Submissions for Diagnostic Protocols

1. General information

Submission number	2021-005
Title of Proposal	Diagnostic Protocol for Bactrocera zonata (Saunders, 1842)
Submitted by	IPPC Contracting Party Egypt

2. Contact information

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3. Summary of proposal

Summary of justification for the proposal	The Bactrocera zonata (Saunders), is one of the most invasive species of Tephritidae. It is a polyphagous attacking many economic important crops. Peach fruit-fly is a serious pest for economically-important exporting fruits in many regions such as peach, guava and mango; secondary hosts include apricot, fig and citrus. It causes serious economic losses, either by direct damage to fruits or indirectly by justifying quarantine and phytosanitary measures. Huge economic loose estimated to 320 M EUR in Near East Region, and 190 M EUR in Egypt (EPPO 2005). Although, B. zonata is an Indian native it presents in numerous tropical countries of Asia (Agarwal et al., 1999). Nonetheless, in 1990s this pest successfully established in Egypt and became widespread. Therefore, the pest demonstrated ability to establish outside tropical climates. It showed adoption to hot-climates, higher low-temperature thresholds than those of Ceratitis capitata, which is widespread in the Mediterranean countries. Pest risk analysis suggests that the peach fruit-fly is able to enter, establish and spread in coastal areas of the Mediterranean region, causing significant damage on fruit production (Delrio and Cocco 2012). It is important to prevent its global dispersal, by accurately identifying this species whether while surveillance or at ports of entry. Several studies were successful in this field (El-Samie and Fiky 2011, Choudhary et al., 2017, Koohkanzade et al., 2018 & Amad et al., 2019). Improving diagnostic measures is necessary. Diagnosing orchards on-site is a challenging since it is based on adult phase identification, while fruits inspections at ports and detecting larvae, this requires sending samples to laboratories which can take longer time for rearing and pest identification. Hence, the rational for optimizing molecular analysis is of a great importance.
Proposed priority	1 (high)
Comments	Fruit flies considered one of the world's most destructive horticultural quarantined pests that pose risks to most commercial fruits as well as some vegetable crops. This has a direct impact for the sustainable production and market access for many countries where it exists. In Egypt, the percentages of apricot and citrus infested with B. zonata were higher than those infested with Ceratitis capitata and reached 20% (Saafan et al., 2005). Considering that, B. zonata has increased its host range to a number of important commercial crops such as in fruits, mango (Mangifera indica), apple (Malus domestica), loquat (Eriobotrya japonica), and in vegetables such as eggplant (Solanum melongena), tomato (Solanum lycopersicum) and also in potato (Solanum tuberosum). (El-Samea and Fetoh, 2006).

4. Literature review

Literature review	Bactrocera zonata (Saunders, 1842) is an economically important invasive pest species to agriculture, natural ecosystem, plant health and trade. A harmonised adopted diagnostic protocol is urgently needed to standardize its diagnostic technology within the region and in globe for any potential spread. • Agarwal M.L., Pramod K. and Kumer P. (1999). Effect of weather parameters on population dynamics of peach fruit fly, Bactrocera zonata (Saunders). Entomologist 24: 81-84. • Abd-El-Samie EM, El Fiky ZA. (2011) Molecular phylogeny and identification of the peach fruit fly, Bactrocera zonata, established in Egypt. J. Insect Sci.; 11:177. • Amad I, Hafeez F, Khan MA, Nahid N, Javed MR, Shaheen S, Farooq M, Khan AZ, Hussain K (2019) Mitochondrial gene cytochrome c oxidase I (CO1) used for molecular identification of Bactrocera zonata in Pakistan. Cell Mol Biol (Noisy-le-grand). 65(2):82-84. • El-Samea SAA; Fetoh BEA, 2006. New record of Bactrocera zonata (Saundera) (Diptera: Tephritidae) on potatoes in Egypt. Egyptian Journal of Agricultural Research, 84(1):61-63. • EPPO/CABI (2005) Bactrocera zonata. OEPP/EPPO Bulletin 35: 371–373. • Choudhary JS, Naaz N, Lemtur M, Das B, Singh AK, Bhatt BP, Prabhakar CS. (2017) Genetic analysis of Bactrocera zonata (Diptera: Tephritidae) populations from India based on cox1 and nad1 gene sequences. Mitochondrial DNA A DNA Mapp Seq Anal. 29(5):727-736. • Delrio, G. and Cocco, A. (2012). The peach fruit fly, Bactrocera zonata: a major threat for Mediterranean fruit crops?. Acta Hortic. 940, 557-566. • FAO. 2008. Fruit fly trapping, Annex 1 to ISPM No. 26 (Establishment of pest free areas for fruit flies (Tephritidae), June 2008, Rome, Italy. • IAEA. 2003. Trapping guidelines for area-wide fruit fly programmes. Joint FAO/IAEA Division, Vienna, Austria. • Ismail R. El-Gendy and Atef M.K. Nassar (2014) Delimiting survey and seasonal activity of peach fruit fly, Bactrocera zonata and Mediterranean fruit fly, Ceratitis capitata (Diptera: tephritidae) at El-Beheira Governorate, Egypt. Egypt. Acad. J. Biolog. Sci., 7(2): 157 – 169. • Koohkanzade M, Zakiaghl M, Dhami MK, Fekrat L, Namaghi HS (2018) Rapid identification of Bactrocera zonata (Dip.: Tephritidae) using TaqMan real-time PCR assay. PLOS one 13(10) e0205136. https://doi.org/10.1371/journal.pone.0205136. • Saafan MH; Foda SM; Abdel-Hafez TA, 2005. Ecological studies of flies on different hosts at Fayoum Governorate. 3 - Ecological studies of Mediterranean fruit fly, Ceratitis capitata (Wied.) and Peach fruit fly, Bectrocera zonata (Saund.) in apricot orchards. Egyptian Journal of Agricultural Research, 83(4):1635-1648.

5. Criteria for prioritization of Diagnostic Protocols

Criteria	Information provided by Submitter
1. Need for international harmonization of the diagnostic techniques for the pest (e.g. due to difficulties in diagnosis or disputes on methodology)	The accurate and harmonized identification of B zonata is a key component of countries biosecurity system where it is affected, this supports the trade movement of fruits and vegetables, foster international market access performance and protects borders from exotic pest incursion. Routine surveillance for the pest is a requirement to process and identify any of the fly stages. Accredited laboratories and skilled technicians are in high demand for harmonized and accurate diagnostic protocols compiled with the international phytosanitary measures. For instance, mitochondrial cytochrome oxidase CO1at 369 bp was amplified using RT-PCR (El-Samie and Fiky 2011) utilizing comparative analysis of sequence with other B. zonata related-species sequences retrieved from databases which were identified through phylogenetic analysis. Pairwise sequence alignment showed the sequence identity about 96% with Bactrocera zonata (Amad et al., 2019). This is to easily identify a single fly of economic importance amongst a large range of native fruit flies that can have less impact on commercial fruits and vegetables.
2. The relevance of the diagnosis	The robust and proper pest diagnosis and identification in accordance with the proper treatment or integrated measures will provide an efficient pest management option.

Criteria	Information provided by Submitter
to the protection of plants including measures to limit the impact of the pest.	
3. Importance of the plants protected on the global level (e.g. relevant to many countries or of major importance to a few countries).	B. zonata is recorded on 20 hosts from 15 families including Anacardiaceae, Annonaceae, Caricaceae, Malpighiaceae, Malvaceae, Myrtaceae, Rosaceae and Rutaceae. Commercial hosts including Mangifera indica, Prunus persica, Prunus armeniaca, Psidium guajava, Annona reticulata, Carica papaya, Abelmoschus esculentus, Malus domestica.
4. Volume / importance of trade of the commodity that is subjected to the diagnostic procedures (e.g. relevant to many countries or of major importance to a few countries).	B. zonata is known as a serious pest for tropical and subtropical fruits in South-East Asia, India and Pakistan. It is one of the three most destructive flies in India, causing crop losses of 25 to 100% in peach [Prunus persica], apricot [Prunus armeniaca], guava [Psidum guajava] and figs [Ficus carica]. In Pakistan, B. zonata alone has caused 25-50% damage to guava fruit (Siddiqui et al., 2003). Farmers abandoned harvesting the guava crop in southern Pakistan because of the massive loose. In Egypt, near the quarter of the apricot and citrus production were infested with B. zonata which were higher than those infested with Ceratitis capitata. High economic damages were recorded annually as in the Near East was estimated 320 million EUR, in addition of intensive control measures to grow susceptible crops. In Egypt, B. zonata has caused an estimated 190 million EUR damage a year. In countries where B zonata are spread, it is reported that this pest could out compete other Tephritid fruit fly species such as Ceratitis capitata (EPPO 2005).
5. Other criteria for topics as determined by CPM that are relevant to determining priorities	- There is a huge economic loose estimated to 320 M EUR in Near East Region, and 190 M EUR in Egypt (EPPO 2005). In Egypt, the percentages of apricot and citrus infested with B. zonata were higher than those infested with Ceratitis capitata and reached 20% (Saafan et al., 2005). - A Pest risk analysis study (Delrio and Cocco 2012) suggests that the peach fruit-fly is able to enter, establish and spread in coastal areas of the Mediterranean region, causing significant damage on fruit production.
6. Th balance between pests of importance in different climatic zones (temperate, tropics etc) and commodity classes.	B. zonata is an Indian native it presents in numerous tropical countries of Asia. Nonetheless the pest had successfully established in Egypt in nearly 2 decades and became widespread. Therefore, the pest demonstrated ability to establish outside tropical climates. It showed adoption to hot-climates, higher low-temperature thresholds than those of the Mediterranean fruit-fly, Ceratitis capitata, which is widespread in the Mediterranean region. The pest infects several economically important crops for the region which are categorized in 15 plant families.
7. Number of labs undertaking the diagnosis.	There are several scientific research centres and laboratories with skilled personnel such as Plant Protection Research laboratories and Plant Quarantine Reference laboratories at the Plant Pathology Research Institute. These places are in mutual support for the Egyptian NPPO meeting phytosanitary requests of diagnosis purposes and technical knowledge.
8. Feasibility of production of a protocol, including availability of knowledge and expertise.	There are skilled research and technical teams with publication records at research centres represented in Agriculture Research Centre and Universities. In addition, of the availability of accredited laboratories for plant quarantine pathogens reference laboratory for evaluating and developing protocols.