

Diagnosics

Diagnostic

Sternochetus mangiferae

Specific scope

This standard describes a diagnostic protocol for *Sternochetus mangiferae*¹.

Specific approval and amendment

Approved in 2011-09.

Introduction

Mango trees are grown to a limited but increasing extent around the Mediterranean basin [Spain, Italy, Portugal (Madeira), Israel and Egypt], both for fruit production and as ornamentals, e.g. in Morocco. *Sternochetus mangiferae* is native to India but has been widely dispersed by commerce and is now widespread in Africa, Asia, Australia and islands of the Caribbean and the Pacific (see geographical distribution in EPPO datasheet, EPPO/CABI, 1997). *Sternochetus mangiferae* is often confused with two closely related species, *Sternochetus olivieri* (Faust) and *Sternochetus frigidus* (Fabricius), the former also developing in mango stones while the latter develops in the fruit pulp. In Asia, *S. mangiferae* occurs from the Arabian Peninsula to the south of the Indian subcontinent and into Myanmar and Malaysia, whereas *S. olivieri* occurs further east, in Indochina (mainly Myanmar, Thailand, Laos, Cambodia and Vietnam) and *S. frigidus* is distributed from North-East India (Assam) and Bangladesh across Indochina to Indonesia and the Western Philippines (De Jesus *et al.*, 2002).

Sternochetus mangiferae is currently absent from the EPPO region, but with increasing import of mangoes from South-East Asia, Africa and America a risk of introduction and spread across the Mediterranean mango-growing area cannot be excluded. Additional information on the biology of the pest can be found in OEPP/EPPO (1997).

Identity

Name: *Sternochetus mangiferae* (Fabricius)

¹Use 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.

Synonyms:

Curculio mangiferae Fabricius
Rhynchaenus mangiferae (Fabricius)
Cryptorhynchus mangiferae (Fabricius)
Acryptorhynchus mangiferae (Fabricius)
Cryptorhynchus monachus Boissduval
Cryptorhynchus ineffectus Walker

Taxonomic position: Coleoptera: Curculionidae: Molytinae: Cryptorhynchini (Cryptorhynchinae *auctt.*)

EPPO code: CRYPMA

Phytosanitary categorization: EPPO A1 no. 286/EU Annex designation IIB.

Detection

Infested fruits are difficult to detect since there is usually no damage visible externally. Incisions are made by ovipositing females when the fruit is very small (nut-sized), and the oviposition marks disappear quickly as the fruit grows. Only significant egg-laying can damage the appearance of the fruit. The first-instar larva bores through the pulp into the stone, where it completes its development and pupates. The adult weevil ecloses inside the stone and bores through the fruit to the outside, leaving a scar on the outside that can develop secondary fungal infections. However, in early-maturing varieties the fruit usually ripens before the weevils emerge from the stone. Infected fruits rot from the outer surface of the stones and may show holes, with the cotyledons turning black and forming a rotten mass (visible when opening the stone).

Identification

Morphological identification of the adult weevils is the recommended method. A binocular and light microscope is needed for

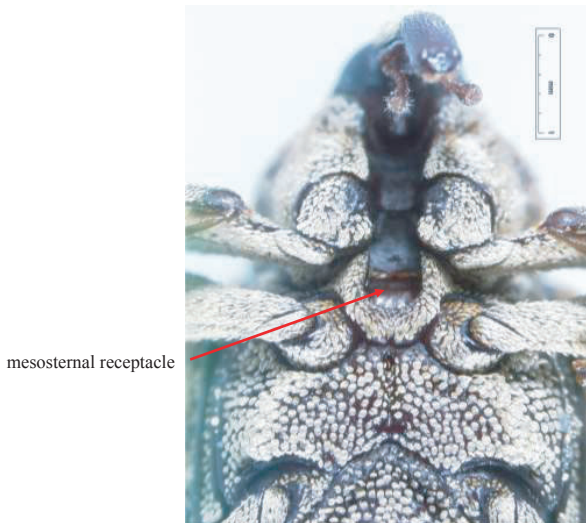


Fig. 1 *Sternochetus mangiferae*, mesosternum (Photo courtesy of LSV).

this purpose. For preparation of the male genitalia, see Appendix 1.

For a key to the families of Coleoptera see Delvare & Aberlenc (1989); for the Afrotropical and Neotropical regions see Downie & Arnett (1996), for the Nearctic see Freude *et al.* (1965), and for the Palearctic see Booth *et al.* (1990).

For a key to the subfamilies of Curculionidae (in the Nearctic region), see Arnett *et al.* (2002). However, the subfamily Cryptorhynchinae as used in this and other works is a composite group, including several discordant elements with strong affinities to Molytinae (Zimmerman, 1994; Oberprieler *et al.*, 2007).

The tribe Cryptorhynchini, to which *Sternochetus* belongs, is easily recognized by its deep pectoral canal, which receives the rostrum when this is folded down and which extends posteriorly beyond the fore coxae onto the mesosternum, where it ends in a pronounced receptacle (Fig. 1). This receptacle abuts directly onto the fore coxae, without the prothorax forming flanges

(lamellae) behind the fore coxae (as is the condition in the tribe Aedemonini).

With the tribe Cryptorhynchini, *Sternochetus* may be distinguished from other genera by the following combination of characters: rostrum curved, slightly flattened, basal half dorsally covered with pale, erect scales; scape shorter than funicle, almost but not quite reaching the eye when folded back; funicle 7-segmented, basal two segments subequal and slightly longer than the rest; antennal club elongate, slightly flattened, unsegmented; head not depressed above eyes; pronotum subtriangular, shorter than wide; scutellum present, covered with pale scales; elytra with distinct, subrectangular humeri; mesosternal receptacle as long as wide, inner margin U-shaped; middle coxae separated by their width, hind coxae by less than their width; metasternum with deep median groove, shorter than ventrite 1; metepisternal suture complete, with sclerolepidia; ventrite 1 in middle as long as ventrites 2–4, these subequal in length; femora clavate, ventrally weakly sulcate and with single flat tooth before subapical emargination; tibiae carinate on outside, the carina at apex running into prominent, flat lamella that continues onto strong uncus at inner apical angle, outside of apex above lamella with two short, oblique rows of strong erect setae (Fig. 2); tarsal claws free, simple.

Eggs

Creamy-white when freshly laid; elliptical, 0.72–0.87 mm long (mean 0.79 ± 0.20 mm) and 0.24–0.34 mm wide (mean 0.29 ± 0.01 mm).

Larva

First instar: body white, legless, elongate, cylindrical, extremely slender, 1.34–1.44 mm long (mean 1.39 ± 0.02 mm); head dark brown. Final (3rd) instar: body creamy-white, legless, curved, typical curculionid form, 16.0–18.0 mm long (mean 16.7 ± 0.28 mm), 6.0–9.0 mm wide (mean 8.0 ± 0.32 mm); head pale brown, not retracted into prothorax, pronotal plate

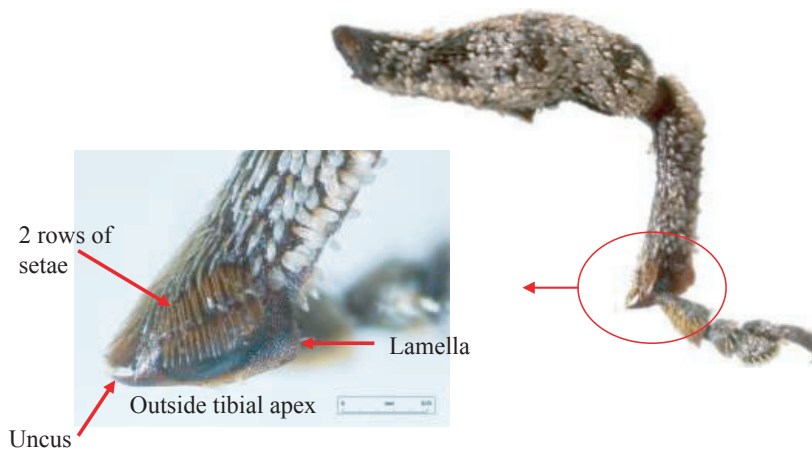


Fig. 2 *Sternochetus mangiferae*, mesothoracic leg (Photos courtesy of LSV).

strongly transverse, typical abdominal segment tripartite, terga without coarse asperities, spiracles annular bifourous.

Pupa

Whitish when newly formed, changing to very pale-red just prior to adult eclosion; 7.0–10.0 mm long (mean 8.6 ± 0.27 mm) wide; abdominal apex with paired urogomphi.

Adult

Body compact (Fig. 3), 7.5–10 mm long, black, covered with dark scales and pattern of greyish to yellowish ones; pronotum subtriangular, subparallel-sided in basal third; elytra elongate, abruptly declivitous behind, dorsally with pale, more or less distinct V-shaped macula stretching from humeri towards suture and posteriorly with a similar but fainter, transverse band, interstriae faintly but evenly costate; femora ventrally with single large tooth, fore femora stout, distinctly clavate; tarsal claws simple, free; apical tergite (pygidium) in male transverse and broadly rounded, in female broadly triangular with narrower apex; apical ventrite in male flat, in female with posterior margin deflexed to form a distinct transverse crescentic subapical groove; aedeagus with pair of apical internal sclerites separate (Fig. 4B). For details of the differences compared to *S. olivieri* and *S. frigidus* see the key below.

Key to the species of mango weevils (Sternochetus) (after Oberprieler & Banks, 2008 unpublished):

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| <p>1 Elytra with a large, whitish macula (patch) stretching from just behind humeri (shoulders) to top of declivity, inscribing a black, inverted medial triangle before middle length and sometimes posteriorly interrupted by a fainter, dark, transverse band above declivity; pronotum medially with a conspicuous carina (keel) in basal 2/3 of length, which is flanked on either side by a line of white scale and at its anterior end (in middle pronotum) by a tuft of dense, erect black scales (Fig. 5); aedeagus with sides nearly parallel, apically broadly rounded and no internal sclerites (Fig. 4A); length 6–8 mm.</p> | <p><i>Sternochetus olivieri</i> (Faust)</p> |
| <p>1' Elytra with whitish markings less extensive and more fragmented, more or less restricted to a broad V-shaped macula stretching from behind humeri to middle of length but no crossing suture and a similar, transverse band at top of declivity, black inverted triangle very faint and often limited to a short line of black scales on interstria 3; pronotum medially only faintly carinate (keeled) but carina largely obscured by pale scales, erect black scales in loose cluster or scattered over basal part of pronotal disk; aedeagus narrowing toward apex, which is narrowly rounded, and with small pair of internal sclerites.</p> | <p>2</p> |

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|---|---|
| <p>2 Elytra with sides nearly parallel from base to beyond middle, interstriae flat to faintly but evenly costate (ridged), stria punctures rectangular to square, whitish macula forming a more or less distinct V and transverse posterior band; pronotum with erect black scales scattered over basal part of pronotal disk (Fig. 3); aedeagus with pair of internal sclerites separate, not touching epically (Fig. 4B); length 75–10 mm.</p> | <p><i>S. mangiferae</i> (Fabricius)</p> |
| <p>2' Elytra narrowing from base to apex, odd interstriae except sutural one distinctly costate-tuberculate, stria punctures round, whitish macula fragmented but usually forming a vague anterior inverted triangle inscribing a similar, smaller black median triangle and a broken posterior band on declivity; pronotum with erect black scales arranged in medial pair of loose clusters (Fig. 6); aedeagus with pair of internal sclerites overlapping apically (Fig. 4C); length 38–59 mm.</p> | <p><i>S. frigidus</i> (Fabricius)</p> |

Reference material

ANSES Plant Health Laboratory (LSV) – Entomology and Invasive Plants Unit Montpellier, CBGP, Campus International de Baillarguet, CS 30016, 34988 Montferrier-sur-Lez Cedex.

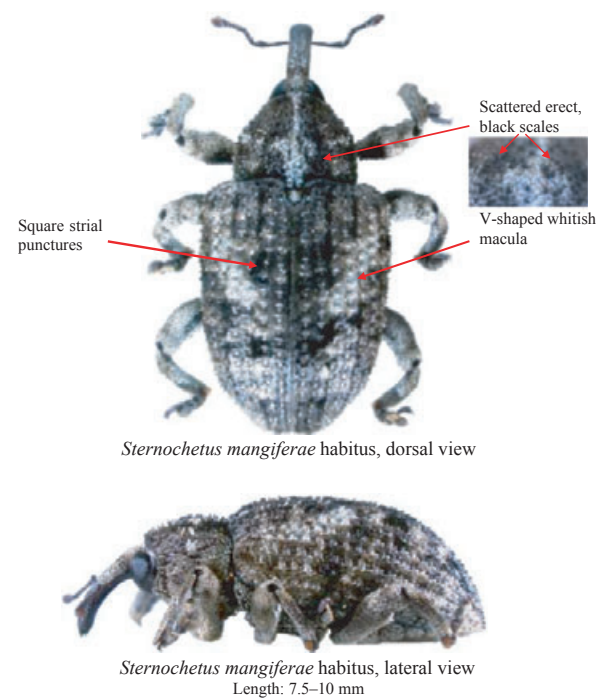


Fig. 3 *Sternochetus mangiferae* habitus: (i) dorsal view; (ii) lateral view. Length: 7.5–10 mm (Photos courtesy of LSV).

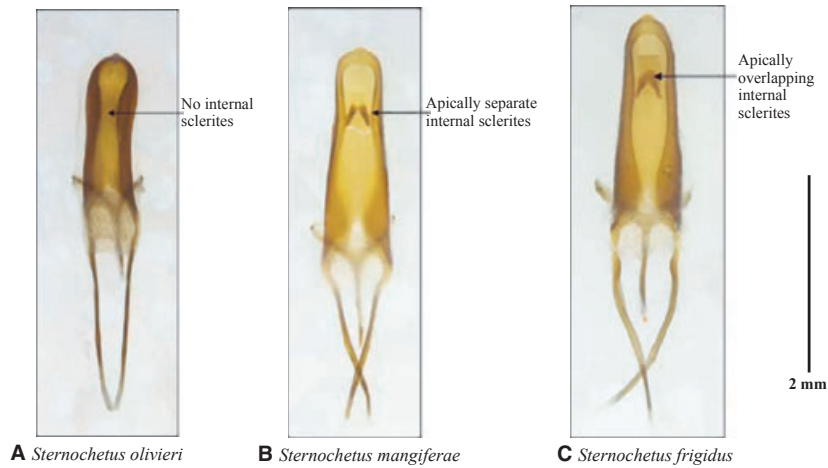


Fig. 4 Aedeagus, dorsal view. (A) *Sternochetus olivieri*. (B) *Sternochetus mangiferae*. (C) *Sternochetus frigidus* (Photos courtesy of CSIRO).

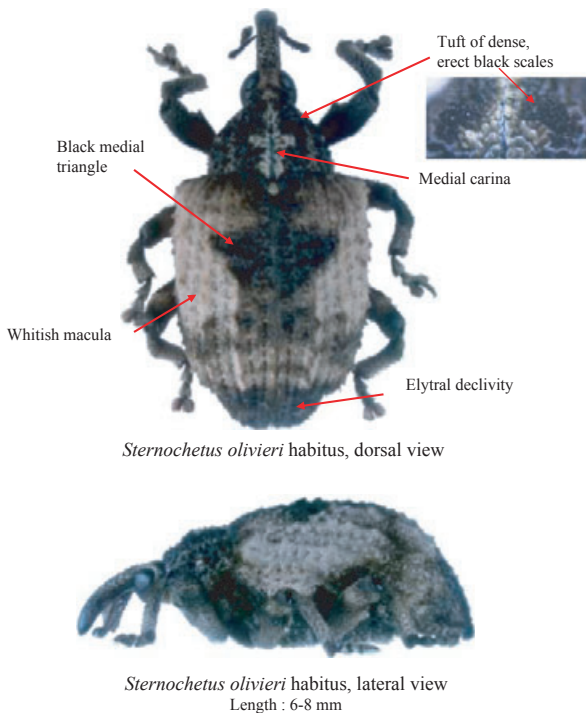


Fig. 5 *Sternochetus olivieri* habitus: (i) dorsal view; (ii) lateral view. Length: 6–8 mm (Photos courtesy of LSV).

Reporting and documentation

Guidelines on reporting and documentation are given in EPP0 Standard PM7/77 (1) *Documentation and reporting on a diagnosis*.

Further information

Further information on this organism can be obtained from: Jean-François Germain. ANSES Plant Health Laboratory (LSV) – Entomology and Invasive Plants Unit Montpellier, CBGP, Campus International de Baillarguet, CS 30016, 34988

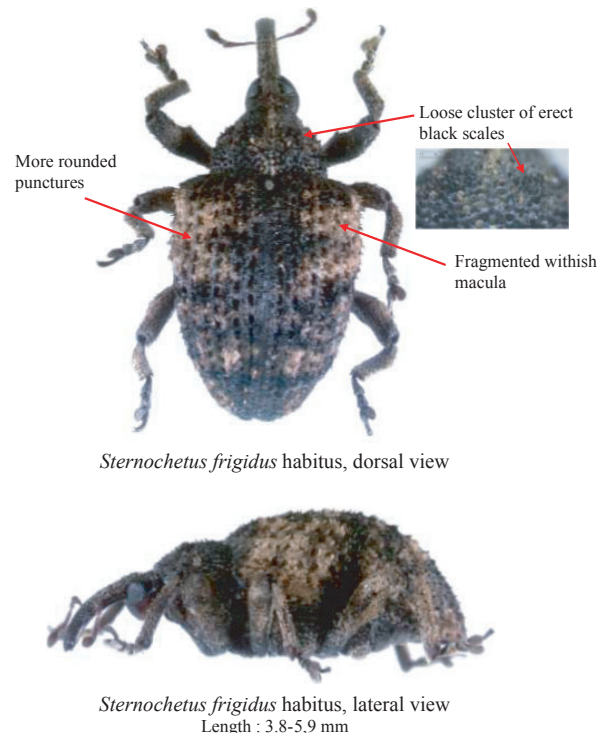


Fig. 6 *Sternochetus frigidus* habitus: (i) dorsal view; (ii) lateral view. Length: 3.8–5.9 mm (Photos courtesy of LSV).

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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.

References

- Arnett Jr RH, Thomas MC, Skelley PE & Frank JW (2002) *American Beetles. Polyphaga: Scarabaeoidea through Curculionidea. Volume 2*. CRC Press Kentucky, (US), 861 pp.
- Booth RG, Cox ML & Madge RB (1990) *Guides to Insects of Importance to Man. 3. Coleoptera*. 2nd edition The Natural History Museum/CAB International, Wallingford (UK), 384 pp.
- De Jesus LRA, Nojima S, Medina JR & Ohsawa K (2002) Method in sex discrimination in the mango pulp weevil *Sternochetus frigidus* (Fabr) (Coleoptera: Curculionidae). *Applied Entomology and Zoology* 37, 251–255.
- Delvare G & Aberlenc H-P (1989) Les insectes d'Afrique et d'Amérique tropicale Clés pour la reconnaissance des familles. CIRAD-PRIFAS, Montpellier (FR), 302 pp. (in French).
- Downie NM & Arnett Jr RH (1996) *The Beetles of Northeastern North America, Volume 1*. The Sandhill Crane Press, Gainesville (FL), 880 pp.
- EPPO/CABI (1997) *Quarantine Pests for Europe*, 2nd edn. Data sheets on *Sternochetus mangiferae*. CABI/EPPO, pp 526–531, CAB International, Wallingford, GB.
- Freude H, Harde KW & Lohse GA (1965) *Die Käfer Mitteleuropas Band 1: Einführung in die Käferkunde*. Goecke & Evers, Krefeld, 214 pp.
- Oberprieler RG, Marvaldi AE & Anderson RS (2007) Weevils, weevils everywhere. *Zootaxa* 1668, 491–520.
- Zimmerman EC (1994) *Australian Weevils (Coleoptera: Curculionoidea), Volume 1 – Orthoceri, Anthribidae to Atelabidae: The Primitive Weevils*. CSIRO, Canberra, 741 pp.

Appendix 1

Preparation of male genitalia for study under a high power microscope (×200)

If specimen is dry, soften in warm water for approximately 30 min, until the abdomen can be moved. Remove whole abdomen under binocular microscope with forceps and place in warm potassium hydroxide solution (c. 10%) for approximately 30 min to macerate muscles and fat tissues. Rinse and dissect abdomen in 70–80% ethanol under binocular microscope (×10), opening the abdomen along one side with fine scissors or pins, clean out remaining tissues and carefully sever the genitalia from the apical segments. Rinse abdomen and genitalia in distilled water or ethanol and place into glycerine on a cavity slide for study and temporary storage. For permanent storage, place genitalia back into abdomen and transfer to a drop of fresh glycerine in a glass or plastic microvial, which is pinned through its stopper beneath the corresponding specimen.