Country_name	BSk	BSh	Cfa	Cfb	Cfc	Csa	Csb	Dfb	Dfc	ET
Egypt	0%	0.3%	0%	0%	0%	0%	0%	0%	0%	0%
El Salvador	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Equatorial Guinea	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Eritrea	0%	37.5%	0%	0%	0%	0%	0%	0%	0%	0%
Estonia	0%	0%	0%	3.7%	0%	0%	0%	96.3%	0%	0%
Ethiopia	0%	17.1%	0%	6.0%	0%	0%	0.3%	0%	0%	0%
Falkland Is.	0%	0%	0%	0%	25.0%	0%	0%	0%	0%	75.0%
Faroe Is.	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%
Fiji	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Finland	0%	0%	0%	0%	0%	0%	0%	6.8%	92.8%	0.4%
France	0%	0%	0.4%	90.1%	0.8%	4.3%	3.2%	0%	1.2%	0%
French Guiana	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Gabon	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Georgia	0%	0%	24.1%	13.8%	0%	0%	0%	55.2%	3.4%	0%
Germany	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%
Ghana	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Greece	0%	0%	2.0%	3.9%	0%	72.5%	21.6%	0%	0%	0%
Greenland	0%	0%	0%	0%	0%	0%	0%	0%	0%	29.3%
Guadeloupe	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Guatemala	0%	0%	0%	12.8%	0%	0%	0%	0%	0%	0%
Guinea	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Guinea-Bissau	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Guyana	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Haiti	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Honduras	0%	0%	2.8%	0%	0%	0%	0%	0%	0%	0%
Hungary	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%
Iceland	0%	0%	0%	0%	8.3%	0%	0%	0%	0%	91.7%
India	0.1%	22.0%	0.1%	0.6%	0%	6.9%	0%	0.4%	1.2%	1.5%
Indonesia	0%	0%	0%	0.2%	0%	0%	0%	0%	0%	0%
Iran	21.2%	8.9%	1.0%	0%	0%	17.2%	0%	0%	0%	0%
Iraq	0%	19.9%	0%	0%	0%	9.9%	0%	0%	0%	0%
Ireland	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%
Israel	0%	28.6%	0%	0%	0%	28.6%	0%	0%	0%	0%
Italy	0%	0%	24.8%	26.4%	0%	34.1%	4.7%	0.8%	4.7%	4.7%
Jamaica	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Japan	0%	0%	57.9%	2.0%	0%	0%	0%	36.2%	2.0%	0%
Jordan	8.6%	2.9%	0%	0%	0%	2.9%	0%	0%	0%	0%
Kazakhstan	37.9%	0%	0%	0%	0%	0.8%	0%	25.5%	1.7%	0.3%
Kenya	0%	37.4%	0%	9.6%	0%	0%	1.1%	0%	0%	0%
Kuwait	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Kyrgyzstan	15.3%	0%	0%	0%	0%	0%	0%	11.8%	25.9%	11.8%
Laos	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Latvia	0%	0%	0%	11.4%	0%	0%	0%	88.6%	0%	0%
Lebanon	0%	0%	0%	0%	0%	75.0%	25.0%	0%	0%	0%
Lesotho	0%	0%	0%	58.3%	0%	0%	0%	0%	0%	0%

Country_name	BSk	BSh	Cfa	Cfb	Cfc	Csa	Csb	Dfb	Dfc	ET
Liberia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Libya	0%	4.9%	0%	0%	0%	1.2%	0%	0%	0%	0%
Lithuania	0%	0%	0%	2.6%	0%	0%	0%	97.4%	0%	0%
Luxembourg	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%
Macedonia	0%	0%	18.2%	63.6%	0%	0%	9.1%	9.1%	0%	0%
Madagascar	0%	13.1%	8.0%	5.5%	0%	0%	0%	0%	0%	0%
Malawi	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Malaysia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mali	0%	17.1%	0%	0%	0%	0%	0%	0%	0%	0%
Malta	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%
Mauritania	0%	0.3%	0%	0%	0%	0%	0%	0%	0%	0%
Mexico	12.8%	23.6%	1.7%	1.4%	0%	5.4%	3.3%	0%	0%	0%
Moldova	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%
Mongolia	32.8%	0%	0%	0%	0%	0%	0%	0%	0%	3.4%
Morocco	19.2%	9.0%	0%	0%	0%	34.6%	0%	0%	0%	0%
Mozambique	0%	23.6%	0%	0%	0%	0%	0%	0%	0%	0%
Myanmar	0%	5.6%	0%	0.4%	0%	0%	0%	0%	0%	0.4%
Namibia	0.7%	33.1%	0%	0%	0%	0%	0%	0%	0%	0%
Nepal	0%	0%	0%	0%	0%	0%	0%	0%	0%	19.2%
Netherlands	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%
New Caledonia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
New Zealand	0%	0%	0%	86.7%	12.5%	0%	0%	0%	0%	0.8%
Nicaragua	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Niger	0%	5.0%	0%	0%	0%	0%	0%	0%	0%	0%
Nigeria	0%	21.1%	0%	0%	0%	0%	0%	0%	0%	0%
North Korea	0%	0%	0%	0%	0%	0%	0%	4.2%	0%	0%
Norway	0%	0%	0%	6.2%	6.2%	0%	0%	2.9%	72.0%	12.8%
Oman	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pakistan	7.4%	12.6%	3.1%	0.6%	0%	0.9%	0.6%	2.2%	3.4%	2.5%
Panama	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Papua New Guinea	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Paraguay	0%	16.9%	38.7%	0%	0%	0%	0%	0%	0%	0%
Peru	1.6%	1.9%	0%	7.7%	0%	0%	0%	0%	0%	15.7%
Philippines	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Poland	0%	0%	0%	87.7%	0%	0%	0%	12.3%	0%	0%
Portugal	0%	0%	0%	0%	0%	69.2%	30.8%	0%	0%	0%
Puerto Rico	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Qatar	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Romania	0%	0%	23.2%	33.9%	0%	0%	0%	40.2%	2.7%	0%
Russia	0.7%	0%	0.5%	0.1%	0%	0%	0%	14.3%	46.8%	11.5%
Rwanda	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%
Sao Tome & Principe	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Saudi Arabia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Senegal	0%	54.4%	0%	0%	0%	0%	0%	0%	0%	0%
Serbia & Montenegro	0%	0%	16.3%	72.1%	0%	2.3%	0%	9.3%	0%	0%
Sierra Leone	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Slovakia	0%	0%	0%	46.2%	0%	0%	0%	50%	3.8%	0%

Country_name	BSk	BSh	Cfa	Cfb	Cfc	Csa	Csb	Dfb	Dfc	ET
Slovenia	0%	0%	0%	88.9%	0%	0%	0%	0%	11.1%	0%
Solomon Is.	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Somalia	0%	37.3%	0%	0%	0%	0%	0%	0%	0%	0%
South Africa	22.0%	19.8%	4.2%	8.2%	0%	0.7%	1.8%	0%	0%	0%
South Georgia & the South Sandwich Is.	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
South Korea	0%	0%	14.3%	0%	0%	0%	0%	4.8%	0%	0%
Spain	13.0%	0%	2.3%	22.7%	0%	41.7%	20.4%	0%	0%	0%
Sri Lanka	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sudan	0%	26.7%	0%	0%	0%	0%	0%	0%	0%	0%
Suriname	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Svalbard	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Swaziland	0%	40%	0%	0%	0%	0%	0%	0%	0%	0%
Sweden	0%	0%	0%	14.7%	0%	0%	0%	12.2%	67.9%	5.1%
Switzerland	0%	0%	0%	50%	5.6%	0%	0%	0%	11.1%	33.3%
Syria	17.8%	17.8%	0%	0%	0%	21.9%	1.4%	0%	0%	0%
Tajikistan	15.3%	0%	0%	0%	0%	5.1%	0%	0%	0%	33.9%
Tanzania	0%	10.3%	0%	1.0%	0%	0%	0%	0%	0%	0%
Thailand	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
The Bahamas	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
The Gambia	0%	33.3%	0%	0%	0%	0%	0%	0%	0%	0%
Timor Leste	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Togo	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trinidad & Tobago	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tunisia	15.3%	15.3%	0%	0%	0%	11.9%	0%	0%	0%	0%
Turkey	3.7%	0%	0.9%	9.0%	0%	36.5%	24.5%	4.6%	0%	0%
Turkmenistan	25.5%	0%	0%	0%	0%	1.5%	0%	0%	0%	0%
Uganda	0%	3.8%	0%	2.6%	0%	0%	0%	0%	0%	0%
Ukraine	0%	0%	7.4%	12.8%	0%	0%	0%	77.7%	0.3%	0%
United Arab Emirates	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
United Kingdom	0%	0%	0%	90.3%	9.7%	0%	0%	0%	0%	0%
United States	15.4%	1.0%	21.7%	2.2%	0.5%	1.1%	4.6%	15.4%	12.6%	6.8%
Uruguay	0%	0%	94.3%	5.7%	0%	0%	0%	0%	0%	0%
Uzbekistan	17.2%	0%	0%	0%	0%	14.0%	0.5%	0%	0%	0%
Vanuatu	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Venezuela	0%	2.0%	0%	0.7%	0%	0%	0%	0%	0%	0%
Vietnam	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
West Bank	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%
Western Sahara	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yemen	4.5%	5.8%	0%	0%	0%	0%	0%	0%	0%	0%
Zambia	0%	12.0%	0%	0%	0%	0%	0%	0%	0%	0%
Zimbabwe	0%	59.6%	0%	0%	0%	0%	0%	0%	0%	0%