Opinion of the Scientific Panel on Plant Health on the Pest Risk Analysis made by Spain on *Bactrocera zonata*[1]

(Question N° EFSA-Q-2006-052)

Opinion adopted by written procedure on 27 February 2007

SUMMARY

The European Commission requested EFSA to provide a scientific opinion on the Pest Risk Analysis (PRA) made by Spain on *Bactrocera zonata*, a fruit fly listed in the quarantine list of the Community plant health legislation (Council Directive 2000/29/EC) and in particular to consider the threats posed by *Bactrocera zonata* to the whole Community, to identify the fruit species at risk and to determine whether the management measures proposed are appropriate.

Bactrocera zonata (Saunders), the peach fruit fly, attacks ripe fruit of many species, especially mango, peach and guava, rendering them inedible. It is common in many tropical and sub-tropical countries of Asia, especially the Indian sub-continent, and has recently invaded Egypt. It is absent from the European Community and listed in Annex I Part A Section I of the Council Directive 2000/29/EC under the synonym *Dacus zonatus* as a harmful organism whose introduction into, and spread within, all member states shall be banned. In 2005, Spain detected *Bactrocera* larvae, assumed to be *B. zonata*, in two consignments of citrus from Egypt and conducted a pest risk assessment and an analysis of risk management options following the 1997 version of the EPPO pest risk analysis (PRA) scheme. The Spanish PRA concluded that *B. zonata* poses a serious threat to fruit production in the Mediterranean countries of Europe and that appropriate management measures should include phytosanitary treatments before export, targeted entry inspections and the prohibition of fruit carried by passengers.

The EFSA Scientific Panel on Plant Health conducted a detailed review of the Spanish PRA and concluded that the PRA does provide sufficient evidence to support the listing of *B. zonata* in Annex I Part A Section I of the Council Directive 2000/29/EC. The additional work required to determine the threat to the whole community, identify the fruit species at greatest risk and select the most appropriate management options is outlined.

[1] For citation purposes: Opinion of the Scientific Panel on Plant Health on a request from the Commission on Pest Risk Assessment made by Spain on *Bactrocera zonata*. The EFSA Journal (2007) 467, 1-25.

The Panel found that, although the Spanish pest risk assessment could be improved, it did provide sufficient evidence to justify an analysis of risk management options. It confirmed that *B. zonata* is capable of entering, establishing, spreading and causing significant impacts on fruit production in southern member states. However, the pest risk assessment could be improved, principally by (a) clearly defining the PRA area, (b) updating, extending and analysing data on the different pathways *B. zonata* could enter the Community, (c) conducting a detailed assessment of the climatic suitability of the EC for *B. zonata*, (d) defining which member states and areas are most endangered, (e) identifying the fruit species that are most at risk, (f) further exploring the potential impacts on export markets and (g) summarising the key uncertainties.

The Spanish analysis of risk management options could also be enhanced since it (i) follows an old EPPO standard that contains a number of ambiguities and inconsistencies, (ii) does not analyse a key pathway (fresh fruit carried by passengers) in detail, (iii) rejects or fails to recognise several management options that, while insufficient on their own, could, when combined with others, form part of a systems approach, (iv) overlooks measures, such as surveillance trapping, the male annihilation technique and insecticides, that can be very effective in the importing country and (v) does not determine the extent to which the measures identified interfere with trade, are cost-effective and have no undesirable social or environmental consequences.

Key words: *Bactrocera zonata*, peach fruit fly, pathway analysis, systems approach

TABLE OF CONTENTS

BACKGROUND[2]

The current Community plant health regime is established by Council Directive 2000/29/EC on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community (OJ L 169, 10.7.2000, page 1), as last amended by the Commission Directive 2006/35/EC (OJ L 88, 25.3.2006, page 9).

The Directive lays down amongst others, the technical phytosanitary provisions to be met by plants and plant products and the control checks to be carried out at the place of origin on plants and plant products destined for the EC or to be moved within the EC, the list of harmful organisms whose introduction into or spread within the EC is prohibited and the control measures to be carried out at the border of the EC on arrival of plants and plant products. A harmful organism is defined in its Article 2.1(e) as: any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products.

In Annex I, Part A, Section I[3], point 25, fruit flies, Tephritidae (non-European) are listed whose introduction into and spread within the Community shall be banned. In Annex IV, Part A, Section I, point 16.5 specific requirements for fruits of *Citrus*, *Fortunella*, *Poncirus* and their hybrids originating in third countries where Tephritidae (non-European) are known to occur are mentioned.

Recently, Spain has intercepted citrus fruit originating in Egypt infested with *Bactrocera* spp. This is very worrying as at present the organism is still absent in the Community. Moreover, a workshop organised by the European and Mediterranean Plant Protection Organization (EPPO) held in Paris (2002), recognised the potential economic importance of this harmful organism for the EPPO region, and believed that countries neighbouring Egypt are at risk, while other Mediterranean countries are also exposed. Moreover, the Workshop believed that fruits of all species coming from infested areas constituted potential pathways as the organism has a wide host range.

Spain has therefore prepared a pest risk analysis (PRA) for the organism and has defined the Community Mediterranean countries as the endangered area.

The PRA has been made according to the Guidelines for the European and Mediterranean Plant Protection Organization (EPPO) pest risk assessment scheme in EPPO Standard PM 5/3(1) (EPPO Bulletin 27, 281-305). This scheme aims at assessing the potential risk of a particular pest (or harmful organism) for a clearly defined area through quantitative evaluation of that risk based on questions to which replies are given on a 1 – 9 scale. Expert judgement is used in interpreting these replies. Moreover, a data sheet containing the most important data on the organism has been made according to the EPPO Standard PM 5/1 on Checklist of information required for the PRA (EPPO Bulletin 23, 191-198). The guidelines are based on many years experience of EPPO experts in the EPPO Panel on PRA and the

[2] Submitted by European Commission, ref. SANCO E1/VE/svi D(2006) 510301
[3] Hereinafter referred to as Annex IAI

EPPO Panel on phytosanitary measures. They conform with the International Standards on Phytosanitary Measures (ISPM) No 11 (Guidelines on PRA for quarantine pests) and use the terms of ISPM No 5 (Glossary of phytosanitary terms).

The PRA also contains the information on pest risk management according to the revised EPPO Standard PM 5/3(2) (not yet published- but available on the EPPO website). It identifies management options for reducing the risk identified under the above pest risk assessment phase. These measures are evaluated for efficacy, feasibility and impact in order to select those measures that are appropriate.

TERMS OF REFERENCE

EFSA is requested, pursuant to Article 29(1) and Article 22(5) of Regulation (EC) No 178/2002, to provide a scientific opinion on the PRA made by Spain on *Bactrocera zonata* and in particular on:

a) whether this organism can be considered as a harmful organism in the meaning of the definition mentioned in article 2.1. (e) of Directive 2000/29/EC, for

   - the endangered PRA area identified by Spain, i.e. the Community Mediterranean countries, or
   - for a wider area, i.e. the whole of the Community,
   - for which fruits,

and thus potentially eligible for addition to the list of harmful organisms in Directive 2000/29/EC;

b) whether the identified management options for reducing the risk identified at the pest risk assessment phase, are appropriate through an evaluation of their efficacy, feasibility and impact.

ASSESSMENT

1. Introduction

The peach fruit fly, *Bactrocera zonata* (Saunders) attacks ripe fruit of many species, especially mango, peach and guava, rendering them inedible. It is common in many tropical and sub-tropical countries of Asia, especially the Indian sub-continent, and is absent from the European Community. In 2005, Spain detected *Bactrocera* larvae, assumed to be *B. zonata*, in two consignments of citrus from Egypt and conducted a pest risk assessment and an analysis of risk management options following the 1997 version of the EPPO pest risk analysis (PRA) scheme (EPPO, 1997).

2. Procedures for reviewing the Pest Risk Analysis by Spain

The Scientific Panel on Plant Health[4] reviewed the Pest Risk Analysis[5] made by Spain for *Bactrocera zonata* in detail. Where the Panel has uncovered new information that supports the PRA, this has been noted. While the literature has been checked and additional data, e.g. on import pathways, has been sought, no new analysis has been undertaken.

Comments have been made only for the questions where it was considered that the PRA is incorrect or could be improved. The Panel has noted where it considers the risk scores provided by Spain were too low or too high but has not suggested an exact score. The comments on the PRA follow the sequence of the PRA itself.

3. Detailed analysis of the PRA by Spain

3.1. THE PEST RISK ASSESSMENT FOR *BACTROCERA ZONATA* BY SPAIN

3.1.1. Initiation (Stage 1)

The scientific name (Stage 1, point 1) is given in the PRA as: "*Bactrocera zonata* (Saunders) (Diptera: Tephritidae); synonyms: *Dacus zonatus* (Saunders), *Dasyneura zonata* Saunders, *Rivellia persicae* Bigot; common names: Peach fruit fly, guava fruit fly". However, it is important to note that tephritid larvae cannot be easily distinguished and must be bred to adults to confirm their identification. In some cases, confusion has been reported in the literature, e.g. its recorded presence in Indonesia is erroneous and should be *B. maculigera* (CABI, 2006).

The PRA area (Stage 1, point 3) is defined as: "Community Mediterranean countries". This is not clear because there is no accepted definition. The Community Mediterranean countries could be considered in two ways: (i) those that border the Mediterranean Sea (Spain, France, Italy, Slovenia, Greece, Malta and Cyprus) or (ii) those with a Mediterranean climate. Neither definition is satisfactory. France borders the Mediterranean but northern France cannot be considered to be Mediterranean. The same is true for several other southern Community countries, e.g. Spain. Various different maps of Mediterranean climate exist. Bouma's (2005) Mediterranean agroclimatic zone differs considerably from the modified Köppen Mediterranean climate area mapped by the European Climate Support Network (ECSN, 1995) and the three Mediterranean environmental zones proposed by Metzger *et al*. (2005). The International Standard for Phytosanitary Measures (ISPM) No 11 (FAO, 2004) states that the "PRA area should be defined as precisely as possible in order to identify the area for which information is needed" and the European and Mediterranean Plant Protection Organisation (EPPO) PRA scheme (EPPO, 2006) states that "The PRA area can be a complete country, several countries or part(s) of one or several countries." In this case, as in the majority of

[4] Hereinafter: the Panel
[5] Hereinafter: PRA

PRAs relevant to the European Community (EC) as a whole, it would be more appropriate to define the current EC (i.e. excluding accession countries) as the PRA area.

No PRA for Europe exists (point 4); however, PRAs for Jordan (Bahdousheh *et al.*, 2001) and the USA (APHIS, 2003) provide useful information.

3.1.2. Qualitative criteria of a quarantine pest (Stage 2, Section A)

The pest does not occur in the PRA area (Section A, point 7). However, it is not clear whether any EC member state, apart from Spain, is trapping for this species. There has been a recent report of *B. zonata* in Lebanon (Chahine, 2006) and confirmation is required.

As noted in the pest risk assessment, *B. zonata* is highly polyphagous and would have no difficulty in finding hosts in the PRA area (Section A, point 9). It is also important to note that, except in winter, which is probably passed in the dormant stage as a pupa in the soil or as fully developed larvae in fallen fruit, *B. zonata* needs a continuous supply of fresh ripe fruit. If fresh ripe fruit are unavailable, as in cooler areas during late spring/early summer, adults will be unable to lay eggs.

3.1.3. Entry (Stage 2, Section B)

The following pathways are listed in the pest risk assessment (Section B, question 1): "Transport of infested fruits either through trade or by travellers and means of transport". These should be more clearly described by listing them as follows:

- the countries where the species is present,
- the hosts (divided into major and minor),
- trade pathways (trade in fresh fruit),
- other pathways (passengers, mail).

At present, *B. zonata* cannot reach the EC from Egypt by natural spread so this pathway need not be considered in detail (though a comment to this effect should be added to the pest risk assessment). However, if the species enters other countries bordering the Mediterranean, this may change and it is important that southern EC member states and neighbouring countries undertake a surveillance programme.

The pest risk assessment gives a low score for the number of pathways (Section B, question 1.1) as "3". However, several pathways have been identified in question 1 (see above) and so this should be a higher score.

The pest risk assessment only assesses the entry potential of "fruits" (Section B, question 1.2). This pathway should be more clearly defined and the different methods by which fruit can enter the PRA area should be considered separately. The question asks that these be placed in descending order of preference. The following order may be appropriate: (a) fresh fruit as a commodity from Egypt, (b) fresh fruit as a commodity from other countries where the pest is

present, e.g. India and Pakistan, and (c) fruit carried by passengers, e.g. as gifts, from countries where the pest is present. The Panel has assumed that the Spanish pest risk assessment is considering fresh fruit as a commodity from Egypt and has restricted the comments to this pathway. It is important to note that, although there have been detections in citrus consignments, (a) citrus is not a major host and (b) *B. zonata* population densities may not be high in areas of citrus monoculture unless there are other fruit tree species nearby (see the PRA Section B, question 1.4). Although a larger quantity of fruit hosts enters the EC from India and Pakistan, it is assumed that Egyptian produce poses a higher risk because Egyptian *B. zonata* is likely to have adapted to cooler climatic conditions. *B. zonata* is capable of surviving winters with temperatures at or close to freezing in North Sinai (William Routhier, IAEA[6] Consultant, personal communication).

As stated in the pest risk assessment, the pest is very likely to be associated with the pathway (fresh fruit as a commodity from Egypt) because the pest is widespread and at high population densities in Egypt (Section B, question 1.3b). However, there is insufficient evidence from the literature to confirm what proportion of the *B. zonata* population in Egypt spends the cooler months as pupae in the soil (and therefore will not be carried by the pathway). Nevertheless, three years of trapping data confirm that adult *B. zonata* can be found in northern Egypt during the winter months (W. Routhier, pers. comm.).

The concentration of the pest on the pathway at origin may be moderately high (Section B, question 1.4) but *B. zonata* is most common in private gardens where fruit is available throughout the year (EPPO, 2002) and these fruit are only likely to be transported by passengers. It is also common in commercial orchards of peach, fig and guava. Citrus is not a major host and population densities in these orchards will be lower. There is no evidence that apricots are attacked, though they are closely related to peach and likely to be a suitable host.

B. zonata is a serious pest and there has been little success in controlling it in Egypt (Section B, question 1.5b). However, Egypt is now planning a major campaign against *B. zonata* and population densities are likely to fall (Walther Enkerlin, IAEA, pers. comm.).

The pest is likely to survive and remain undetected during existing Community phytosanitary procedures (Section B, question 1.6) so the score of "6" in the pest risk assessment is too low. Although puncture holes are difficult to see, detections do occur (often when ripe fruit begins to rot). Annex V Part B Section I(3.) of the Directive 2000/29/EC[7] states that the following fruit, including major hosts of *B. zonata*, must be subject to a plant health inspection in the country of origin or the consignor country in the EC, if originating outside the community, before being permitted to enter the community:

- *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids, *Momordica* L. and *Solanum melongena* L. originating in all countries outside the EC.

[6] International Atomic Energy Agency
[7] OJ L169, 10.7.2000, p.90

- *Annona* L., *Cydonia* Mill., *Diospyros* L., *Malus* Mill., *Mangifera* L., *Passiflora* L., *Prunus* L., *Psidium* L., *Pyrus* L., *Ribes* L., *Syzygium* Gaertn., and *Vaccinium* L., originating in non-European countries.

However, despite the requirement for inspections, the number of detection records of *B. zonata* by EC member states may be low because, in addition to the difficulty of detection, larvae can only be identified to the genus level and have to be reared carefully to confirm species identification. Although some post-harvest treatments would be effective against *B. zonata*, there is no approved method or combination of methods. The pest is likely to survive in transit (Section B, question 1.7a,b) and a number of EC detection records exist, including those by Spain in March and April 2005 of *Bactrocera* sp. at the port of Valencia in consignments of oranges from Egypt (Spanish Plant Protection Organization, 2005). Although *B. zonata* was not confirmed, the only other *Bactrocera* species present in Egypt, *B. cucurbitae*, does not attack citrus. Larvae are likely to pupate after 15 days, but live pupae will then be present in the consignment and they are likely to survive.

For the amount of movement along the pathway, the pest risk assessment states (Section B, question 1.9) that the "import volume of citrus fruits from Egypt to Spain reached approximately 14,000 tonnes during the season 2004/2005. Other potential hosts, different from *Citrus* spp., are also imported by countries of the PRA area. The imported fruits are the following: *Pyrus* spp., *Malus* spp., *Ficus* spp., *Solanum* spp., *Cucumis* spp., *Prunus* spp. (except *P. dulcis*), *Mangifera indica*. Spain has no records of the amounts of fruits imported by other Mediterranean countries." These data need to be resolved with those provided by FAOSTAT (2006) which show that Spain imported 44 tonnes of oranges (and no other citrus species) from Egypt in 2004. However, it is important to note that (a) citrus is only a minor host for *B. zonata* and (b) very large quantities of major hosts, e.g. mangoes, are imported from countries, e.g. India and Pakistan, where the pest is indigenous. In 2004, Egypt exported 47 tonnes of mangoes to the EC (1 tonne to Spain), India exported 18,496 tonnes (1 tonne to Spain) and Pakistan exported 10,771 tonnes (22 tonnes to Spain) (FAOSTAT, 2006).

The pest risk assessment (Section B, question 1.10) gives a relatively low score of "6" regarding the distribution throughout the PRA area. However, the commodity is likely to be widely distributed so a higher score would be appropriate.

The pest risk assessment (Section B, question 1.11) gives a relatively high score of "7" for the degree to which different consignments are widely spread in time. However, the comment states that Spanish imports of Egyptian citrus are limited to January to April and other fruit are mainly imported from June to August suggesting a lower score would be appropriate. It would be useful to obtain monthly fruit import data for other countries. During the winter months, *B. zonata* will find it more difficult to survive and transfer to a suitable host.

For transfer from the pathway to a suitable host, the pest risk assessment (Section B, question 1.12b) gives a relatively low score of "6". However, fruit fly infested fruit are likely to be discarded, host plants are available throughout the PRA area, especially in gardens where

many different fruit trees are likely to be present, and *B. zonata* is a strong flier suggesting that a higher score would be appropriate.

As stated in the pest risk assessment, the intended use of the commodity (Section B, question 1.13), primarily fresh market consumption, will aid introduction but the pest risk assessment gives a surprisingly low score of "6". Although imports of fresh fruit to Spain for personal consumption are likely to be of high quality, fruit with larvae are likely to be discarded and not eaten, so the pest will survive. If imported for processing to juice or jam they are likely to be less subject to inspection, but might be expected to be of lower quality and the pest may still survive unless an effective waste disposal procedure is carried out.

It would be useful for the pest risk assessment to summarise the overall potential for entry before continuing to assess establishment.

3.1.4. Establishment (Stage 2, Section B)

The pest risk assessment (Section B, question 1.14) notes that there are very large numbers of cultivated and non-cultivated hosts. However, it is important to distinguish between major hosts (peach, mango, guava) and minor hosts, e.g. citrus (White & Elson-Harris, 1994; CABI, 2006).

The pest risk assessment states that hosts of *B. zonata* are very widespread (Section B, question 1.15). However, the ripe fruit needed for oviposition may be absent in late spring/early summer in cooler areas of southern EC member states. The importance of considering the temporal availability of hosts is not clearly stated in the EPPO PRA Scheme.

As noted in the pest risk assessment, wild host plants are widespread (Section B, question 1.19) in the PRA area. Uncultivated *Opuntia* (prickly pear) and *Ficus* (fig) may also help establishment.

The pest risk assessment gives a very high score ("9") for the similarity between the climatic conditions in the PRA area and the area of origin (Section B, question 1.20). However, *B. zonata* is native to areas of Asia with very hot climates, e.g. India and Pakistan. Its presence in northern Egypt shows that it has adapted to a Mediterranean climate but further analysis is required to determine whether the monthly range in maximum-minimum temperatures and rainfall is similar to those experienced in EC member states with Mediterranean climates. Minimum winter temperature is a key factor to analyse. Particular emphasis should be given to locations in northern Sinai, e.g. Rafa and El-Arish, where *B. zonata* is present throughout the year even though temperatures can fall at or close to freezing in winter (W. Routhier, pers. comm.). A variety of techniques could be used, starting with (a) a straightforward graphical comparison of monthly max-min temperatures, rainfall etc at Alexandria or El Arish and weather stations throughout countries of the EC bordering the Mediterranean and leading on to (b) calculations of degree days above the minimum temperature threshold for *B. zonata* at different locations, (c) the use of climatic matching software, e.g. the CLIMEX Match Index (Sutherst *et al*., 2004), and (d) an attempt to estimate the potential distribution of *B. zonata*

using the "Compare Locations" facility in CLIMEX that calculates an ecoclimatic index based on current distribution and the publications that explore the relationship between temperature and *B. zonata* development. Gridded climatologies (New *et al.*, 1999) are preferable to weather station data because these provide an interpolated climate relevant to the landscape, based on elevation, latitude and longitude. The results can be imported to a geographical information system (GIS) to map potential distribution based on current and future climates predicted by global circulation models. Some of the difficulties to be borne in mind when predicting the potential distribution of *B. zonata* based on climate include (i) the indication that *B. zonata* in Egypt may have adapted to the cooler weather in the Nile delta and northern Sinai so published experimental data from other areas may not be relevant, (ii) *B. zonata* is very common in Alexandria, Rafa and El-Arish and these locations are therefore not representative of locations at the edge of its potential range based on climatic responses, (iii) 30 year climatic means provided in global gridded climatologies do not reflect the substantial climatic warming that has occurred in the last 10 years or so and (iv) the role of microclimate, which provides very different climatic conditions to those locations where the weather is recorded. In addition to northern Egypt, it may also be appropriate to study the climatic conditions in the San Joaquin Valley in California, where *B. zonata* appears to have survived freezing temperatures during the winter (W. Routhier, pers. comm.).

No score for the similarity of other abiotic factors is given in the pest risk assessment (Section B, question 1.21). However, the Tephritidae are less affected by abiotic factors other than temperature and, since they are likely to be the same in the PRA area, this could be given a very high score.

As stated in the pest risk assessment, *B. zonata* is very unlikely to have competition from existing species in the PRA area (Section B, question 1.22). It is a strong competitor and in Egypt it is now more common in bait traps than the Mediterranean fruit fly, *Ceratitis capitata* (Saafan *et al.*, 2005). In Réunion it has become dominant in the lowlands, restricting *C. capitata* to the highlands and showing that it can also outcompete other native and alien *Ceratitis* species (*C. catoirii* and *C. rosa*) (Duyck *et al.*, 2006). It is probable that *C. capitata* is better adapted to cooler conditions (Papadopoulos *et al.*, 1996; Duyck *et al.*, 2004b) than *B. zonata* but competitive interactions are very unlikely to affect pest establishment. The two species have different host preferences. *C. capitata* prefers citrus (Duyck *et al.*, 2004a).

As stated in the pest risk assessment, *B. zonata* establishment is very unlikely to be prevented by existing natural enemies in the PRA area (Section B, question 1.23). Successful biological control would have to be augmentative since, for biological reasons, there have been no successful classical biological control releases for fruit fly pests.

The pest risk assessment gives no score or comment on differences in the crop environment that might aid establishment (Section B, question 1.24). Since there are no particular differences to note, this factor is unlikely to play a role in preventing establishment and so this can be given a high score.

The pest risk assessment gives a high score ("8") indicating that existing control measures are very unlikely to have an effect on pest establishment (Section B, question 1.25). However, many insecticides are already used against *C. capitata* and these will have some effect on *B. zonata* populations.

The pest risk assessment gives a very high score ("9") for the extent to which the organism's reproductive strategy and duration of life cycle will aid pest establishment (Section B, question 1.26). However, *B. zonata* is not parthenogenic and the number of generations is likely to be lower in the PRA area than in Egypt because climatic conditions are cooler.

As stated in the pest risk assessment, populations at low densities are very likely to establish (Section B, question 1.27). This is particularly the case because *B. zonata* males can attract female mates with pheromones, a common mating behaviour in the Tephritidae (Cayol *et al*., 2002).

The pest risk assessment gives a high score ("8") indicating that eradication is not likely and states that there is no record of successful eradication (Section B, question 1.28). However, after early detection, eradication was successful in Israel and California (CABI, 2006), although the latest more widespread outbreak in the San Joaquin Valley is still under eradication (W. Routhier, pers. comm.). Small populations can be eradicated, so the use of traps to detect initial populations is critical to success. Eradication in Réunion using the male annihilation technique (MAT) failed because *B. zonata* had already spread to most lowland areas (Quilici *et al*., 2005).

As stated in the pest risk assessment, populations have already adapted and evolved in Egypt (Section B, question 1.29). Pesticide resistance has never been reported in the Tephritidae.

The pest risk assessment gives the highest possible score ("9") for establishment in new areas outside its original range (Section B, question 1.30). However, the native range for *B. zonata* is unclear and, when compared to many other pest species, it has not spread to a very large number of countries.

It would be useful for the pest risk assessment to summarise the overall potential for establishment before continuing to assess the potential for spread and impacts.

3.1.5. Spread and impacts (Stage 2, Section B)

As stated in the pest risk assessment, extensive economic loss has been reported (Section B, question 2.1). However, in one country, Sri Lanka, *B. zonata* only attacks the native uncultivated species, *Careya arborea* (CABI, 2006).

The pest risk assessment does not give a score and states that there are no data available on environmental impact in *B. zonata*'s existing geographic range (Section B, question 2.2). Insecticide use can be very high, killing pollinators, natural enemies and damaging the environment. Although this can rarely be attributed just to *B. zonata*, in some crops, e.g. mango, *B. zonata* may be the key target. Reductions in the number of species are unlikely

since seeds are undamaged and the fruit is still attractive to most frugivores. Overall, a low score is warranted.

The pest risk assessment gives a medium score ("5") due to the possible loss of export markets causing social impacts in *B. zonata*'s existing geographic range (Section B, question 2.3). However, FAOSTAT (2006) provides data for 2004 that show that countries where *B. zonata* is present, e.g. Egypt, India and Pakistan, still exported very large quantities of fruit that are *B. zonata* hosts. Confirmation is required to determine (a) which countries where *B. zonata* is absent, e.g. the USA, now prohibit or restrict imports and (b) the extent to which trade in fruit from countries where *B. zonata* is present has continued to thrive (see also comment on question 2.11).

The pest risk assessment gives a high score ("8") for the proportion of the PRA area likely to suffer damage (Section B, question 2.4). Potential hosts are very widespread in the PRA area but climatic conditions are likely to limit the area where impacts can occur. This is a key question for the pest risk assessment and further analysis is merited.

The pest risk assessment states that the pest is capable of spreading very rapidly by natural means (Section B, question 2.5). However, the end of the comment should be deleted since this question refers to movement by man. Although many *Bactrocera* spp. can fly 50-100 km (Fletcher, 1989), the maximum reported for *B. zonata* is 40 km (Qureshi *et al*., 1975).

The pest is able to spread very rapidly with human assistance (Section B, question 2.6). The PRA stresses the importance of the rejection and disposal of damaged fruit, however, movement with infested produce is likely to be far more important.

The pest risk assessment indicates that spread is unlikely to be contained in the PRA area (Section B, question 2.7). However, methods for containing spread exist and there have been success stories in California and Israel. A great deal depends on the early discovery of outbreaks.

The pest risk assessment predicts that the pest will have a very serious ("9") direct effect on crop yield and/or quality in the PRA area (Section B, question 2.8). However, bearing in mind the cooler conditions in the PRA area together with the likelihood that there is better integrated pest management (IPM) practice and crop hygiene in orchards, a lower score would seem appropriate. *B. zonata*, like many polyphagous Tephritidae, seems to attain highest densities in gardens where there are many different kinds of ripe fruit available for successive generations and there is no control. In orchards, densities may be lower.

The pest risk assessment states that *B. zonata* is very likely ("9") to have a significant effect on producer profits due to changes in production costs, yields etc (Section B, question 2.9). If *B. zonata* establishes in Spain or any other country of the PRA area, routine insecticide-bait treatments (6-8 per year) would have to be conducted as MAT application is mainly used for eradication of initial outbreaks, and not as a routine population suppression method. However, a great deal depends on the extent to which insecticide use will increase following *B. zonata* arrival since this may already be high to control *C. capitata* and other pests and restricted by

environmental regulations and pesticide residue testing. Malathion is used in insecticide-bait treatments but it may soon be banned for use in plant protection by the EC under changes to pesticide regulations thus making the future for this control technique uncertain. Other more environmentally friendly insecticides, e.g. spinosad, might be suitable for use but will first have to be registered. Jackson and McPhail traps are used for detection at a density of 5 traps per km^2 (W. Enkerlin, pers. comm.).

The pest risk assessment states that *B. zonata* is likely ("7") to have a significant effect on consumer demand (Section B, question 2.10). However, although Egyptian fruit prices may have increased and quality decreased following *B. zonata*'s arrival, this is less likely to occur in the EC where fruit comes from many sources in addition to the EC, there are much better pest control hygiene measures and *B. zonata* may not have such high densities in orchards due to cooler temperatures and lack of ripe fruit in spring. If *B. zonata* became established in the EC and export markets were affected, consumers might benefit because EC production would have to be absorbed by the internal market. If reduction in quality of some fruit as a result of *B. zonata* became an important issue, consumers may switch to other fruit from other sources.

The pest risk assessment states that *B. zonata* is very likely ("9") to affect export markets (Section B, question 2.11). However, FAOSTAT (2006) shows that many countries with *B. zonata* were still (up to 2004) exporting very large quantities of the major hosts to countries where *B. zonata* is a quarantine pest. For example, India exported 2,789 tonnes of mangoes to the USA in 2004. This requires further study and the collection of recent data. It is possible that the trade was in non-fresh, dried products. However, the regulations listed in the current APHIS-PPQ Manual[8] indicate that this trade cannot still be occurring since litchis are the only fruit that can now be imported from India and Pakistan (APHIS, 2007). Extensive export markets where *B. zonata* is present also exist (Pakistan exported 35,676 tonnes to United Arab Emirates and 13,224 tonnes to Saudi Arabia in 2004) (FAOSTAT, 2006). However, if countries, such as Spain, Italy and Greece, which can currently export oranges, clementines and lemons to the USA despite the presence of *C. capitata*, lost this market and other high value markets, such as Japan, Australia and South Korea, following *B. zonata* establishment, then the impacts could be very severe.

The pest risk assessment gives a very high ("9") score for other costs, e.g. research, resulting from introduction (Section B, question 2.12). However, many of the methods for *B. zonata* control are well known compared to other pest species so a lower score would seem to be more appropriate.

The pest risk assessment does not give a score for the environmental impact in the PRA area (Section B, question 2.13) and states that there are no data to allow predictions to be made. However, although native fruit flies may be displaced, attacking ripe fruit is unlikely to reduce the number of native species (see comments for question 2.2) so a low score is warranted. Following invasion, pesticide use may be very high, pollute the environment and

[8] http://www.aphis.usda.gov/ppq/manuals/port/pdf files/fv.pdf%202004 (03/04/2007)

have a negative effect on pollinator and natural enemy populations, particularly if there is illegal use. However, this may be limited because the EC has very strict regulations for pesticide use and many importers require residue testing.

The pest risk assessment gives a low-medium score ("4") due to commercial depreciation and the possible loss of export markets causing social impacts within the citrus sector (Section B, question 2.14). However, very serious economic impacts leading to social damage are only likely to occur where production is solely for markets outside the EC and the producers cannot switch to markets in the EC (see also comments for question 2.3 and 2.10). Such cases are likely to be rare so a lower score would seem to be appropriate.

The pest risk assessment states that the pest is highly difficult to control (Section B, question 2.16), giving a score of "8". However, effective control measures do exist and, if detected early, populations, as in Israel and California, can be eradicated. A lower score would therefore seem to be appropriate.

The pest risk assessment states that control measures are very likely to disrupt existing biological and IPM programmes (Section B, question 2.17). In addition, it is important to add that the establishment of *B. zonata* would significantly disrupt the use of the sterile insect technique (SIT) against *C. capitata* in the PRA area. Insecticide-bait applications against *B. zonata* would affect the sterile fly release programmes and would be required even in citrus orchards where *B. zonata* is not a major host in order to contribute to national programmes ensuring low pest prevalence so that the phytosanitary regulations of importing countries can be followed and exports maintained. MAT would be appropriate for eradication if the pest is detected early. Once the pest becomes established, MAT would not be cost-effective as an ongoing control measure. In addition, any attempt to use more environment friendly control options against the established *C. capitata* would be disrupted by an extensive use of insecticide baits against *B. zonata*.

The pest risk assessment does not give a score and states that there are no data to determine whether control measures are likely to have other undesirable side effects, e.g. on human health, in the pest risk assessment area (Section B, question 2.18). Although it is uncertain whether *B. zonata*'s arrival would cause massive, uncontrolled, dangerous spraying, sprays, including aerial applications, will be confined to orchards and only affect orchard workers if proper safety measures are not undertaken.

The pest risk assessment does not give a score and states that there are no data to determine whether resistance to plant protection products is likely to develop (Section B, question 2.19). There are no records of insecticide resistance in the Tephritidae, so this can be given a score of "1".

It would be useful for the pest risk assessment to summarise the magnitude of spread and impacts at this stage.

3.1.6. Conclusions of the Spanish PRA (Stage 2, Section B)

The pest risk assessment provides a short conclusion (Section B, question 3) stating that all the Mediterranean countries are at a high risk of introduction (i.e. entry), establishment and economic impact. However, this needs qualification because the Mediterranean countries, however they are defined, are not all at the same risk.

The pest risk assessment includes an analysis of the scores. However, this is not currently recommended, principally because averages imply incorrectly that each question is of equal importance and because they underestimate the importance of extreme values, e.g. massive, in the assessment (Zhu *et al*., 2000; Holt, 2005).

3.1.7. General comments on the Spanish pest risk assessment (Stage 2, Section B)

The Spanish pest risk assessment follows an earlier EPPO PRA standard (EPPO, 1997). It would be better to update it to the most recent version of the standard (EPPO, 2006a), which has corrected a number of ambiguities and inconsistencies and is more closely aligned with ISPM 11 (FAO, 2004). In general, it follows the scheme correctly. However, there are a few occasions when questions have been misinterpreted, no score or comment has been provided or comments have been placed under the wrong question. For certain key questions it would have been useful if a more detailed comment had been made supported by references to the scientific or technical literature.

The review of the pest risk assessment highlighted the following issues:

- The PRA area (Community Mediterranean countries) should be more clearly defined.
- The pest risk assessment could be enhanced by updating and adding to the data and information used, e.g. on trade volumes, and by conducting further analysis, e.g. on the different pathways, such as entry with fruit carried by passengers, the suitability of climatic conditions in the PRA area and impacts on growers.
- The threat posed by *B. zonata* to different countries in the PRA area is not assessed and a clear distinction between the endangered area and the PRA area needs to be defined.
- The pest risk assessment assumes that all fruit listed as hosts are likely to be equally important as pathways and equally vulnerable to attack even though host lists are classified into major and minor hosts.
- The potential impact on export markets is a key issue. To clarify this will require more detailed analysis of exports from countries where *B. zonata* is currently present and the phytosanitary regulations of countries where it is a quarantine pest.
- The pest risk assessment does not summarise the key areas of uncertainty and identify priorities for further work, e.g. determining the potential for overwintering in southern Europe.

Nevertheless, the pest risk assessment does provide sufficient evidence to show that *B. zonata* can enter, establish, spread and cause impacts at least in part of the PRA area. As it stands, it provides justification for an analysis of risk management options (the key conclusion that is required at the end of the pest risk assessment stage (FAO, 2004).

3.2. THE ANALYSIS OF RISK MANAGEMENT OPTIONS BY SPAIN

3.2.1. Detailed comments (Stage 3)

The Spanish analysis of pest risk management options only considers movement of fruit as a commodity (Question 3). Movement with passengers, mail etc could be significant and should also be studied (see question 9).

The Spanish analysis of pest risk management options states that the pest cannot be reliably detected by a general or targeted visual inspection of a consignment at the time of export (Questions 12 & 13). Visual inspection, which includes cutting of fruit, is not completely reliable but would still be useful in a systems approach.

Part of the difficulty with this and several subsequent questions lies in the meaning of the word "reliably." In later versions of the scheme, EPPO (2006a) has provided the following clarification: "***Reliably*** *should be understood to mean that a measure is efficient, feasible and reproducible. Measures can be reliable without being sufficient to reduce the risk to an acceptable level. In such cases their combination with other measures to reach the desired level of protection against the pest should be envisaged. When a measure is considered reliable but not sufficient, the assessor should indicate this. The efficiency, feasibility and reproducibility of the measures should be evaluated by the assessor for each potential management option identified. Limitations of application of measures in practice should be noted*." The Spanish analysis of pest risk management options states the pest cannot be reliably detected during post-entry quarantine (Question 15). In fact, storing fruit to see if anything emerges would be a reliable detection method but most fruit would then be useless for sale.

The Spanish analysis of pest risk management options states that the pest can be effectively destroyed in the consignment by treatment (chemical, thermal, irradiation, physical) (Question 16). This is true but it is important to point out that no specific phytosanitary treatment schedule has been agreed for *B. zonata*. EPPO has a draft official control procedure standard (EPPO, 2006b) for *B. zonata* but, treatments are based on those used for *B. dorsalis*.

The Spanish analysis of pest risk management options states that consignments that may be infested could not be accepted without risk for certain end uses, limited distribution in the PRA area, or limited periods of entry (Question 18). However, consignments sent in the winter months would pose a much lower risk since the cooler climatic conditions are less suitable for pest spread and development. If fruit is sent only to produce juice or jam, this

would still pose a risk because (a) the fruit is likely to be of reduced quality and (b) waste, unless carefully managed, may pose a significant risk.

The Spanish analysis of pest risk management options states that infestation of the commodity cannot be reliably prevented by treatment of the crop (Question 19). As noted in questions 12 & 13, preventative treatments of the crop would not be completely reliable but still useful in a systems approach.

The Spanish analysis of pest risk management options states that infestation of the commodity cannot be reliably prevented by harvesting only at certain times of the year, at specific crop ages or growth stages (Question 22). However, consignments sent in the winter months would pose a much lower risk. Some fruit species can be picked while they are still immature and still ripen satisfactorily for sale. This will greatly reduce the likelihood of infestation because the pest oviposits primarily in physiologically mature fruit.

The Spanish analysis of pest risk management options states that infestation of the commodity cannot be reliably prevented by handling and packing methods. As noted in Questions 12 & 13, this would not be completely reliable but still useful in a systems approach. Post-harvest, the crop can be protected by netting etc.

Questions 25-28 ask the assessor to select an appropriate management option based on pest mobility. The Spanish analysis of pest risk management options suggests a pest free area is appropriate because *B. zonata* is of medium to high mobility. This is logical but some less stringent measures, such as pest-free place of production, may be helpful in a systems approach. Annex IV Part A Section I Article 16.5 of the Council Directive 2000/29/EC[9] for citrus and related species requires a pest free area for relevant organisms, or, if this requirement cannot be met, the place of production to be free from the pest (with additional safeguards), or, if this requirement cannot be met, the crop to be free from the pest, or, if this requirement cannot be met, appropriate treatments.

The Spanish analysis of pest risk management options states that there are no effective measures that can be taken in the importing country (surveillance, eradication) to prevent establishment and/or economic or other impacts (Question 30). However, there are measures, such as surveillance, detection trapping, male annihilation technique and insecticides that can be taken (FAO IAEA, 2000). Trapping is a particularly important method for the early detection of outbreaks and should be employed as a component of a prevention strategy both in the PRA area and neighbouring non-EC countries.

The Spanish analysis of pest risk management options states that the only measures identified that will reduce the risk of introduction of the pest are: phytosanitary treatments in orchards and targeted port-of-entry inspections (Question 31). However, in a systems approach, these measures can be integrated with the export of minor hosts, general visual inspections,

[9] OJ L169, 10.7.2000, p. 45

treatments of consignment, shipping/harvesting at particular times of the year, certain end uses, handling/packing methods, areas of low pest prevalence or pest free production.

The Spanish analysis of pest risk management options states that the two measures they identified (phytosanitary treatments in orchards and targeted port-of-entry inspections) will each reduce the risk of introduction of the pest to an acceptable level but then says they need to be combined (Question 32). Logically the answer given should be "no" and not "yes".

The Spanish analysis of pest risk management options states that the two measures can be combined (Question 33) but gives no further details. Integrating the available surveillance and control methods in a systems approach would be appropriate to reduce the risk to acceptable levels. However, a specific post harvest treatment schedule for *B. zonata* needs to be developed before an effective system approach for this species can be constructed. Annex IV, Part I, Section A, Article 16.5 of the EC Plant Health Directive provides a systems approach for citrus. The degree to which this is appropriate for *B. zonata* and other fruit species needs to be evaluated.

The Spanish analysis of pest risk management options states that measures for reducing the risk posed by the pathway have been identified and these do not unduly interfere with trade, are cost-effective and have no undesirable social or environmental consequences but gives no further details (Question 37). More detailed analysis is needed here. It is important that any measures follow the IPPC principle of equivalence and it would therefore be useful to compare the measures identified with other actions against fruit flies. Examples of systems approaches for Tephritidae include those described by Jang (1996), Enkerlin (1999) and Malavasi & Zucchi (2000). General guidance on the systems approach is provided by an international standard for phytosanitary measures ISPM No 14 (FAO, 2002).

The Spanish analysis of pest risk management options states that all major pathways have been analysed (Question 43) but then continues by stating that fruit carried by travellers should be banned without any analysis. This comment is the only place where movement with passengers is considered. Article 5 paragraph 4 of the Council Directive 2000/29[10] allows small quantities for personal or non-industrial/commercial use provided there is no risk of quarantine pests spreading. If fruit carried by travellers should be banned then it is not logical for small quantities of fruit for personal or non-industrial/commercial use to be allowed. A PRA conducted for *C. capitata* identified small amounts of fruits carried by travellers as a major pathway (APHIS, 2002). Natural spread has not been analyzed in detail because the EC is currently not within the flight range of Egypt.

3.2.2. General comments (Stage 3)

The Spanish analysis of pest risk management options follows an earlier EPPO PRA standard (EPPO, 2001). It would be better to update it to the most recent version of the standard

[10] OJ L169, 10.7.2000, p. 8

(EPPO, 2006a) which has corrected a number of ambiguities and inconsistencies and is more closely aligned with ISPM 11 (FAO, 2004).

The review of the analysis of pest risk management options highlighted the following issues:

- Management options for a key pathway, movement with fresh fruit carried by passengers, are not analysed in detail.
- Several management options that could form key components of a systems approach are inappropriately rejected or not recognised.
- Even though measures that can be taken in the importing country, such as surveillance, trapping, male annihilation technique and insecticides, can be very effective, these are not considered to be useful.
- Details of the extent to which the measures that have been identified interfere with trade, are cost-effective and have no undesirable social or environmental consequences are not provided.

4. The risks posed by *Bactrocera zonata* to the community Mediterranean countries

The Spanish pest risk assessment shows that there is a significant threat to the EC but does not clearly identify which countries are included in the PRA area and define an endangered area that highlights the countries and regions at highest risk of invasion and significant impacts. To determine this, additional analysis would have to be undertaken, focussing on:

- Trade pathways and passenger movement: volumes, frequencies and times of year.
- Climatic analysis: (a) comparing climates in areas where the pest currently occurs with climates in fruit growing areas in the southern EC, using, e.g. the CLIMEX Match Index, loaded with gridded climatologies and up to date meteorological data and (b) predicting potential distribution using, e.g. the CLIMEX "compare locations" procedure to estimate ecoclimatic indices. There will still be considerable uncertainties that may only be reduced by rearing experiments.
- Analysis of economic impacts to show which countries within an endangered area defined primarily by climate are likely to suffer the greatest economic loss.

5. The risks posed by *Bactrocera zonata* to the European Community as a whole

An analysis, equivalent to that proposed under (4.) above, will be required.

6. The principal fruit species at risk

The Spanish PRA does not distinguish between major and minor host species. A detailed analysis is required to compare the known host range of *B. zonata* with fruit production statistics in the endangered area of the EC.

7. The potential eligibility of *Bactrocera zonata* for addition to the list of harmful organisms in Directive 2000/29/EC

B. zonata is already listed in Annex I Part A Section I as *Dacus zonatus*[11]. Although it could be improved, the Spanish PRA provides sufficient evidence to support its retention in Annex IAI of the list of harmful organisms in Directive 2000/29/EC.

8. The efficacy, feasibility and impact of the management options identified by Spain

A more detailed analysis of management options adapted to the different host species is required to develop an appropriate systems approach for *B. zonata*. The Spanish analysis of management options provides too limited a basis for management decisions to be made.

CONCLUSIONS AND RECOMMENDATIONS

The Panel on Plant Health concludes that the Spanish Pest Risk Analysis does show that there is a threat posed by *B. zonata* to at least part of the southern EC and that it is appropriate for the analysis of risk management options. However, there are a number of weaknesses. It does not correctly define the endangered area and its analysis of management options is poor – rejecting or not recognising several methods that would be effective in a systems approach and failing to analyse additional key pathways such as movement with passengers and mail. Further work will therefore be needed to answer the additional questions asked by the Commission concerning the threat to the wider EU, the key fruits that will be affected and the appropriateness of the management options identified by Spain.

[11] OJ L169, 10.7.2000, p. 24.

At present, *B. zonata* cannot reach the EC from Egypt by natural spread so this pathway need not be considered in detail (though a comment to this effect should be added to the pest risk assessment). However, if the species enters other countries bordering the Mediterranean, this may change and it is important that southern EC member states and neighbouring countries undertake a surveillance programme.

DOCUMENTATION PROVIDED TO EFSA

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