Diagnostics
Diagnostic

Ceratitis cosyra

Specific scope

This standard describes a diagnostic protocol for *Ceratitis cosyra*[1].

Specific approval and amendment

Approved in 2011-09.

Introduction

Ceratitis cosyra is the most serious pest for mango (*Mangifera indica*) in many South and East African countries in the sub-Saharan zone (EPPO/CABI, 1997). Along with *Bactrocera invadens* Drew, Tsuruta & White, *C. cosyra* is one of the most commonly intercepted fruit flies in Europe on mango (Steck, 2000). The fly also attacks guava (*Psidium guajava*), sour orange (*Citrus aurantium*), avocado (*Persea americana*), marula plum (*Sclerocarya birrea*), peach (*Prunus persica*) and wild custard-apple (*Annona senegalensis*) (White & Elson-Harris, 1992).

Further information on its host range can be found in White & Elson-Harris (1992) and Steck (2000). Further information on the distribution is available in the EPPO Plant Quarantine data Retrieval system (EPPO, 2011).

Identity

Name: *Ceratitis (Ceratalaspis) cosyra* (Walker, 1849)
Synomyms: *Pardalaspis cosyra* (Walker), *Pardalaspis parinarii* Hering, *Trypeta cosyra* Walker.
Taxonomic position: Diptera Brachycera Tephritidae[2]
EPPO code: CERTCO
Phytosanitary categorization: EU Annex I/A1

[1]Use of brand names of chemicals or equipment in these EPPO Standards implies no approval of them to the exclusion of others that may also be suitable.

[2]Taxonomic note: *Ceratitis giffardi* Bezzi and *Pardalaspis giffardi* var. *sarcocephali* Bezzi have not been formally synonymized with *C. cosyra* but may be the same species (De Meyer, 1998); White & Elson-Harris (1992) doubt that *C. discussa* (Munro) is distinct from *C. cosyra*.

Detection

Fruit flies may be detected as eggs or larvae in fruits or as adults caught in traps.

Detection on fruits

Attacked fruit will often have puncture marks made by the female's ovipositor. Occasionally there may be some tissue decay around these marks or secondary rot and some fruits with a very high sugar content, exude globules of sugar which are usually visible surrounding the oviposition puncture (White & Elson-Harris, 1992). Rotting of the underlying tissue causes a depression on the surface.

A primary method of collecting larvae is by cutting into infested fruit. When the surrounding air temperature is warm, fully grown larvae flex and 'jump' repeatedly up to 25 mm when removed from fruit. Larval identification is extremely difficult, so that when feasible it is best to rear them to adults for identification. Infested fruits should be placed in a container that has a gauze or muslin top and dry medium at its base, such as sterilized sawdust or sand, in which emerging larvae can pupate. Samples should be checked every 2 days for puparia and fruit from which larvae have emerged should be discarded. When all the larvae have emerged from the fruit, or if any sign of mould appears, the sawdust should be sieved and the puparia collected. Puparia can then be transferred to petri dishes and covered with a thin layer of moist heat-sterilized sawdust and then placed in a small emergence cage. It is important to provide sugar solution as food for the emerging adults and to keep the adults alive for at least 4 days after emergence, so that the flies develop their full body colouration and normal shape. Failure to feed the flies will result in specimens that have shrivelled abdomens and dull colours (White & Elson-Harris, 1992).

If collected larvae are to be preserved, they should be placed in boiling water for a few seconds and then transferred to 70% ethanol. Other procedures can also be used.

Detection of adults

Adults of *C. cosyra* can be monitored by traps baited with male lures or sticky traps. Additional information on trapping is available in EPPO/CABI (1997).

Identification

Please note that morphological terminology follows White & Elson-Harris (1992).

Morphological identification with a binocular microscope is the recommended diagnostic method. Magnification ×10 for adult to ×200 for larva and aculeus.

A reliable identification can only be performed on an adult specimen. Although larvae are described below, identification based on this stage is not recommended.

Description for egg, larval and pupal stages

Egg: no published description.

Larva: (after White & Elson-Harris, 1992 and Carroll, 2004).

Partial description of 3rd instar larva: medium-sized, length 6.5–7.0 mm; width 1.5 mm (Fig. 1).

- Head: oral ridges 10–12 rows, margins serrate or scalloped (short rounded teeth); accessory plate absent; mouthhooks with a small preapical tooth; antennal-sensory organ 2-segmented.
- Thoracic and abdominal segments: anterior portion of each thoracic segment with an encircling band of spinules; anterior spiracle with 11–12 tubules (Fig. 2); A8 with two pairs of small tubercles and sensilla, intermediate areas small; posterior spiracles with spiracular slits 3.0–3.5 times as long as broad; spiracular hairs short, about half the length of a spiracular slit, most branched with 7–13 hairs per bundle; anal lobes well defined, surrounded by small spinules; area between posterior spiracle smooth.

Larval identification is based primarily on characteristics of mature 3rd instar larvae. However, this identification has a high level of uncertainty. For identification of the family Tephritidae see Stehr (1991) and for identification of the genera and species *Ceratitis cosyra* larvae see White & Elson-Harris (1992), but note that this key is based on old and inadequate descriptions and does not include all *Ceratitis* spp. of economic importance.

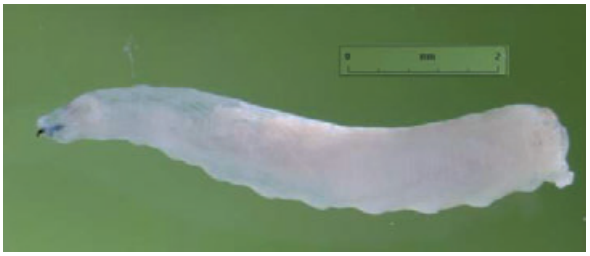

Fig. 1 *Ceratitis cosyra* – larva.

Fig. 2 *Ceratitis cosyra* larva – anterior spiracle.

Pupa: no published description.

Description for adult

A key for adults is described in Appendix 1.

Adult: (after De Meyer, 1998; Carroll, 2002 and White & Elson-Harris, 1992).

Body length: 4.4 (3.3–5.4 mm); wing length: 4.2 (3.4–5.2) (Fig. 3).

Head: antenna yellow-orange. Third antennal segment twice as long as second segment. Arista with short hairs over entire length. Frons with short scattered hairs which are either distinctly darker than or the same colour as frons. Frontal bristles: two pairs (usually) or three pairs; orbital bristles: two pairs; anterior orbital bristles of male normal, unmodified; posterior orbital bristles

Fig. 3 *Ceratitis cosyra* – female.

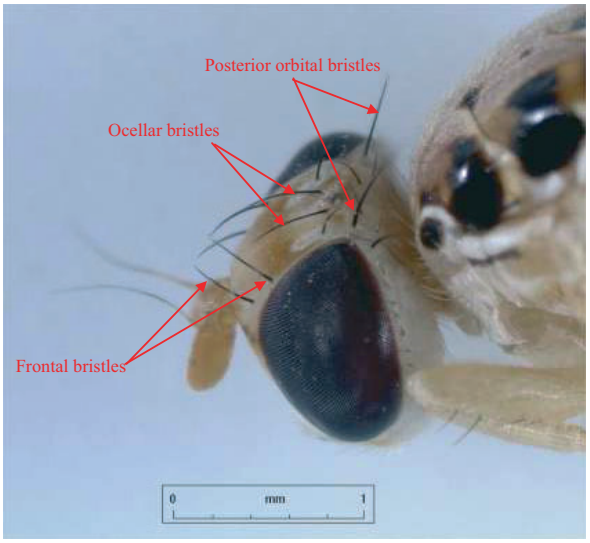

Fig. 4 *Ceratitis cosyra* head.

Fig. 5 *Ceratitis cosyra* scutum.

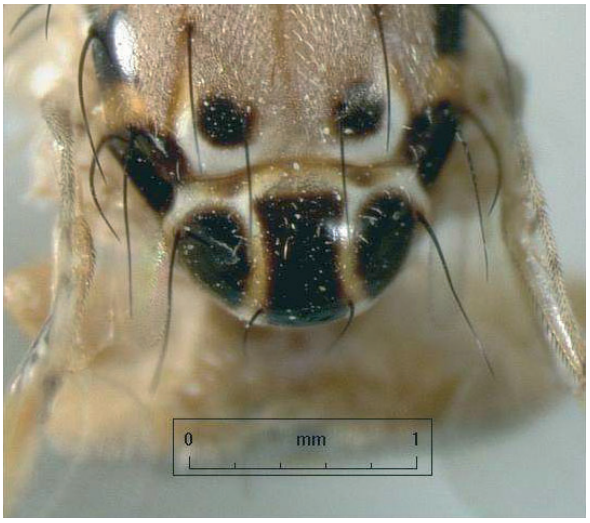

Fig. 6 *Ceratitis cosyra* scutellum.

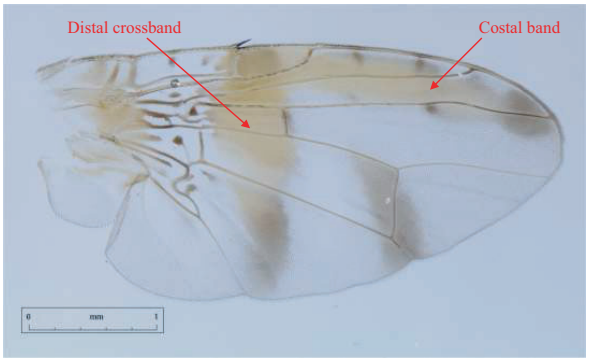

Fig. 7 *Ceratitis cosyra* wing.

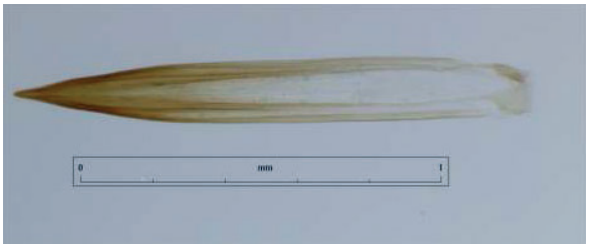

Fig. 8 *Ceratitis cosyra* aculeus.

reclinate, acuminate; ocellar bristles long, about as long as frontal bristles; postocellar bristles present (Fig. 4).

Thorax: Postpronotum pale whitish or yellowish, with a large central dark spot. Mesonotum pale with yellow-orange tinge, without median line; mesonotal pattern variable especially spots at mesal end of suture and prescutellar spot variable in size and coloration, anterior supra-alar spots usually continuous (Fig. 5). Scapular setae pale. One anepisternal bristle (Fig. 13). Scutellum white basally, otherwise yellow with three black separate markings apically; basally usually with two separate black spots (Fig. 6), sometimes spots not separated, and only present as slightly brown patches. Subscutellum dark medially and laterally, with yellowish to orange brown spots sublaterally.

Legs: yellow. Setation mainly pale especially on femora. Fore femur with regular bristles; It should be noted that Carroll (2002) describe the fore femur as having no ventral spines, whereas De Meyer (1998) described them as having 'ventral spines (yellowish or black)'; whether these are called spines or bristles, it is important to distinguish this dorsal row from the setae as they are distinctively longer and stouter than all other setae on the femur, although this character is not discriminatory for identification; (with 1 to 3 posterodorsal and 1 posteroventral rows of bristles only).

Wings: (Fig. 7) Wing band with markings extensively yellow; banding sometimes faint. Marginal band continuous; cubital band

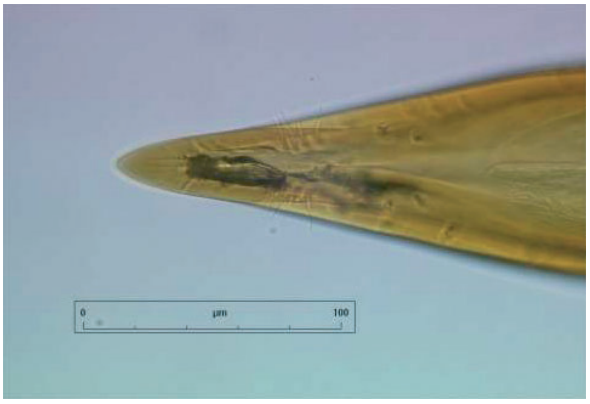

Fig. 9 *Ceratitis cosyra* aculeus (×400).

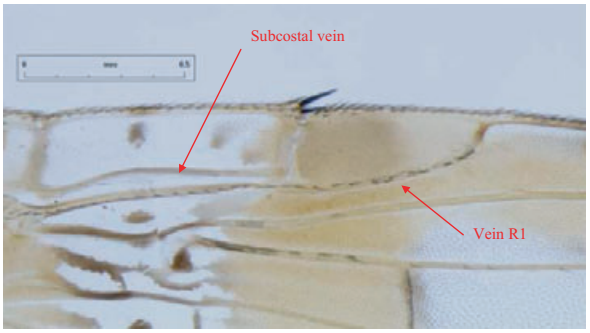

Fig. 10 *Ceratitis cosyra* subcostal vein and vein R1.

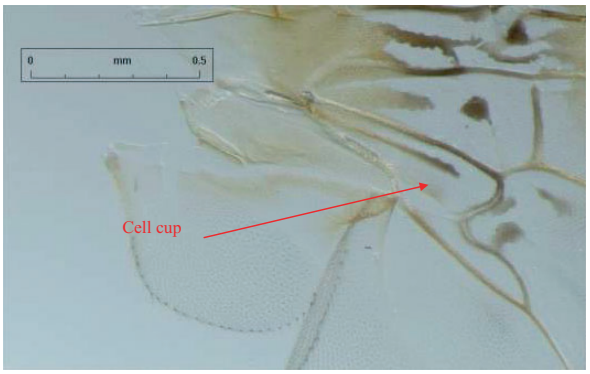

Fig. 11 *Ceratitis cosyra* cell cup.

Fig. 12 Scutellum of *Ceratitis capitata.*

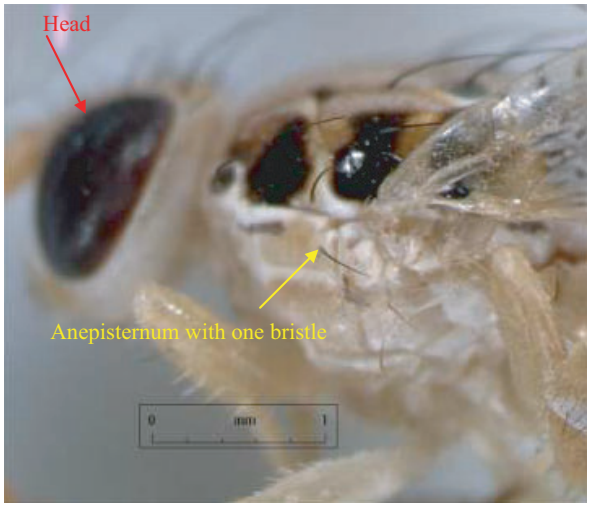

Fig. 13 *Ceratitis cosyra* anepisternum.

free; medial band absent; crossvein r-m before middle of discal cell. Crossvein dm-cu position variable.

Abdomen: Abdomen ovate or parallel sided. Abdominal tergites separate. Abdomen in lateral view flatter, more flexible. Abdominal tergite 1 broader at apex than at base; without a prominent hump laterally. Pecten of dark bristles on tergite 3 of male absent. Abdominal tergite 5 normal. 6th tergite of female normally concealed, or exposed (strap-like); shorter than 5th. Abdominal setulae mixed dark and pale acuminate. Abdominal microtomentum in bands. Abdominal sternite 5 of male broad, at least 2× wider than long. Posterior margin 5 of male with shallow posterior concavity. Abdominal tergites 3–5 predominantly yellow to orange brown. Abdominal tergites without medial dark stripe; not brown with medial T-shaped yellow mark; without isolated dark areas on lateral margins of T3–T5; without dark brown transverse bands.

Aculeus 1.3–1.6 mm (Fig. 8) without apical notch (Fig. 9). For preparation of aculeus see Appendix 2.

Reference material

Specimens are available in many laboratories in the EPPO region.

Reporting and documentation

Guidelines on reporting and documentation are given in EPPO Standard PM7/77 (1) *Documentation and reporting on a diagnosis*.

Further information

Further information on this organism can be obtained from:

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Acknowledgements

This protocol was originally drafted by Ms V. Balmès. ANSES Plant Health Laboratory (LSV) – Entomology and Invasive Plants Unit Montpellier, CBGP, Campus International de Baillarguet, CS 30016, 34988 Montferrier-sur-Lez Cedex, France. E-mail: valerie.balmes@anses.fr.

Feedback on this diagnostic protocol

If you have any feedback concerning this Diagnostic Protocol, or any of the tests included, or if you can provide additional validation data for tests included in this protocol that you wish to share please contact diagnostics@eppo.fr.

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Appendix 1

For identification of the Family Tephritidae see Papp & Darvas (2000).

Identification of the adult of *Ceratitis cosyra* (after White & Elson-Harris, 1992).

(Note that this key adapted from White & Elson-Harris (1992) is not exhaustive. It will only separate *Ceratitis* from the four other major pest genera, and *C. cosyra* from a few other *Ceratitis* spp. Users should ensure that the specimens match the species description given).

1	Subcostal vein abruptly bent and dorsal side of vein R1 with setulae (Fig. 10)	Tephritidae 2
	Subcostal vein not abruptly bent or dorsal side of vein R1 lacks setulae	Other families
2	Cell cup with sinuous extension (as shown in Fig. 11)	*Ceratitis* 3
	Cell cup with extension of another shape	Other genera
3	Scutellum with yellow lines meeting margin, such that each apical scutellar seta is based in or adjacent to a yellow stripe (Fig. 6)	4
	Scutellum different (Fig. 12)	Other species
4	Scutellum with large black areas (Fig. 6)	5
	Scutellum different	Other species
5	Costal band and discal crossband joined (Fig. 7)	6
	Costal band starting beyond the end of R1, and separated from discal crossband by a hyaline area at the end of R1	Other species
6	Anepisternum with 1 bristle (Fig. 13). Aculeus without an apical notch (Fig. 9)	7
	Anepisternum with 2 bristles. Aculeus with a minute apical notch	*Ceratitis punctata*
7	Wing bands yellow (Fig. 7). Scutum predominantly yellow or pale brown, with a pattern of brown to black spots (Fig. 5). Fore femur yellow on both sides and in both sexes. Aculeus 1.3–1.6 mm (Fig. 8)	*Ceratitis cosyra*
	Wing bands brown. Scutum predominantly brown to black. Male fore femur patterned with black and white patches on the anteior side. Aculeus long 2.2 mm	*Ceratitis pedestris*

Appendix 2

Preparation of aculeus for observation under a binocular microscope with ×200 or ×400 magnification.

Break off the abdomen of the female and place it in a 10% potassium hydroxide solution, 1 h at room temperature or 20–30 min below boiling temperature.

When the abdominal sclerites are smooth enough, remove them leaving only the aculeus. Use a pin to separate aculeus and take care to not damage the tip of the aculeus.

Transfer the aculeus in distilled water for approximately 20 min and mount on a glass slide in a drop of glycerol with a cover slip.

This preparation method produces a temporary mount. There are published permanent methods described (e.g. White & Elson-Harris, 1992).