**Diagnostics**[1]
**Diagnostic**

# *Tecia solanivora*

## Specific scope

This standard describes a diagnostic protocol for *Tecia solanivora*.

## Specific approval and amendment

Approved in 2005-09.

## Introduction

*Tecia solanivora* is an important pest of potato in Central and South America. Described for the first time from Costa Rica in 1973 (Povolný, 1973), this pest has spread within Central America and to the north of South America. In 1999, it was found in Spain (Islas Canarias). The larvae attack tubers, which may be completely destroyed, it may be injurious for green parts of the host-plant and stored potato tubers may be damaged as well. For elements on biology see Povolný (2004).

## Identity

**Name:** *Tecia solanivora* (Povolný).
**Synonyms:** *Scrobipalpopsis solanivora* Povolný.
**Taxonomic position:** *Insecta: Lepidoptera: Gelechiidae*.
**EPPO code:** TECASO.
**Phytosanitary categorization:** A2 action list no. 310.

## Detection

Potato is the only host identified so far. Damage is similar to that caused by other tuber moths. Larvae bore galleries containing residues of food, frass and larval exuviae. The entry holes remain inconspicuous but 2–3 mm circular exit holes are visible when the larvae leave tubers. Secondary rotting may occur. Holes and galleries are larger that those produced by other species of *Lepidoptera* developing on potato tubers. Visual inspection of tubers should be performed, looking for holes and galleries with or without larvae. Eggs are deposited on soil near the base of plants, occasionally on plants themselves (mainly foliage). Oviposition may be observed on stored potatoes, where eggs could be laid on tubers. Pupation takes place in soil, near the surface. In stores, pupae spin in corners. Pupae may also be observed in the burlap sacks used for transporting potatoes.

## Identification

Some entomological terms are defined in Appendix 1.

Egg and pupal stages are not reliable for identification. Morphological identification is the recommended method for larvae and adults. For larvae, a binocular microscope should be used and the chaetotaxy should correspond to the illustrated one.

For adults, habitus may be compared with the description below, but the only unequivocal means of identification is the preparation and observation of the male or female genitalia under the light microscope. For preparation of genitalia, see Cribb (1972) or Robinson (1976). A key to the families of adults is given in Arnett (2000). There is no exhaustive key allowing the identification of genera of the *Gelechiidae*. For Palaearctic families, see Emmet & Langmaid (2002) or Medvedev (1990). For a key of neotropical members of the tribe *Gnorimoschemini* tribe, see Povolný (1994).

Details are given below describing the habitus of adult males and females, eggs, last instar larvae and pupae of *T. solanivora*. These should be used to make comparisons with voucher specimens.

### Adults

The description of the adults (Web Fig. 1) is based on that of Povolný (1973). Adults are large broad-winged stout moths compared with other species of the tribe *Gnorimoschemini*. General coloration is deep to light brown with rather poorly defined radiate forewing pattern in the male but very pronounced in the female.

[1]The figures in this Standard marked 'Web Fig.' are published on the EPPO website www.eppo.org.

Head, thorax and tegulae deep brown (male) to light brown (female). Especially in light brownish females, dark narrow strip from erect scales of the head vertex to the middle of the thorax. In heavy labial palpus, second segment covered by erect scales. Third segment, not very slender, covered by normal appressed scales. Palpus darker brown in the male than in the female. Individual scales with distinctly brown to brown-grey tips in most cases. Outward surface of second segment with one basal and one subterminal, not strictly limited, dark spot, which may fuse in males. Inward surface of second joint pale. Third labial joint distinctly deep brown to dark grey with a medial ring or spot of light scales, indistinct in males.

Forewing 7.2 (male) to 10.6 (female) mm. Forewings comparatively broad. Ground colour chocolate brown (males) or bright brown (females), with a triad of well visible stigmata with bright and, especially in females, distinctive pattern of longitudinal lines, distinct in the tornus terminating in the form of more or less developed marginal spots. Costal margin distinctly darker brown, especially in males, like the striking axial stripe or shade stretching and widening from the third stigma to the wing tip, where it ends in the form of a dark ocellus. Admixture of deep brown to dark grey scales found centrally before and between the triad of stigma. In males, narrow area of lighter scales found subcostally, as well as above and between the second and third stigmata, with a tendency to form longitudinal lines towards the wing tornus. Blackish stigmata surrounded by light brown scales. First stigma tends towards reduction being sometimes represented only by a trace of ochreous scales. In females, whole wing, with the exception of a darker costal margin and an axial longitudinal shade, with rich pattern of pale longitudinal lines following the blackish venation. Area around the stigmata also pale. Pale ochreous hair-like scales of the forewing margin separated by a dark line from the pattern, which ends in the form of marginal spots. In males, hindwings light grey, sparsely suffused with blackish scales along the costal margin, and veins. In females, hindwing light grey with similar blackish suffusion. Marginal hair blackish to grey, in both sexes.

Abdomen dorsally graphite-grey, ventrally whitish dusted with two parallel longitudinal lines of brown colour. Legs brown to whitish sprinkled, outward side brown to grey, inward side pale. Tibiae of the third pair with long and dense dorsal hairs.

Sexual dimorphism is apparent in both size and coloration. Males are deep brown with two (second and third) stigmata as a rule, bust mostly strong longitudinal markings. Females are visibly larger in most cases, brighter brown in colour, with a more distinctive pattern of three stigmata and longitudinal linear markings. For a positive identification, male or female genitalia should be mounted and compared with drawings.

*Male genitalia (Web Figs 2 and 3)*

Stout and heavy, in general appearance similar to those of the genus *Scrobipalpa* and with the elements characteristic of this genus, but differing in size, chitinization, and several minute characters. Uncus narrowed with a distinct obtuse tip. Gnathos thorn-like and well developed. Valva stout, with moderately curved cylindrical bases and spatulate flat tips. Parabasal processes of valvae well defined and distinctly curved inwardly. Saccular wall broad (tall) provided with a pair of symmetric processes; these are rather flat, falciform and separated by a symmetric medial excision. Their tips do not reach over those of the parabasal processes. Saccus comparatively broad and long, but not longer than the lateral teguminal corners. Aedeagus long and strong, only a little shorter than the distance between tips of the saccus and uncus. Basal part of aedeagus only slightly inflated. Subterminal hooklet of aedeagus prominent. Variability not important, since it mostly concerns size, which corresponds with that of the individual males concerned. Form of saccus and the paired processes seem to be slightly variable.

*Female genitalia (Web Figs 4 and 5)*

Subgenital plate subquadrate, smooth, apophyses long. Above place where 8th sternite emits anterior apophyses, edges membranous and concave. Inner edge of apophyses provided with a characteristic tubercle. Central part of the subgenital plate transparent membranous, without any sculpture. Proximal part of the 8th sternite before ostium bursae chitinized in the form of a paired crescent separated medially by a triangular membrane. Ostial ringlet broad chitinized and proximal portion of ductus bursae sclerotized. Signum a strongly arched thorn-like hooklet. Subgenital plate quite characteristic, lacking the foamy sculpture of the genus *Scrobipalpa* and having the characteristic tubercle and dilatation on inner edges of the anterior apophyses.

The following combinations of key characters identify adult males and females of *T. solanivora* (complete keys in Povolný, 1994).

*Males*: labial palpus recurved or uprounded; uncus more or less rounded without dorsal spines; paired processes symmetrical; gnathos not spatulate or rounded; sacculus without unpaired medial process; gnathos pendulous or hooklet-shaped; moth grey or cinereous, with or without pattern, never blackish with white spotting; gnathos more or less spine-like, parabasal process present, or gnathos deeply pendulous and of various forms, and uncus visibly arched; paired processes (parabasal and saccular) present and showing various forms, gnathos rather slender or only moderately inflated, unpaired process absent; uncus narrow subtriangulate with tapering tip, moth very stout and broad-winged (forewing length 7.2–7.8 mm), chocolate brown with radiate pattern and a triad of blackish stigmata centrally.

*Females*: labial palpus recurved and uprounded; stout signum present; anterior apophyses basally inflated forming a flat sclerite, moth extremely stout and broad-winged (forewing length 10.5–10.7 mm), pale brown with bright radiate pattern and a triad of blackish stigmate centrally.

## Eggs

Freshly oviposited eggs are pearl white, measuring 0.46–0.6 mm in length and 0.39–0.43 mm in width. Eggs become mat white before hatching.

#### Larvae (Web Fig. 6)

A key to the families of larvae is given in Stehr (1987). No key exists for larval genera within the *Gelechiidae*. There are 4 larval instars. Description presented here is based on the last instar. Original description by Povolný (1973). Last larval instar 12.4–14.2 mm long. Head, pronotum and tubercles pale chitin brown. Sutures of head and mandibles chestnut brown. Thoracic legs pale. Body coloration bright red-scarlet with pale to whitish pleurae and body underside. Red coloration more expressive than in other gnorimoschemoid larvae, where it is usually pink, and does not form longitudinal stripes. In dorsal view, the scarlet is interrupted and forms fine irregular narrow lines. The red coloration does not substantially vary in intensity. Laterally, the red colour grades into pink and subventrally into pale pink or whitish, like the underside of the body. Central proleg crochets 19–22 and nearly in uniordinal circle, anal crochets 11–12, uniordinal serial. The tarsi are spinolate.

Head rather large, well rounded. Adfrontal setae AF2 and AF1 only slightly nearer each other than AF1 to clypeal setae C1. Frontal setae F1 of nearly same length as clypeal setae C2, which are visibly longer than C1. These relations are more similar to *Scrobipalpa*, *Gnorimoschema* and *Symmetrischema* than to *Scrobipalpula*, *Keiferia* and *Phthorimaea*. Line from O2 to A3 usually outside ocellus I, or only touching it. Mandible with anterior setae L3 distinctly longer than M3. Antennal joint nearly as broad as long. Terminal papillae of membranous maxillar lobus rather short. Hypopharyngeal part of labium short subspherical, spinneret not substantially longer than labial palpi. Prothoracic shield with distinct sulcus. Setae SD1 of shield usually longest, together with D2. Mesothoracic and metathoracic setae D1 et D2 on the same tubercle, like setae SD1 and SD2. Tubercle with setae L3 forming a nearly symmetric triangle with tubercles of setae SD1, SD2 et L1, L2. Chaetotaxy of second and fourth abdominal segments similar to that of other *Gnorimoschemini*. On eighth abdominal segment, tubercle of group SV unisetose. On ninth abdominal segment, tubercle with setae SD1 rather small and weakly pigmented. Tubercle with group of setae 'L' bisetose (setae L3 lacking). No specific positions of setae on anal supra tergite.

Larvae are remarkable both in size and coloration, and also in their distinctive setose tubercles. The larvae of *T. solanivora* are the biggest of the tribe. The key characters for identification (probably also of generic value) are the position of setae D1, D2 on the same (one) tubercle of the second and third thoracic segment, and the reduction of SD1 and the absence of L3 on the ninth abdominal segment.

#### Pupae

Fresh pupae are greenish, later become light and, gradually, dark brown. The cocoons are of silk, covered with small pieces of earth and detritus. Length of pupa 7.3–9 mm.

*T. solanivora* can be confused with two other species of *Gelechiidae* developing on potato: *Phthorimaea operculella*, already present in the EPPO area, and *Symmetrischema tangolias*. These two species are smaller than *S. solanivora*, as both adults and larvae. For identification of adults, see Povolný (1994). Genitalia are illustrated in Web Figs 3 and 5, and larvae in Web Fig. 7. *P. operculella* is another pest of South American origin attacking potato which is now cosmopolitan in potato-growing subtropical and tropical countries. Compared with *S. solanivora*, this moth is distinctly smaller (forewing length between 6 and 9 mm) more narrow-winged and showing no distinctive forewing pattern. Its caterpillars are leaf-miners and tuber-borers of cultivated and wild growing *Solanaceae* (potato, aubergine, tomato, capsicum, tobacco, *Solanum* spp., *Datura*, *Hyoscyamus*, *Physalis*). Damage due to *P. operculella* varies according to locality. *S. tangolias* is widely distributed in South America (including Patagonia) and introduced into Australia and USA (California) (Povolný, 1989). In Ecuador, where both species are present, *S. tangolias* seems to be able to eliminate *T. solanivora*.

#### Reference material

Type specimens are deposited in Department of Entomology, Moravian Museum, Brno; Department of Entomology, British Museum (Natural History), London (GB); Department of Entomology, US National Museum, Washington (US); Zoologische Staatssammlung, München (DE).

## Reporting and documentation

Guidelines on reporting and documentation are given in EPPO Standard PM7/– (in preparation)

## Further information

Further information on this organism can be obtained from:

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## Acknowledgements

This protocol was originally drafted by J.-F. Germain, LNPV, Montpellier (FR) and the late D. Povolný, Mendel University of Agriculture, Brno (CZ).

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## Appendix 1 Glossary

Aedeagus: the male's intromittent organ of copulation. The aedeagus or penis is typically long, cylindrical, tapered and sclerotized.

Apophyses: tubercular or elongate process.

Gnathos: tergum somewhat below the base of the uncus extending ventrad and caudad along the sides of the anus.

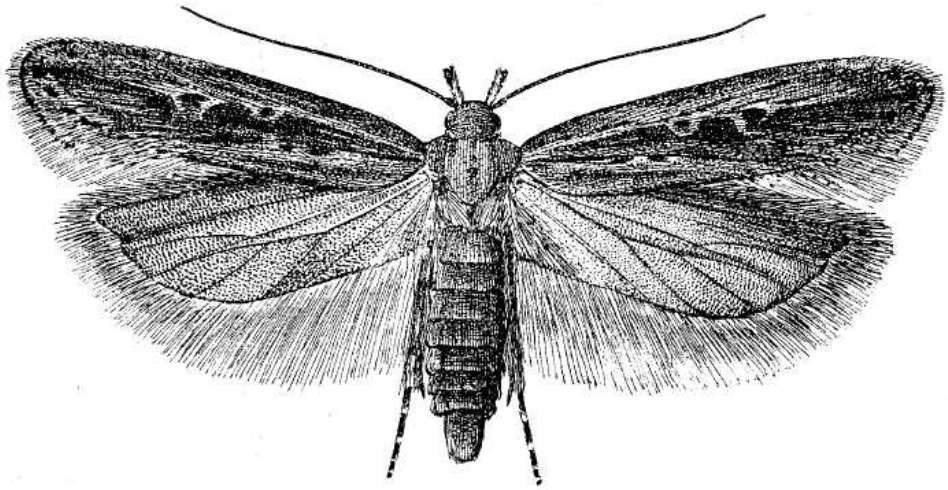
Signum bursae: one or more heavily sclerotized and often elaborate structures in the wall of the Bursa Copulatrix of the female.

Saccular: sac-like

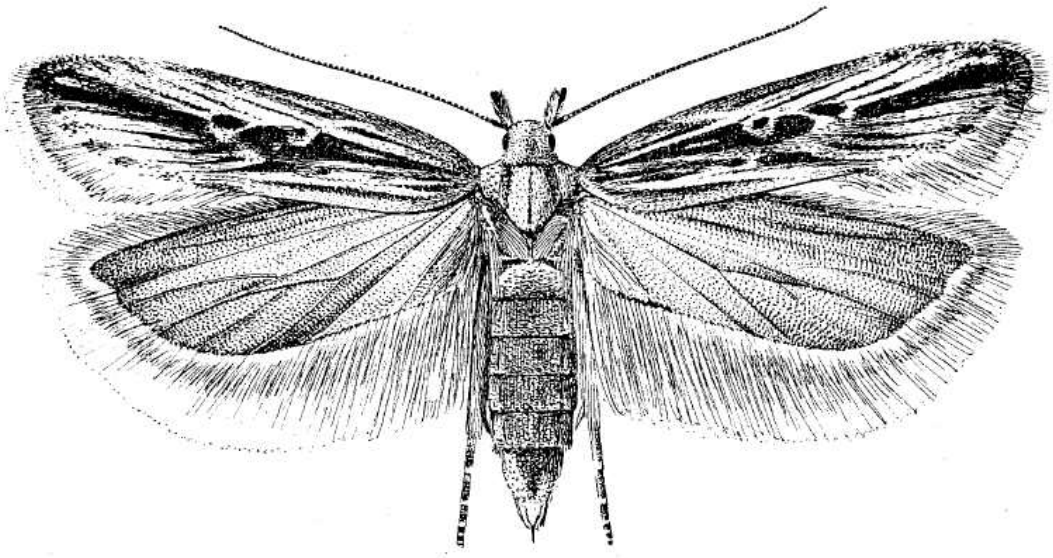
Saccus: in genitalia of male Lepidoptera, a midventral, anteriorly directed projection of the Vinculum (ninth abdominal sternum) inside the body that serves as muscle attachment.

Valve: genitalic claspers of the male.

Uncus: the curved hook directed downward from a triangular dorsal sclerite shielding the penis.



Habitus male

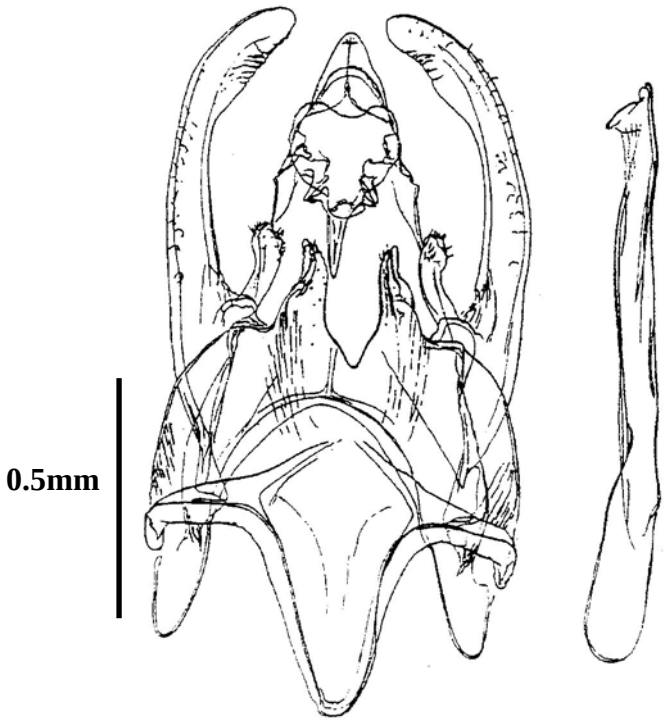


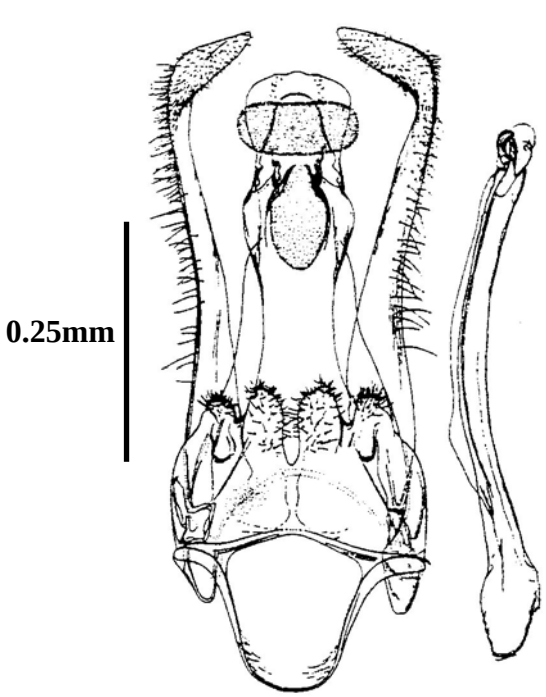
Habitus female

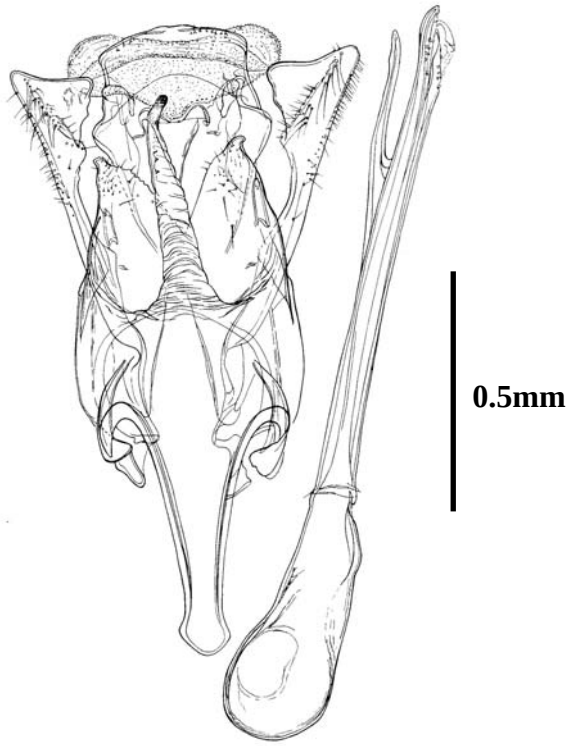
Forewing 7.2 (male) to 10.6 (female) mm.

**Web Fig. 1 :** *Scrobipalpopsis solanivora* adults (after Povolný, 1973)

*Scrobipalpopsis solanivora*



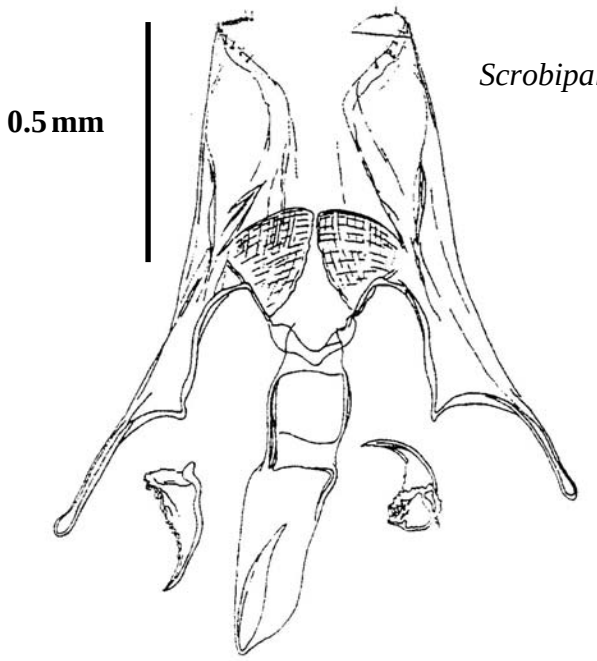




*Phthorimaea operculella* *Symmetrischema tangolias*

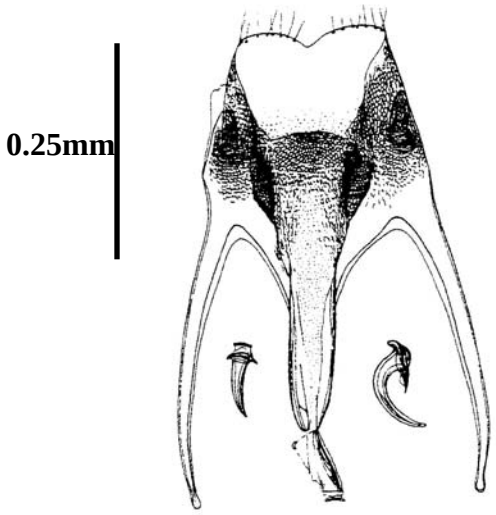
*S. solanivora* 1.6 – 1.8 mm *S. tangolias* 1.3 – 1.5 mm *P. operculella* 0.6 – 0.8 mm

**Web Fig. 2 :** Male genitalia (after Povolný, 1973)

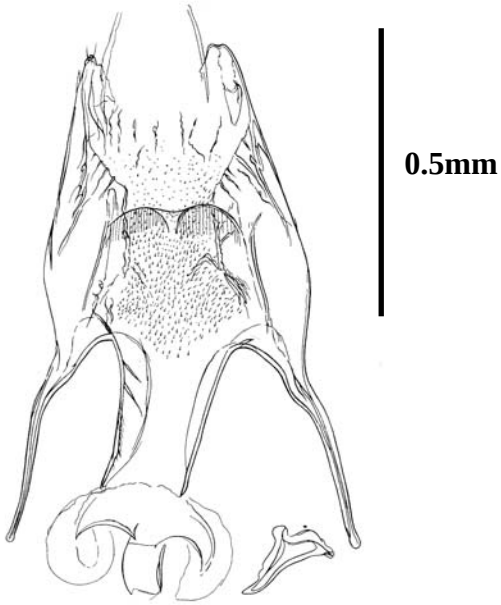

**Web Fig. 3** : *Scrobipalposis solanivora*
Male genitalia
(photo J.-F. Germain)




*Scrobipalpopsis solanivora*



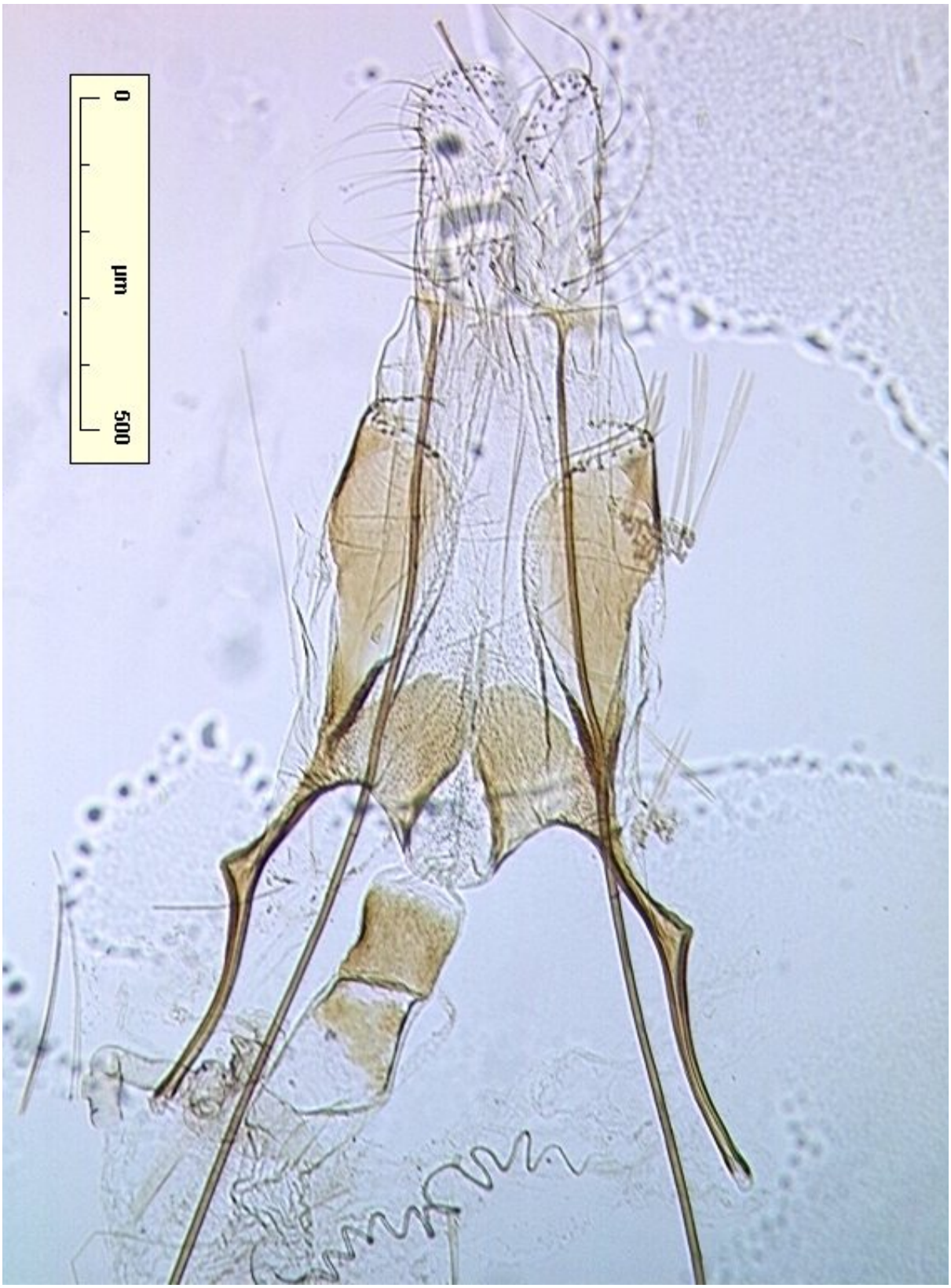

*Phthorimaea operculella*



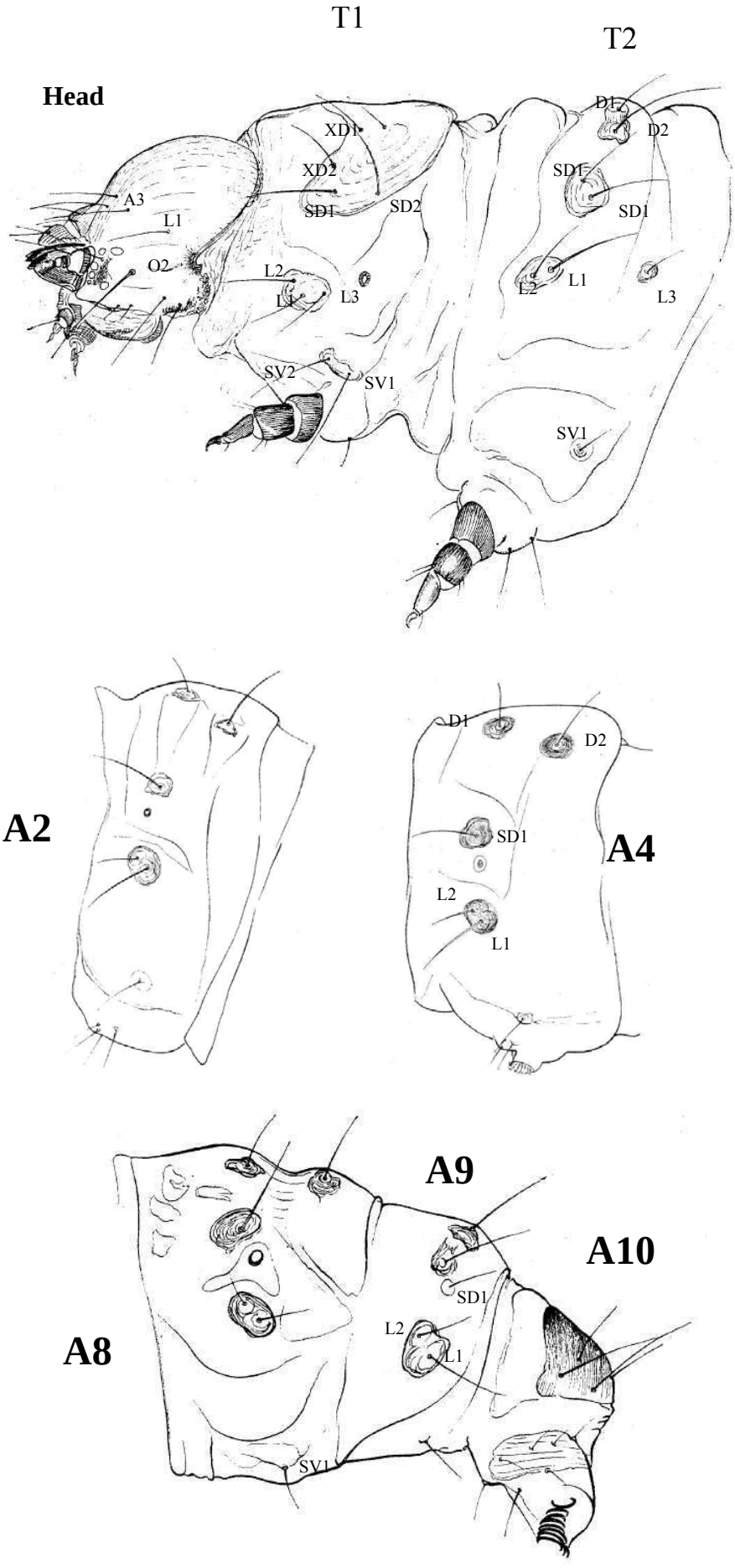

*Symmetrischema tangolias*

| | | |
|---|---|---|
| *S. solanivora* | female subg. plate | 1 – 1.2 mm |
| *S. tangolias* | // | 0.8 – 1 .1 mm |
| *P. operculella* | // | 0.4 – 0.6 mm |

**Web Fig. 4** : female genitalia (after Povolný, 1973)
(Subgenital plate : an apical process which covers and protects the gonopore)




**Web Fig. 5** *Scrobipalpopsis solanivora*
Female genitalia
(photo J.-F. Germain)




**Web Fig. 6** Larvae, chetotaxy last instar (after Povolný, 1973)

(photo André Pollet ©IRD)

*Phthorimaea operculella*
*Scrobipalposis solanivora*
***Symmetrischema tangolias***

**Web Fig. 7** larvae (*S. solanivora* last instar: 12.4 to 14.2 mm)