Analytical method for animal health

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Identification of the Small Hive Beetle, *Aethina tumida*, by morphological examination (WOAH method)

Sophia-Antipolis Laboratory

National Reference Laboratory – Bee Health

European Union Reference Laboratory – Bee Health

History of the method

A method can be updated in order to take changes into account.

A change is considered major when it involves the analytic process, the scope or critical points of the analysis method, the application of which may modify the performance characteristics of the method and/or the results. A major change requires major adaptations and either total or partial revalidation.

A change is considered minor if it provides useful or practical clarifications, reformulates the text to make it clearer or more accurate, or corrects minor errors. A minor change in the method does not alter its performance characteristics and does not require revalidation.

The table below summarises the version history of this method and provides qualifications for the changes. The changes are highlighted in grey in the document.

Version	Nature of changes (Major / Minor)	Date	Main changes
V04	Minor	01/02/2020	1. Reformatting of the method. 2. Updating of references. 3. Revisions of the protocol taking into account EURL practical feedback and results of the comparative laboratory testing SHBCLT18: - Precisions added on how to carry out the analysis. - Precisions added concerning the morphological identification criteria: reformulation of certain criteria, footnotes to explain entomological terms, precisions for the color and the tip of the antennae, extension of the adult size range to better take into account the specimens of extreme size, precisions on the "spines" of the larva. - Re-organisation of the order of the criteria in order to better correspond to the course of the analysis. - Addition of details on figures (new figure concerning the morphology of the larvae = Fig. 6; revision of Fig. 8 comparing SHB and wax moth larvae). - Precisions in the "analytical results" section for "uninterpretable" cases and addition of a section on opinions.
V05	Minor	15/09/2023	- « OIE » now « WOAH » (World Organisation for Animal Health). - New Anses logo. - Updates in the introduction (epidemiological and regulatory context) and in the bibliography. - Precision added concerning the criterion n°6 for identifying adults (shape of club antennae). - Inclusion of a note and a figure on the differential diagnosis of *A. tumida* larvae with those of *Urophorus humeralis* (another species of Nitidulidae): § 3.4, Figure 9. - Performance characteristics of the method.

V06	Minor	10/09/2025	- Addition of a flowchart (§ 1) - Minor precisions in the introduction and in the protocol (§ 8.1) - Rewording of certain identification criteria to make them more precise (§ 8.2 / adult) - Addition of two figures specifying the shape of *A. tumida* antennae (Figure 3 and 4) - Update of the bibliography
V07	Minor	P_APPLICATION_DATE	- Editorial improvements - Bibliographic update following the publication of the new revision of the WOAH chapter - Enhancement of the document figures, notably: Figures 1, 2, 4, 11 and 12 - Addition of Figure 7: adult form of the Nitidulidae beetle *Urophorus humeralis* - Addition of details regarding criteria 4 (abdomen coverage by the elytra) and 7 (shape of the pronotum) to improve reproducibility of the assessment of morphological criteria in non-target adult beetles (§ 8.2 and associated figures) - Addition of clarifications for weighting the criterion regarding adult size in result interpretation (§ 8.2). - Updated method validation data (§ 10)

Foreword

This method was developed by:

ANSES - Sophia-Antipolis Laboratory

French National Reference Laboratory for Bee Health

European Reference Laboratory for Bee Health

WOAH Reference Laboratory for Infestation of Honey Bees with Small Hive Beetle (*Aethina tumida*)

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Introduction

The small hive beetle *Aethina tumida* (Murray, 1867) (Coleoptera: Nitidulidae), commonly referred as SHB, is a parasite and predator of honey bees, and is native to sub-Saharan Africa. Its life cycle takes place partly within honey bee colonies and partly in the soil. Attracted by the scent of the hive, female beetles enter colonies and lay masses of eggs in cracks and crevices of the wood. The eggs hatch into larvae, which develop by feeding on bee brood (eggs, larvae), honey, and pollen. While feeding on food stores the remaining honey is fermenting and the comb is destroyed. SHB infestations can result in significant losses for beekeeping, the severity depending on colony strength and being particularly pronounced in areas with warm climates and high humidity – conditions favourable to the beetle's development. In severe cases, *A. tumida* infestations can lead to honey bee colony absconding, collapse, and harvest losses.

Over the past decades, SHB has spread beyond its native range (Neumann, 2016; WOAH, 2025). In the EU, the first detection occurred in Portugal in 2004, but sanitary measures prevented its establishment. In 2014, SHB was detected in southern Italy, where it remains enzootic[1]. More recently, in July 2022, SHB was also confirmed on Reunion Island, France[2].

SHB infestation is a notifiable disease both within the European Union (EU)[3] and internationally, as it is listed by the World Organisation for Animal Health / WOAH).

In case of suspicion, rapid and reliable diagnosis is crucial to implement sanitary measures and prevent further dissemination of the beetle. The method described here, based on the WOAH Manual (WOAH, 2025), provides a protocol for the morphological identification of *A. tumida* adults and larvae. It is a low cost technique that delivers results quickly, and is therefore recommended as a first-line diagnosic tool.

Warnings and safety precautions

The user of this method should be closely familiar with standard laboratory practices. It is the responsibility of the user to establish suitable health and safety practices and ensure compliance with the current regulations.

All actions taken in accordance with this method must be performed by employees who have attended relevant training.

[1] https://www.izsvenezie.it/aethina-tumida-in-italia/
[2] Veille sanitaire internationale | PLATEFORME ESA (plateforme-esa.fr)
[3] Commission implementing regulation (EU) 2018/1882 of 3 December 2018 on the application of certain disease prevention and control rules to categories of listed diseases and establishing a list of species and groups of species posing a considerable risk for the spread of those listed diseases. In this regulation, infestation with *Aethina tumida* (Small Hive Beetle) is listed in the categories D ("listed disease for which measures are needed to prevent it from spreading on account of its entry into the Union or movements between Member States") and E ("listed disease for which there is a need for surveillance within the Union").

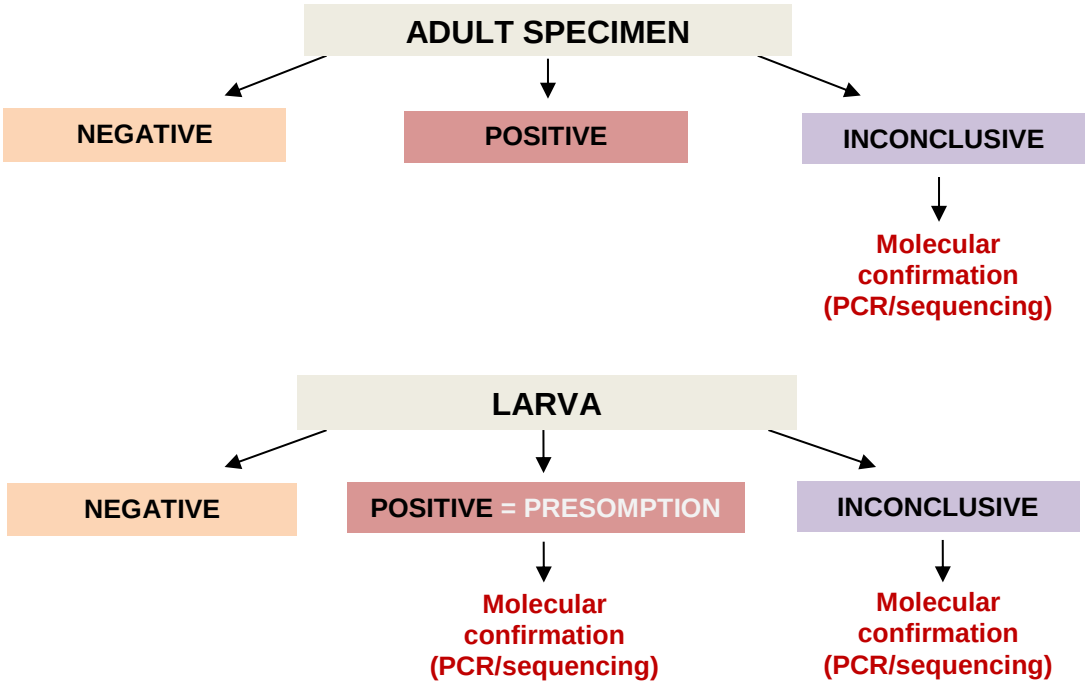
1. Purpose and scope

Aethina tumida Murray, 1867, can be identified by examining the external morphology of adults and/or larvae. The method described here is based on the WOAH manual (2025). It consists in the visual examination of specimens (adults and/or larvae), recording their morphological characteristics and, when necessary, comparing the sample with a reference specimen or detailed photographs.

The insects to be identified are collected in or near honeybee hives (e.g. in beekeeping equipment or queen cages).

Morphological identification may be confirmed, if needed, by molecular methods such as PCR and/or sequencing). For larvae, molecular identification is systematically performed whenever morphological analysis gives a positive or inconclusive result (see flowchart bellow).

Result of morphological identification:



2. Reference documents

[1] ***WOAH, 2025. Infestation of Honey Bees with* Aethina tumida *(Small Hive Beetle). Chapter 3.2.4. In: Manual of standards for diagnostic tests and vaccines for terrestrial animals, Paris.***

3. Terms, abbreviations and definitions

EU: European Union

WOAH: World Organisation for Animal Health

PCR: Polymerase Chain Reaction

SHB: Small Hive Beetle

4. Principle of the method

The identification of *A. tumida* relies on specific morphological characteristics of adults and larvae.

In particular, it is important to distinguish this species from other beetles belonging to the Nitidulidae family that can also be found in honey bee colonies but are not considered pathogenic. For example:

- *Cychramus luteus* Fabricius, 1787 (Coleoptera: Nitidulidae), mainly feeds on pollen (Neumann and Ritter, 2004).
- *Carpophilus lugubris* Murray, 1864 (Coleoptera: Nitidulidae), reported in hives in Italy (Marini et al., 2013).
- *Urophorus humeralis* Fabricius, 1798 (Coleoptera: Nitidulidae), detected in honey bee colonies on Réunion Island (data from French NRL).

In addition, *A. tumida* larvae can also be confused with those of the lesser wax moth, *Achroia grisella* Fabricius, 1794 (Lepidoptera: Pyralidae), and with the greater wax moth, *Galleria mellonella* Linnaeus, 1758 (Lepidoptera: Pyralidae), both commonly found in colonies and beekeeping equipment.

Note: Due to the sanitary risk associated with this exotic parasite, the analysis must be carried out rapidly after sample reception in order to confirm or rule out the suspicion and allow the timely implementation of sanitary measures.

5. Reagents

Warning: Trade names or supplier names may be mentioned in the description of the products required to implement this method. This information is provided for users of the method and does not mean that ANSES recommends the exclusive use of these products. Similar products may be used if it has been demonstrated that they achieve the same results.

- Ethanol 70% (avoid –denatured ethanol)

Note: Non-denatured ethanol must be used, as denaturants may inhibit PCR if molecular analysis is performed later).

6. Equipment and materials

Warning: Trade names or supplier names may be mentioned in the description of the equipment and materials required to implement this method. This information is provided for users of the method and does not mean that ANSES recommends the exclusive use of these materials. Similar materials may be used if it has been demonstrated that they achieve the same results.

- Stereomicroscope (and/or magnifier) (minimum 40' magnification)
- Entomological tweezers and spatula
- Dishes: glass Petri dishes, plastic or porcelain ceramic dishes, watch glass or similar
- Hermetic sealed vials

7. Samples

7.1 Acceptance conditions for samples

The sampling instruction sheet provided to customers must mention that any specimen suspected of belonging to the species *A. tumida* must be must be killed before being submitted to the laboratory. In case of doubt, packages must be opened in containment conditions.

If the specimens are found to be alive on arrival, the sample should be first placed at least at -70°C for approximately one hour before opening fully. This procedure immobilises the specimens in order to avoid their release into the environment.

Afterwards, the specimens are placed in a tube with ethanol 70%.

7.2 Sample storage before analysis

The specimens are stored in ethanol 70% in capped tubes at room temperature.

7.3 Storage of samples or residual materials after analysis

The specimens are stored in ethanol 70% in capped tubes at room temperature.

8. Procedure

8.1 Protocol

1. Lay-out of the work area

Clean the work area before the analysis and prepare the material required.

2. Sampling for analysis

- Place the specimens in a dish.

- Count the number of specimens present in the sample with the naked eye or under a stereomicroscope or a magnifier and record the result. If the number is greater than 100, stop at 100 and note: ">100".

- Carry out the analysis sampling on the basis of the number of specimens counted according to the protocol presented in the Table 1. The specimens are taken at random using entomological twizzers or a spatula.

Table 1 – Analysis sampling strategy

Total number of specimens present in the sample	1-30	31-100	> 100
Number of specimens to analyse	all	30 + 30 % of the remaining specimens (total number of specimens – 30)*	51

** Round up to the next whole number.*

Example: if the total number of specimens in the sample is 58, analyse 30 + 30/100 x (58-30) = 38.4, i.e. *39 specimens to examine.*

Notes:

- *The sampling strategy is inspired by the referential of the French Association for the Study of epidemiology of animal diseases (Toma et al., 2010), and based on the data allowing the detection of an expected prevalence of 5% of positive cases in a population, with a risk of error of 5% (for a population of 1 to 180 units).*

- *It should be noted that the analysis is consistent with an approach of identification of entomological specimens sampled in the apicultural context, further to suspicions. Therefore, the number of specimens to analyse is, in fact, generally low. Nevertheless, it may happen that some larval samples contain a large number of specimens.*

3. Observation with the stereomicroscope

- Allow the specimens to dry until the ethanol has evaporated before making the observation (so that their colour can be correctly assessed).

- Examine the sample using different magnifications in order to appreciate the different criteria for the identification detailed in paragraph 8.2 and annexes 1 and 2. Compare with *A. tumida* reference specimens if necessary (and available).

Note: If at least one of the criteria 1 to 3 is missing, compliance with the other criteria is not achieved.

- Measure the size of the specimens (x1 magnification).

Note: The length of adult beetles is measured from the caudal end to the cranial end without taking into account the antennae and mouthparts which may possibly protrude from the body of the insect. The width of the insect body is measured at the widest part of the pronotum.

- If different species are identified during the examination, sort them by category (sub-samples), and analyse them separately according to the criteria detailed in paragraph 8.2 and annexes 1 and 2.

4. Conclusion of the analysis

- **Adult specimens:**

If the result is inconclusive (e.g. due to non-assessable criteria, or damage specimens), molecular identification is required.

- **Larval specimens:**

If the morphological examination of larvae leads to a negative result, it can be concluded the non-identification of *A. tumida*.

If the morphological examination of larvae leads to a positive result, a molecular test must be performed in order to confirm the identification. If the result is inconclusive, molecular identification will be also necessary.

➔ In case of a positive result, the competent authorities must be notified immediately.

8.2 Identification of the small hive beetle *A. tumida*

A. tumida belongs to the class Insecta, order Coleoptera and family Nitidulidae.

▪ Guidelines for the identification of *A. tumida*, adult form

References: Lee et al., 2017; Li et al., 2018; Lundie, 1940; Menier and Jouan, 2003; Neumann et al., 2013; Numa-Vergel, 2021; WOAH, 2025.

Annex 1: Figures 1, 2, 3 and 4.

Table 2 - Adult diagnosis criteria

1 / Body divided in three parts: head, thorax and abdomen.
2 / Three pairs of legs.
3 / Presence of elytra[4].
4 / Elytra leaving two or three posterior abdominal segments visible in both dorsal and lateral view.*
5 / Overall uniform body colour (no spots), ranging from light brown, to reddish-brown or darkbrow to black.
6 / Antenna tips with compact, almost rounded club ends. The three terminal articles of the antennas, corresponding to the "clubs"[5], are narrowed between them. The transversal size of the first segment of the clubs (proximal article) is slightly larger than the other two segments (distal articles). (Figure 3 and Figure 4)
7 / Posterio-lateral angles of the pronotum[6] sharp, distinct, and projecting backward.**
8 / Size: Length: 3-8 mm; width: 2-4 mm.

During analysis, it is particularly important to assess:
* The coverage of the elytra in both dorsal and lateral views, to determine the number of abdominal segments extending beyond the elytra.
** The shape of the pronotum, by comparing the sample with the morphology of reference *A. tumida* specimens or pictures.

Notes:

- Color:

Depending on the specimen's maturity, adult *A. tumida* vary in color from light brown/reddish-brown shortly after emergence to dark brown or black at full maturity.

A. tumida exhibits a lighter marginal line around the pronotum and elytra (a row of fine yellow bristles) (Menier & Jouan, 2003). This feature may not always be visible on dead specimens preserved in ethanol.

- Size:

The size is one of the indicator criteria that are used to identify *A. tumida* according to our conditions. Under no circumstances shall size be a sole criterion for identifying this beetle.

The size of *A. tumida* can vary depending on whether the beetle is in a retracted (defensive) or extended posture, and according to sex (Ellis, 2002; Menier and Jouan 2003). Other factors, such as food availability, climate or soil type can also influence beetle development and, consequently the size of specimens (Ellis, 2002).

[4] Elytra: sclerotized (= thickened) forewings covering the hind wings at rest in beetles and some other insects.
[5] Clubs: In some beetle families, such as the Nitidulidae, the terminal articles of the antennae are larger and club-shaped.
[6] Pronotum: dorsal part of the first segment of the thorax (the first segment of the thorax is called the prothorax, it never carries wings but the first pair of legs on the ventral side).

In addition to natural variation, measurement variability may occur during analysis, for example due to the specimen's position on the stereomicroscope stage.

Consequently, if size is the sole distinguishing criterion for *A. tumida* identification, the result is considered "uninterpretable," and confirmation by PCR analysis should be performed.

- Differential diagnosis with other Nitidulidae species:

A differential diagnosis should be carried out with other beetle species that may be found in hives, such as the following Nitidulidae: *Cychramus luteus* (Annex 1 - Figure 5) (Neumann & Ritter, 2004), *Carpophilus lugubris* (Annex 1 - Figure 6) (Marini et al., 2013), and *Urophorus humeralis* (Annex 1 - Figure 7) (beetle detected in hives on Réunion Island in 2022, unpublished data).

- **Guidelines for the identification of *A. tumida*, larval form**

(Marini et al., 2013; Menier and Jouan, 2003; Neumann and Ritter, 2004; WOAH, 2025)

Annex 2: Figures 8, 9, and 10.

Table 3 - Larva diagnosis criteria

1/ Three pairs of legs, one on each of the anterior segments, corresponding to the larva thorax.
2/ All of the posterior leg segments are bare and have no false legs (also called pseudopods) on their ventral part.
3/ From the mesothorax[7], presence on each segment, of two dorsal tubers on either side of the midline. These tubers are finished with a short fine silk. They look like "spines".

The identification of the small hive beetle larva is always confirmed by PCR, except when the results are negative (see paragraph 9. Results).

Notes:

- The larvae of *A. tumida* have generally a creamy light beige body colour. The cephalic capsule (head of the larva) is brown in colour.
- The body length at maturity is about 1 cm (1.2 cm maximum length). The length depends on feeding. The width is about 1.6 mm.

[7] Mesothorax: It corresponds to the second thoracic segment of the larva. It has the second pair of legs. The prothorax corresponds to the first thoracic segment; it does not have a tuber, its dorsal part (tergum) is sclerified.

- The dorsal tubers are pigmented. They are terminated by a short fine silk and preceded by two short spines. The last segment of the larva abdomen has two dorsal tubers and two urogomphs[8] (Annexe 2 - Figure 9).

- To distinguish *A. tumida* larvae from Lepidoptera larvae (lesser wax moth, *A. grisella* and honeycomb moth, *G. mellonella*), frequently present in honeybee hives:

The Lepidoptera larvae present pseudopods on the ventral side of the abdominal segments.

There are two bare segments between the last segment with legs and the first segment with pseudopods (Annex 1: Figure 11).

Besides, the Lepidoptera larvae can make a silky web, cocoons, and dark faeces (these webs and faeces can be observed in the sample containers received by the lab).

- Some larvae of other species of Nitidulidae are morphologically very similar to *A. tumida*. **Erreur ! Source du renvoi introuvable.**12 (Annex 2) shows, for example, the larva of the beetle *Urophorus humeralis* (Fabricius, 1798) detected in hives on Réunion Island. These larvae have dorsal tubers on either side of the midline and urogomphs, but no marked "spines", unlike *A. tumida*. If there is any doubt about identification, a confirmatory PCR analysis must be realised.

1. Results

9.1 Reporting of results

The reporting of results based on the morphological examination is shown in Table 4 for adult specimens and Table 5 for larvae.

Table 4 – Reporting results: adult specimens

Analysis results	Conclusion
Criteria 1 to 8 confirmed for *A. tumida.*	**Positive**
Certain fundamental morphological characteristics of *A. tumida* are not present: - At least one out of the three criteria (1 to 3) not confirmed (in this case, the other observations are not realised). - Or at least one out of the five other criteria (4 to 8) not confirmed.	**Negative**
The examination does not allow a determination of the sample as positive or negative: it was not possible to rule on the presence/absence of certain morphological identification criteria (e.g. damaged specimen) OR size was the only distinguishing criterion. → Molecular identification systematically realised.	**Inconclusive**

[8] Urogomph: An extension, fixed or mobile, attached to one of the last segments of the abdomen of certain larvae.

Table 5 – Reporting results: larvae

Analysis results	Conclusion
All criteria 1 to 3 confirmed. → Molecular identification systematically realised.	**Positive / Suspicion**
Criteria 1, 2 or 3 not confirmed.	**Negative**
The examination does not allow a determination of the sample as positive or negative: it was not possible to rule on the presence/absence of certain morphological identification criteria (e.g. damaged specimen). → Molecular identification systematically realised.	**Inconclusive**

9.2 Guidelines for expressing opinions

Opinions, taking into consideration the results of the different analysis performed (morphology and/or molecular diagnosis), can be expressed according to the decisions rules described in Table 6.

Table 6 - Decision rules for giving opinions

		PCR result			
		Analysis not performed	Positive	Negative	Inhibited
Morphological examination result	**ADULT**				
	Positive	(1)	(1)	(3)	(1)
	Negative	(2)	(3)	(2)	(2)
	Inconclusive		(1)	(2)	(4)
	LARVA				
	Suspicion/Positive		(1)	(2)	(4)
	Negative	(2)	(3)	(2)	(2)
	Inconclusive		(1)	(2)	(4)

(1) « Positive identification of the small hive beetle, *Aethina tumida* »

(2) « Negative identification of the small hive beetle, *Aethina tumida* »

(3) « Suspected identification of the small hive beetle, *Aethina tumida.* Further analysis is required to ascertain the identification. »

(4) « Inconclusive result of *Aethina tumida* identification »

2. Performance characteristics of the method

The performance of the method was evaluated using *A. tumida* specimens collected from various geographical origins, as well as non-target species (Table 7).

Given the difficulty of obtaining negative and positive specimens, the data were also consolidated through a literature review.

To assess the reproducibility of the method across laboratories, a comparative laboratory testing (CLT) was organised in 2018, involving nine EU National Reference Laboratories accredited for the method, and the EU Reference Laboratory for Plant Health (Anses, Montpellier laboratory). The CLT demonstrated 100% sensitivity, specificity, and reproducibility of the method (i.e. final analytical result) (Table 7). A more detailed analysis of the assessment of morphological criteria showed mean reproducibility rate values >95% for most of the features. However, for non-target species, the reproducibility of certain criteria was lower, depending on features and species examined.

Table 7 - Performance characteristics of the method

Caracteristic	Parameter	Value	Main information on the methods used for characterisation
Sensitivity (SE) and inclusivity (IN)	SE: Percentage of positive results found among the expected positive results. IN : Ability of the method to detect the target analyte from a wide range of strains, isolates, populations, etc.	**100%**	Characterisation performed using two approaches: ▪ Intra-laboratory: 50 specimens of *A. tumida* (25 larvae and 25 adults) from different geographical areas (South Africa, United States, Mexico, Italy, France/ Réunion Island, Mauritius, England/FERA experimental production). ▪ Inter-laboratory: comparative laboratory testing organised in 2018 (SHBCLT18 campaign) with 9 participating laboratories, panel consisting of 18 samples, 6 of which were positive.
Spécificité (SP)	Percentage of negative results found among expected negatives.	**100%**	Characterisation performed using two approaches: ▪ Intra-laboratory: 86 specimens (71 adults and 15 larvae) corresponding to samples received for analysis (and collected in beehive environment) or to Nitidulidae species collected on plants. ▪ Inter-laboratory: SHBCLT18 CLT, 9 participating laboratories, panel consisting of 18 samples, 12 of which were negative.
Reproducibility	Probability of obtaining two similar results, based on the distribution of observed values.	**100%**	Characterisation performed using two approaches: ▪ Intra-laboratory: 15 specimens (8 adults and 7 larvae) analysed by 3 different operators trained and authorised for the method. ▪ Inter-laboratory: SHBCLT18 CLT, 9 participating laboratories, panel consisting of 18 samples (11 adults and 7 larvae).

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ANNEX 1 - Adult identification

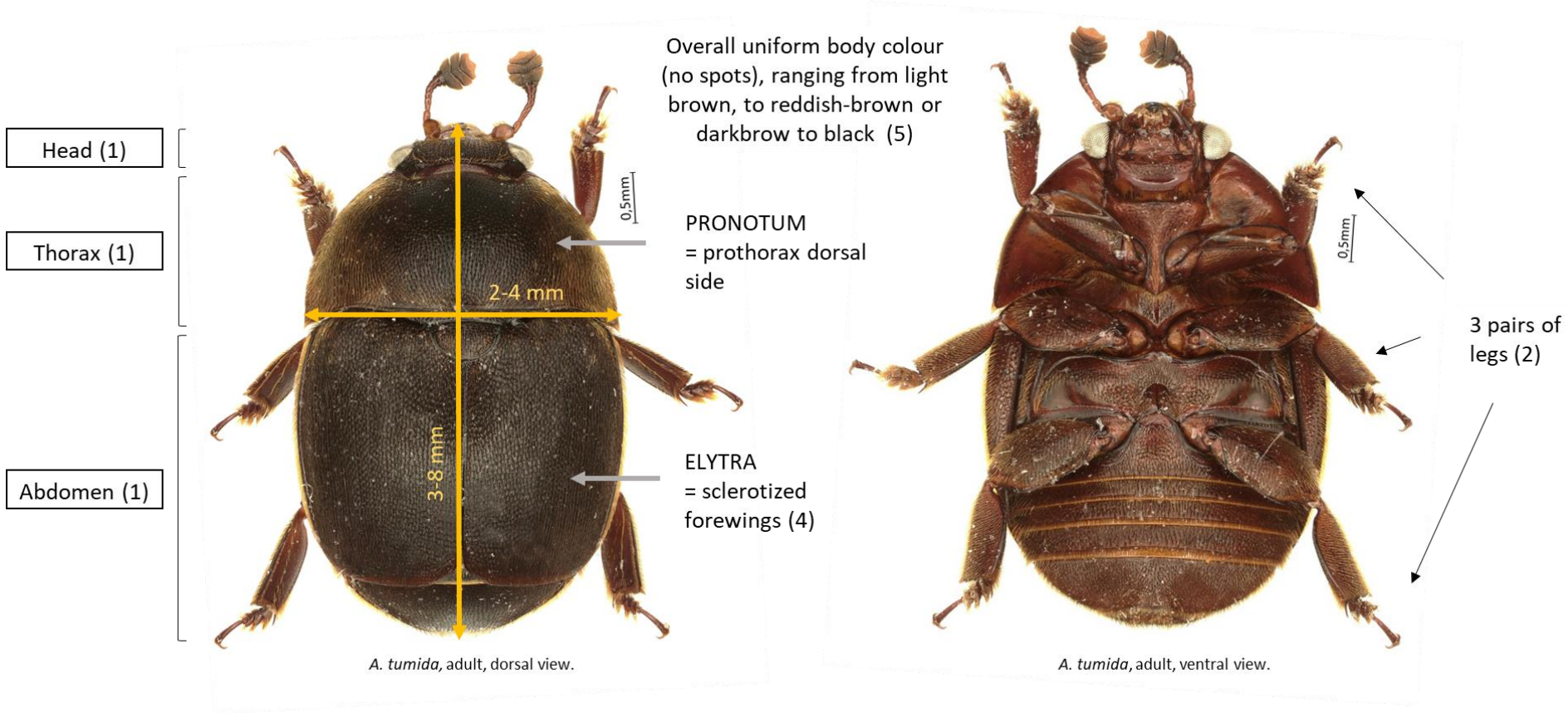


Figure 1 – Adult Small hive beetle, *Aethina tumida* Murray: general morphology

Photos: Anses, Laboratory for Plant Health (Montpellier)

A. tumida, adulte, dorsal view.
Photo: Anses, Laboratory for Plant Health (Montpellier)

Antenna tips with compact, almost rounded club ends. The three terminal articles of the antennas, corresponding to the "clubs" , are narrowed between them. The transversal size of the first segment of the clubs (proximal article) is slightly larger than the other two segments (distal articles) (6)
(see details in Figures 3 & 4)

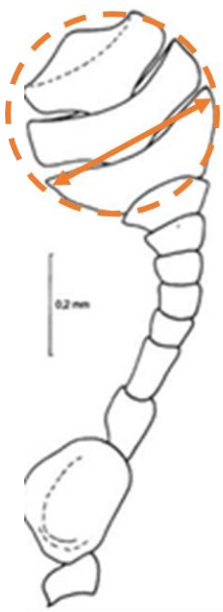
Posterio-lateral angles of the pronotum sharp, distinct, and projecting backward (7) *(see details in Figure 5)*

Elytra leaving two or three posterior abdominal segments visible in both dorsal and lateral view (4)

<u>Elytra overlap (4) :</u>
Elytra leaving two or three posterior abdominal segments visible in both dorsal and lateral view

Photos : Cirad (La Réunion)

Figure 2 - Small hive beetle, *Aethina tumida* Murray – Guidelines to distinguish *A. tumida* from other Nitidulidae species present in the hive



The transversal size of the first segment of the clubs (proximal article) is slightly larger than the other two segments (distal articles) (6)

Figure 3 - A. *tumida* antenna
Drawing: **Menier and Jouan, 2003**

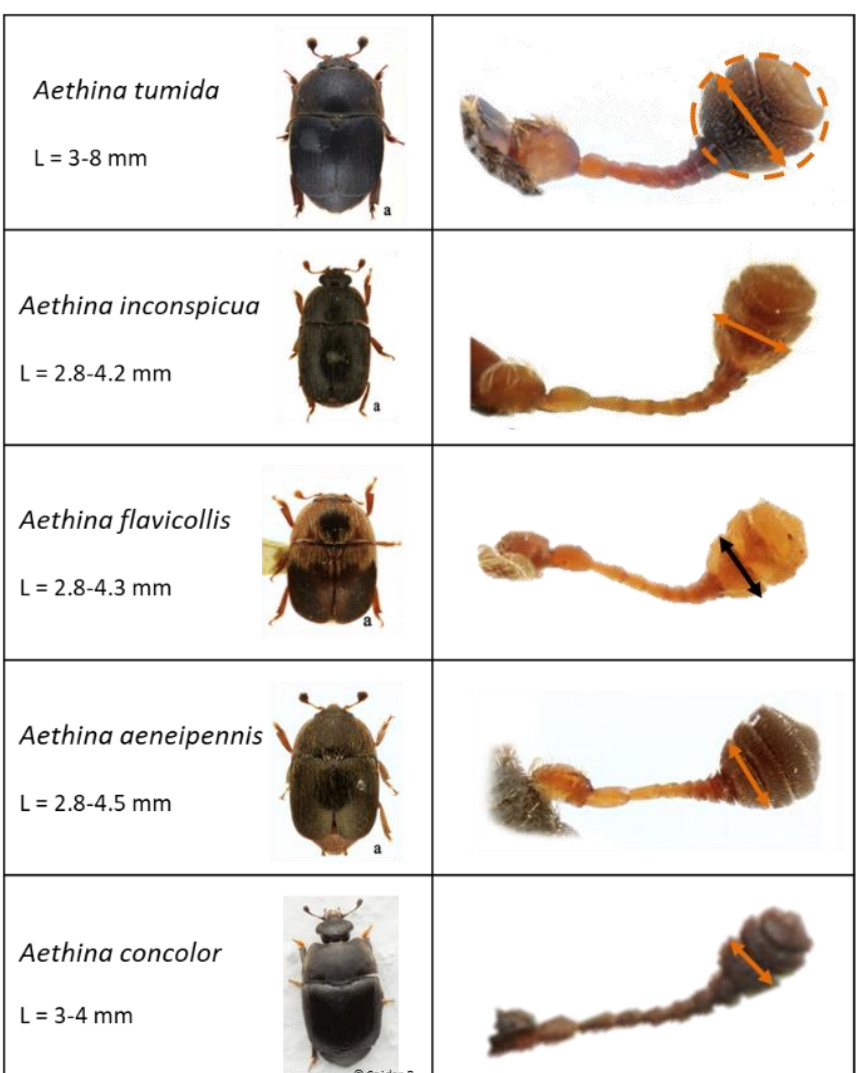
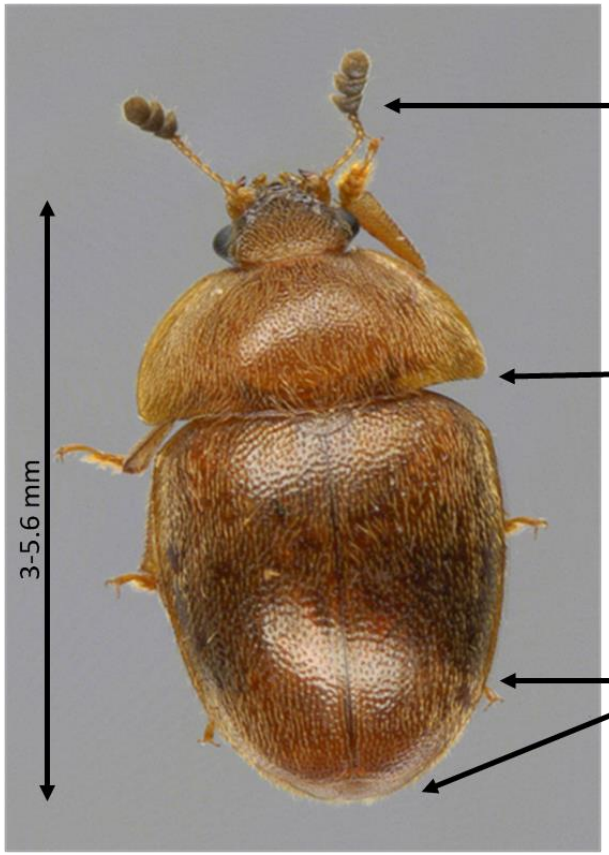


Figure 4 – Antenna shapes of four species of Aethina found in Korea (Lee, 2017) and of *A. concolor*, a species found in New Zealand, Australia, New Caledonia and French Polynesia in particular (iNaturalist contributors, 2024 ; GBIF, 2023 ; Manaaki Whenua Landcare Research, 2024). *Aethina concolor* is the only other species of the genus *Aethina* already detected in beehives (Li, 2018). (L = length)



Club-shaped antennae, the club is not rounded, the three distal segments are not very tightly compacted, and they are approximately equal in size

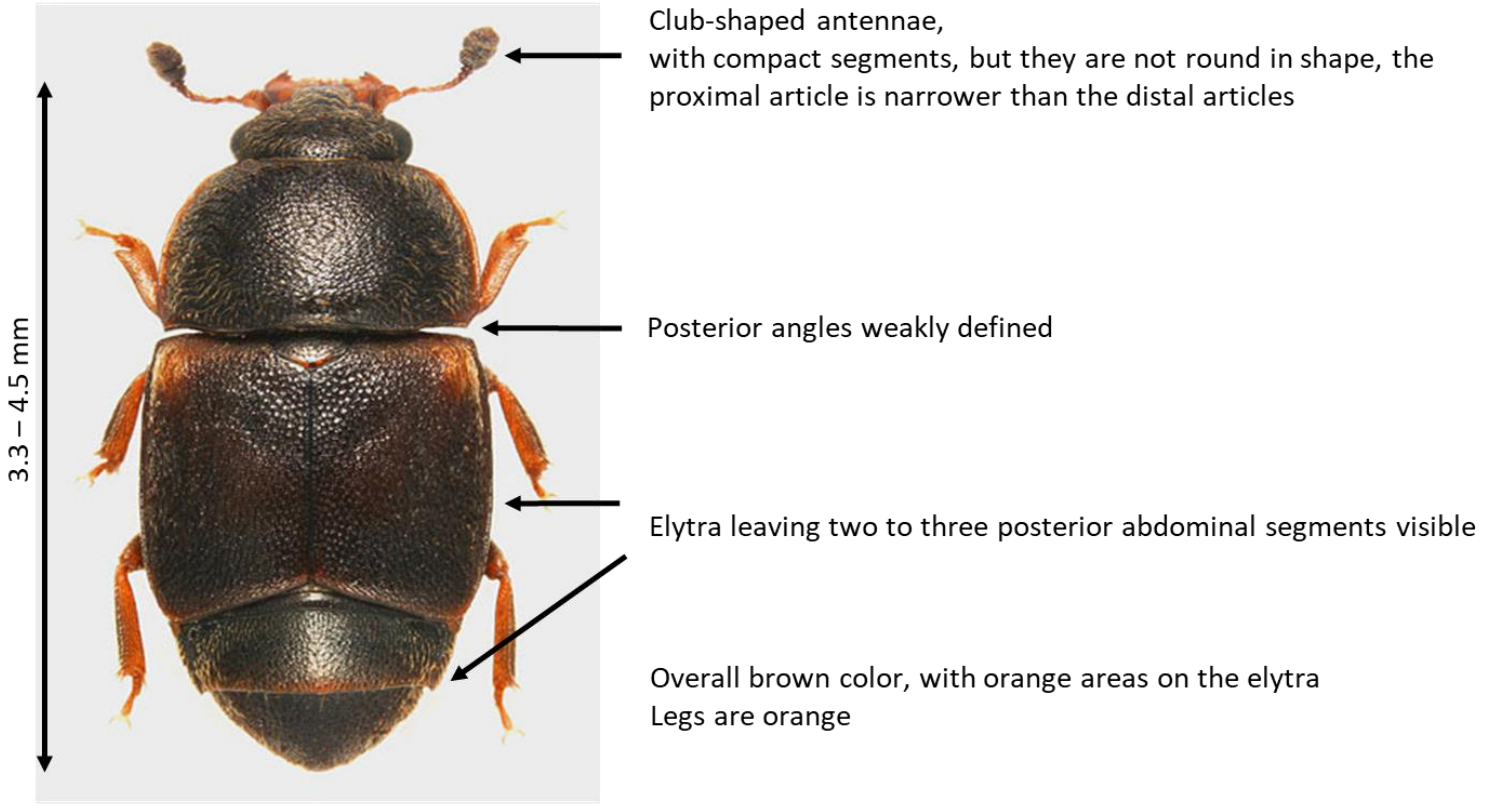
Posterior angles of the pronotum weakly defined, rounded and almost perpendicular

Light-brown body

Elytra covering almost the entire abdomen.
Only part of one abdominal segment is visible dorsally.

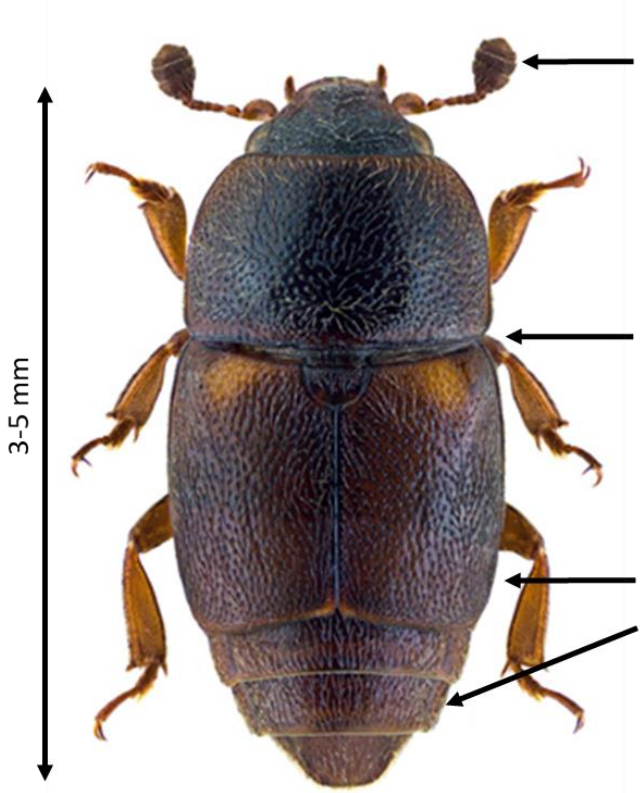
C. luteus, adult, dorsal view.
Photo: Malcolm Storey, 2003, www.bioimages.org.uk,
Web page accessed on 01/12/2016.

Figure 5 - *Cychramus luteus* Fabricus (Neumann and Ritter, 2004)



C. lugubris, adult, dorsal view.
Photo: Marini *et al*. (2013)

Figure 6 - *Carpophilus lugubris* Murray (Marini *et al*., 2013)



U. humeralis, adult, dorsal view.
Photo: U. Schmidt, 2016.
https://kaefer-der-welt.de/urophorus_humeralis.htm,
Web page accessed on 01/09/2025.

Figure 7 - *Urophorus humeralis* Fabricius

ANNEX 2 - Larva identification

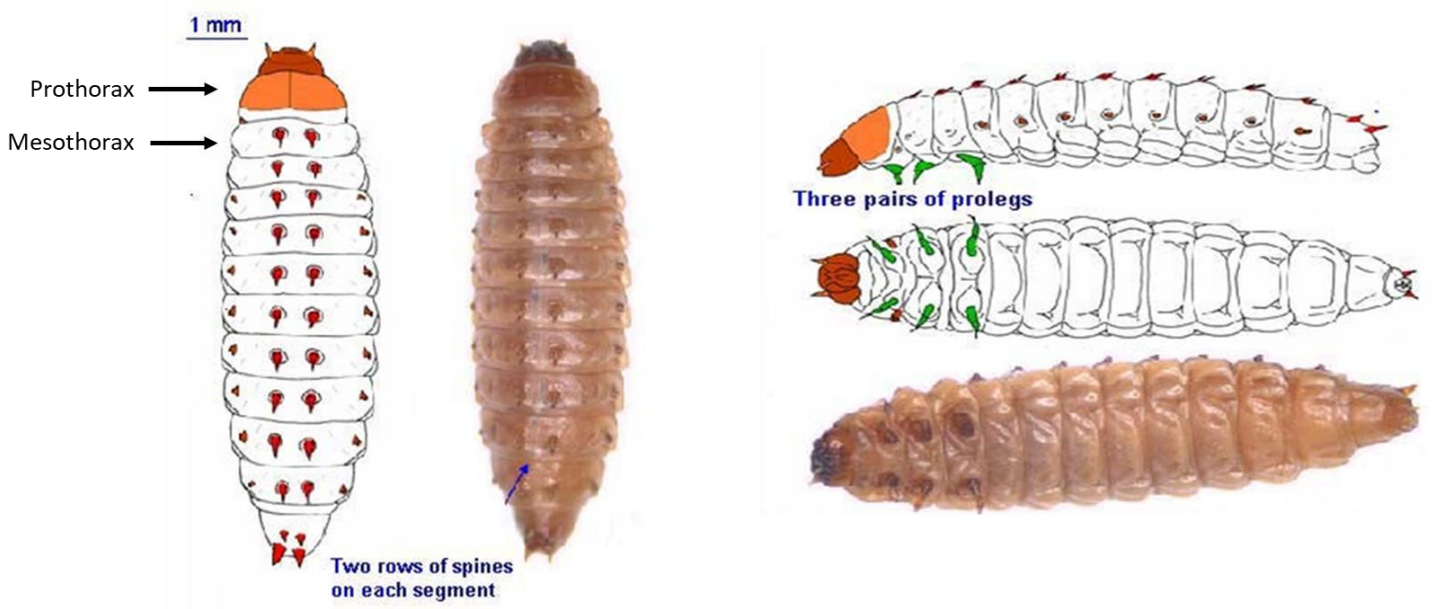


Figure 8 - Larva of the small hive beetle, *Aethina tumida* Murray: general morphology

Drawings: Boeking, 2005

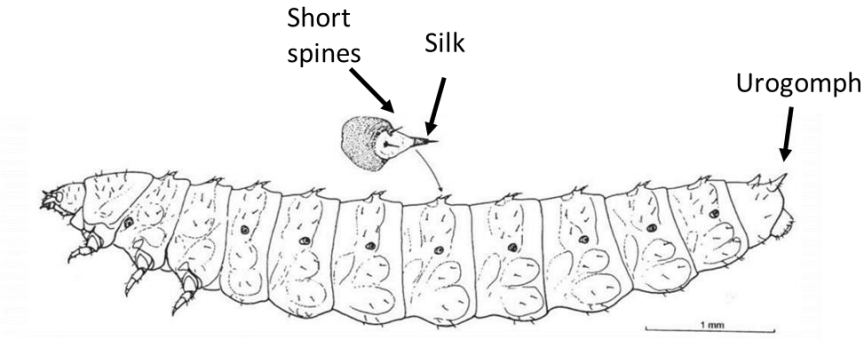
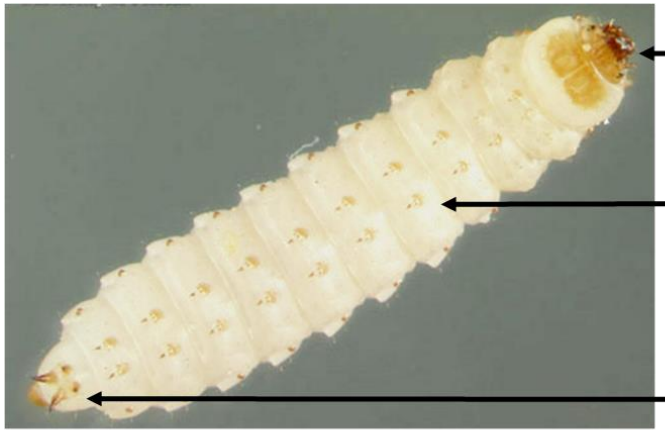
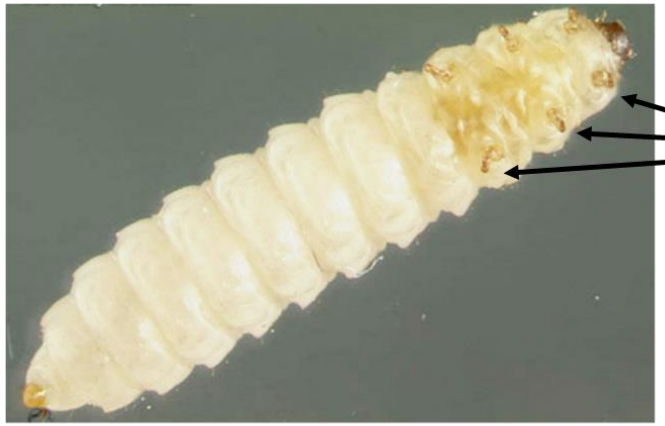


Figure 9 - *Aethina tumida* larva: detail of a dorsal tuber
Drawing: Menier and Jouan, 2003



A. tumida, larva, dorsal view.

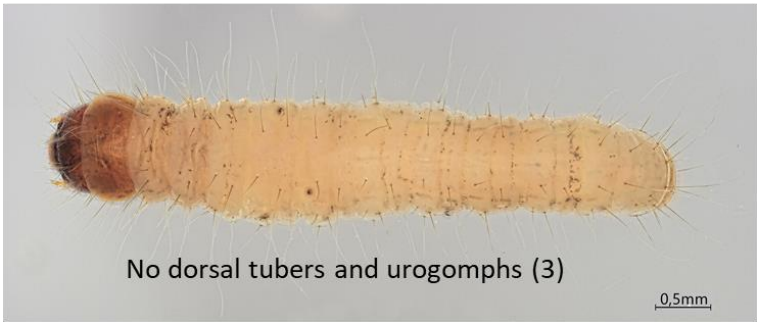


A. tumida, larva, ventral view.

Figure 10 - Larva of *Aethina tumida* Murray: morphological features
Photos: Josephine Ratikan, University of Florida

Light-beige body with a brown cephalic capsule

Achroia grisella, larva, lateral and ventral view.



Achroia grisella, larva, dorsal view.

Figure 11 - Differentiation from wax moth larvae
Photos: Anses, Laboratory for Plant Health (Montpellier)

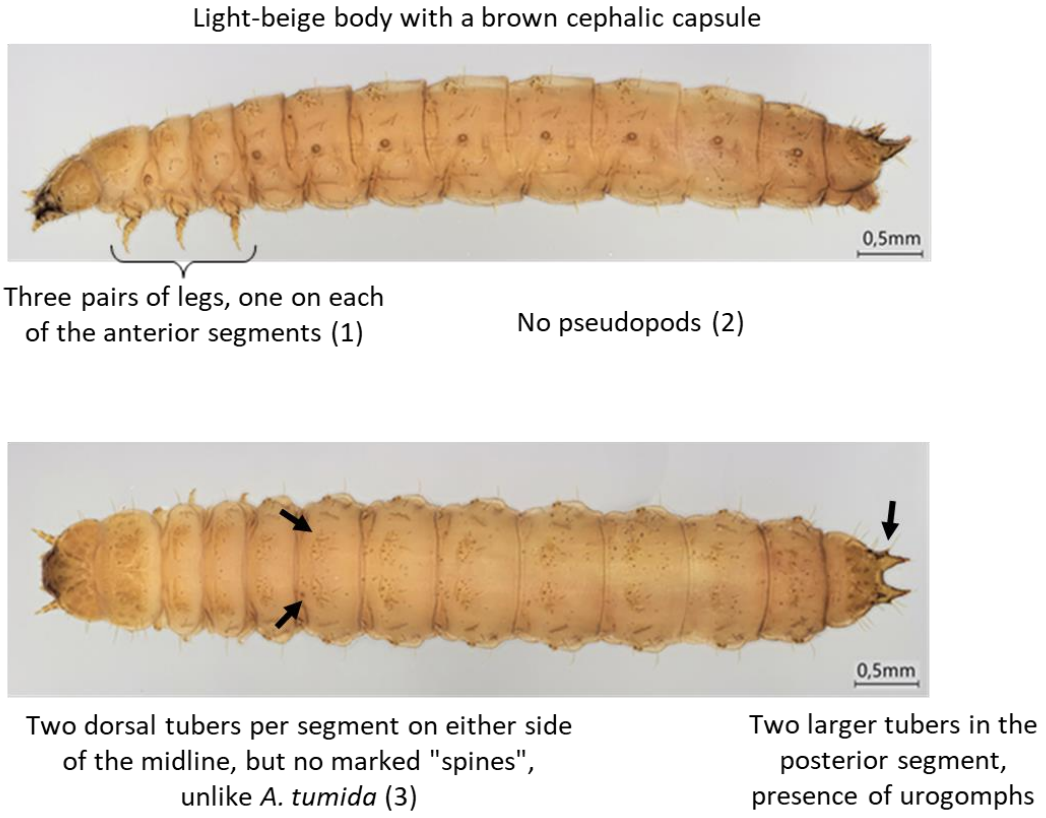


Figure 12 – Differentiation from *Urophorus humeralis* Fabricius larvae
Photos: Anses, Laboratory for Plant Health (Montpellier)