European and Mediterranean Plant Protection Organization
Organisation Européenne et Méditerranéenne pour la Protection des Plantes

Clarification of efficacy data requirements for the authorization of an insecticide applied as seed treatment for the control of wireworms in crops such as maize, sunflowers, millet and sugar beet in the EU

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This document is intended to assist applicants and evaluators to interpret EPPO Standard PP 1/278 *Principles of zonal data production and evaluation*. Expert judgement should be applied in all cases.

The focus of this paper is in particular on the number and location of trials and the extrapolation between different crops for the justification of effectiveness, phytotoxicity and resistance issues. There is a need to provide clarification of these areas as part of the zonal authorisation process for plant protection products (as defined in EU Regulation 1107/2009).

All trials should be carried out under Good Experimental Practice (GEP) and using all relevant general EPPO Standards. Efficacy trials should be performed according to the EPPO Standard PP 1/46 *Wireworms* (available at http://pp1.eppo.int/). All tests should be carried out with the formulation of the product intended for use. If other formulations were used such data may still be used to support the proposed formulation, however bridging data or a sound scientific justification should be supplied to demonstrate comparability of the formulations and allow bridging between formulations. See EPPO Standard PP 1/307 *Efficacy considerations and data generation when making changes to the chemical composition of plant protection products.*

Trials should be carried out across a range of climatic and environmental conditions likely to be encountered, and over at least two years. Trials submitted to demonstrate effectiveness should contain challenging levels of wireworm pressure and wireworm species encountered across the different EU zones. The occurrence of different species and mixed populations should be taken into account. Trials with no or low populations of target species may be used to support crop safety. The trials should cover a range of relevant representative crops for the crops applied for. Extrapolation may be permitted between crops or groups of crops for which the same dose of active substance applied per seed is intended.

The applicant should provide full details of the biology of the pest and the agronomic importance in all relevant countries in the zone in which treated maize, sunflower, millet or sugar beet may be sown.

General information

The EU Zonal Rapporteur Member State (zRMS) and Concerned EU Member States (cMS) should be named, together with the relevant EPPO climatic zones and the status of the use (major or minor). Where the product/formulation is already authorized in countries, information should be provided about the insecticide active substance(s), content, type of formulation, the current registration situation and the registration history in the zRMS and the cMS. Some information should be provided about the active substance(s) (e.g. approval status, mode of action, uptake and transport in the plant, behaviour in the soil, IRAC classification).

Information on the target pests

Pest name; Wireworms (Larvae of *Elateridae*): *Agriotes* spp. (AGRISP), *Agriotes lineatus* (AGRILI), *Agriotes obscurus* (AGRIOB), *Agriotes sputator (*AGRISU), *Agriotes sordidus* (AGRISO), *Agriotes ustulatus* (AGRIUS), *Agriotes brevis* (AGRIBR), *Agriotes litigiosus* (AGRILT), *Agriotes rufipalpis*

(AGRIRU), *Selatosomus aeneus* (CORMAN), *Athous* spp. (ATHOSP), *Hemicrepidius niger* (ATHONI). There may be further species of local importance.

Biology: Wireworms have a generation cycle of 2-5 years depending on factors like species, food availability, temperature and moisture. Occasionally this can even be shorter or longer in southern or northern Europe, respectively. The majority of the species has a developmental cycle with pupation in late summer or autumn. The adults emerge the same autumn from the pupa, but in general, they stay in the soil until the following spring. There are exceptions like *A. ustulatus*, which pupates in the late spring and emerges in summer.

Distribution: The occurrence of species varies within different regions in Europe.

Widespread species in the EPPO North-East and Maritime zone are *Agriotes lineatus, Agriotes obscurus* and *Agriotes sputator*. Especially the first two wireworm species are difficult to distinguish morphologically. Additionally, in the south of the EPPO Maritime zone *Agriotes ustulatus* and *Agriotes sordidus* occur.

In the EPPO Mediterranean zone, *Agriotes ustulatus, Agriotes litigiosus* and *Agriotes brevis* are important. In the west of the zone, including Italy, *A. sordidus* is also of importance, while from the Balkan Peninsula further eastward it is replaced by *A. rufipalpis*.

In the EPPO South-East zone *Agriotes lineatus, A. sputator, A. brevis, A. rufipalpis* and *A. litigiosus* are the most important species.

Species from other genera (*Athous* spp., *Cidnopus* spp., *Hemicrepidius niger* and *Selatosomus aeneus*) can also be regionally important within the EPPO Maritime zone. Species from other genera may also be of regional importance in further climatic zones.

Experiences with some biological products such as entomopathogen fungi indicate that their efficacy is highly dependent on the wireworm species involved. Therefore, when trialling biological products intended for use as a seed treatment, the different species of wireworm in the trials need to be identified because they may react very differently.

The identification key provided in the Annex II will allow identification of wireworms genera and, in some cases, of the species.

Treatment thresholds (examples)

No clear single threshold for wireworms exists.

For maize in Italy, thresholds can vary according to the species involved (Furlan *et al.* 2014). For northern Italy the following threshold in maize was suggested: below 1 wireworm/bait trap for *A. brevis*, 2 wireworms/bait trap for *A. sordidus* and 5 wireworms/bait trap for *A. ustulatus* at bare soil in spring, an average soil temperature above 8 °C at 10 cm soil depth and soil water capacity near maximum (see also Appendix I).

Similar threshold differences between species are likely for wireworm species in other regions of Europe.

Damage: Damage on crops such as maize, sunflower, millet, and sugar beet can be observed as plants destroyed either by wireworm feeding or, in the case of maize, also by the development of secondary tillers when the main vegetation shoot has been destroyed.

Damage is often increased if the growing conditions of the plant are poor (e.g. low temperature, dry or very wet soil etc.) and plants stay in a sensitive young stage for longer periods. Wireworm attacks on plants at later growth stages or that are well established often do not result in significant damage.

Damage in crops such as potato or some root and tuber vegetables where subterranean parts are attacked at later plant stages, is caused by the wireworms feeding on and tunnelling into these plant parts. This can lead to severe quality losses and may render the crop unmarketable. Such sites may be useful for

choosing as wireworm trial sites. However, trials using these crops cannot be used to extrapolate to crops covered in this paper in which wireworms attack young seedlings and vice versa.

Effects on yield

No special yield data are usually necessary, because wireworm attack usually affects the number of plants establishing. Nevertheless, yield data may demonstrate the importance of controlling loss of seedlings in general.

Information on the target crops

The main crops which may need protection from wireworm attack at establishment are considered to be maize (*Zea mays* ZEAMX), sunflower (*Helianthus annuus*, HELAN), millet (millet crops 3MILC) and sugar beet (*Beta vulgaris* subsp. *vulgaris* var. *altissima* BEAVA). In addition, less common spring sown crops such as soybean (*Glycine max* GLXMA) also may need protection.

Maize is produced on large scale in the EU except in most parts of northern EU, UK and Ireland. The crop may be grown for seeds or grain (hard kernels), cobs (soft kernels), silage (fodder maize) or biomass production.

Sunflowers are mainly grown in the warmer areas such as the EPPO Mediterranean and South-East zones for seed production but there is also significant production in the EPPO Maritime zone.

Millet is usually produced in regions with warmer climate conditions and the area of millet production is distinctly smaller than that of maize.

Sugar beet is grown all over Europe, in all EPPO Zones, where sugar beet processing factories or bio-energy production facilities are present.

The applicant should always make sure that reliable and recently updated sources of information are used when discussing whether the crop being supported is major or minor during the justification of trial numbers.

Intended Use(s)

Treatment of seed with a plant protection product in a country is only permitted where that product is registered for use; however, treated seed can be freely traded throughout the EU even if the seed treatment is carried out at only one location.

Therefore, efficacy data for the registration of a seed treatment product should be provided from all EPPO zones in which the intended crop is defined as major (see Table 1). Any exception should be reasoned.

The sowing density, sowing depth and/or the row distance may vary between the EU regions, between countries and even within an individual country and maximum sowing densities for each country where registration is sought have to be clearly defined. The sowing rates used in trials should represent the usual sowing times, sowing densities, row distances and sowing depths for the different crops (see also chapter on Extrapolation to other crops).

The applicant should clearly describe the details of the recommended use/uses for each crop for which registration is sought (See EPPO Standard PP 1/240, *Harmonized basic information for databases on plant protection products,* particularly points 15 - 34).

Number and distribution of trials required for an authorization

Effectiveness (6.2)

EPPO Standard PP 1/226 *Number of efficacy trials* indicates that for authorization in a single country/climatic zone, 6 to 15 fully supportive results are required over 2 years for each intended use. Clearly, this requirement is less where the pest in question is a minor pest.

To support an authorization in the EU, which is classed as one zone for seed treatments, more than the EPPO recommended number of trials results (i.e. 6-15) for a single EPPO climatic zone is required.

The whole of the EU encompasses all 4 different EPPO zones of comparable climate. A sufficient number of trials distributed across these 4 EPPO zones are therefore necessary to encompass the likely range of conditions encountered to support an authorization across all EU zones.

However, depending on the intended crops, the product may not be used in all EPPO climate zones. For example, the EPPO North-East zone is not a relevant growing zone for crops such as sunflower and millet, whereas maize and sugar beet are grown there but often at a lower acreage compared with other zones.

The majority of the effectiveness trials (see PP 1/278 *Principles of zonal data production and evaluation*) should be conducted in those zones and countries where wireworms are a key target and where the intended crop is a major crop in the zone (see Table 1). An effectiveness trials programme to represent the whole of the EU with uses intended for several crops should therefore include trials conducted in all EPPO zones using relevant crops within each of the zones. If only 1 or 2 crops are intended, trials only from countries in the EPPO zones, in which this crop are considered major, need to be presented.

Table 1: Definition of major or minor crops depending on EPPO climatic zones

Crop	EPPO climatic zones			
	Mediterranean zone	**Maritime zone**	**South-East zone**	**North-East zone**
Maize	major	major	major	major
Millet	major	minor	major	minor
Sunflower	major	major	major	minor
Sugar beet	major	major	major	major

An extrapolation between the four crops is only possible if a similar application rate (± 10%) of active substance per seed is used. Trials sites should represent the usual sowing density and depth of the region.

Each EPPO climatic zone should be sufficiently represented. Therefore, trials within each EPPO climatic zone should be carried out in at least three of the countries within that zone.

If use on all four crops is intended, at least 30 trials distributed over the four EPPO zones should be presented (Figure 1). For maize and sugar beet, at least 10 trials for each crop are required. For the two other crops additional data from a minimum of 10 trials together for both crops, sunflower (>6) and millet (>four), are required. All trials should be distributed between the four EPPO climatic zones according to the importance of the crop within the zones.

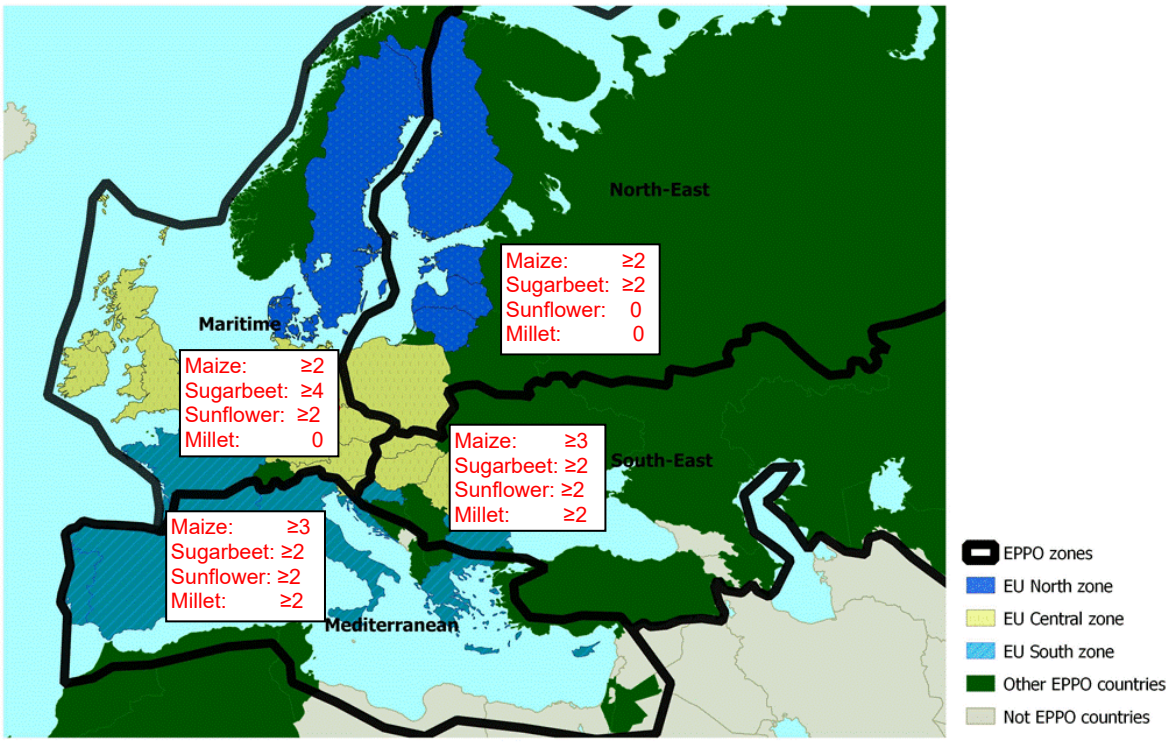

Figure 1. Visualization of the planning of trial numbers for wireworms for an insecticidal seed treatment product used in maize, sunflower, millet, and sugar beet.
Note that this is a schematic overview of the distribution and do not show exact locations (e.g. instead of a trial in the EPPO Maritime zone, a trial in the EPPO South-East zone is also possible).
Please also note that for the EPPO climatic zones, the borders are intentionally broad indicating that there is an area of gradual change in climate between the zones proposed (as defined in EPPO Standard PP 1/241 *Guidance on comparable climates*).

If the proposed use of the product is for the two major (across all zones) crops only, e.g. maize and sugar beet, then data from a minimum of 10 trials for each crop are required with the trials distributed across all the climatic zones where the crop is considered to be major.

If use is proposed for one single major (across all zones) crop only (maize or sugar beet), then data from a minimum of 5 trials from each EPPO climatic zone should be presented.

For millet and sunflower, data of EPPO zones where these crops are major is needed with trials on sunflower and millet primarily, but not exclusively, conducted in the Mediterranean and South-East zone.

The intended use on 'wireworms' includes a complex of species. It is therefore important that trials encompass key major species in the EPPO climatic zones (Table 2) where the relevant crops are grown on a major scale. Extrapolation to all species of wireworm may then be possible, especially if the type of active substance is known to act on a broad range of insects.

Trials for seed treatment products, should also consider different soil types when selecting trial sites. Additionally, it has to be considered that different species of wireworms may have different preferences for certain soil types.

Data from other EPPO countries that are climatically and agronomically comparable to those in the EU and where the target pest is a major pest and target crop is a major crop may also be used to provide evidence of effectiveness and could potentially replace some of the trials conducted in some of the EPPO climatic zones. If such data are used, they must be supported by a scientific reasoned case.

Data may need to be presented separately according to species, EPPO climatic zone (or any other pest relevant geographic areas) and for the different intended crops to enable a consideration of whether there is any impact of climatic conditions or crop grown on performance.

Table 2: Wireworm species to be considered as key pests depending on EPPO climatic zones

Wireworm species	**EPPO climatic zones**			
	Mediterranean zone	Maritime zone	South-East zone	North-East zone
Agriotes sordidus	X	X		
Agriotes ustulatus	X	X	X	
Agriotes lineatus		X	X	X
Agriotes obscurus		X		X
Agriotes sputator		X	X	X
Agriotes brevis	X		X	
Agriotes rufipalpis	X		X	
Agriotes litigiosus	X		X	
Cidnopus spp.		X		
Selatosomus aeneus		X		
Athous spp./ *Hemicrepidius niger*		X		

If data from all zones are considered to show comparable performance, it may be possible to combine all relevant data together. Nevertheless, some initial analysis to demonstrate this is an acceptable approach may be required. When the data are supporting e.g. a new formulation/product, where it has been established that the whole zone can be considered comparable, then summarizing data for the whole zone may be more justified.

Data summary tables should be produced in accordance with EPPO Standards PP 1/181 *Conduct and reporting of efficacy evaluation trials including good experimental practice* and PP 1/152 *Design and analysis of efficacy evaluation trials*.

The key information to provide in the tables should include:

Crop used in trials with seed thousand grain weight (TGW), rate used per seed (in µg or mg/seed), sowing date, sowing density (no. seed per ha), sowing depth, row distance, wireworm species or genus in the trial site, population levels at time of sowing, number of trials, mean % control/efficacy and the range of minimum and maximum levels, for the control and both the test product as well as for the reference products, at each assessment timing

The type of seed treatment (e.g. pelleting) may also be indicated.

Results should only be included from trials conducted to GEP in accordance with all relevant EPPO Standards and where there are agronomically relevant pest populations present.

Minimum Effective Dose (6.2)

Minimum effective dose trials should be conducted in accordance with EPPO Standard PP 1/225 *Minimum effective dose*. These trials should be conducted across the relevant different EPPO climatic zones (or any other pest relevant geographic areas) to demonstrate that the proposed dose is justified for the representative uses and targets. The majority of data should be generated where pest pressure is highest, but a proportion of trials should still include areas of more variable pest pressure.

Resistance 6.3

Reference should be made to EPPO Standard PP 1/213 *Resistance risk analysis*. Wireworms belong to low resistance risk pests, because usually there is no control of wireworms on the same field in several

following years. Furthermore, a considerable part of the population of the species involved lives in non-agricultural areas and the developmental time of a new generation is more than 1 year.

A resistance management option has to be presented which may be different in warmer regions with faster population development and areas in which insecticides may be used on a more regular yearly base. Care should be taken in case of those active substances which are also used to control other insect pests in crops not sensitive to wireworms/ but selecting for resistance of wireworms or even adult wireworms (click beetles) in these crops though they might not produce real damage. Detailed resistance management strategies will often need to be country specific. Reference may be made to relevant 'Resistance Action Committee' (RAC) recommendations, but should be tailored to individual country and reflect e.g. number of applications required, availability of other control options etc. In particular any advice from local 'Resistance Action Groups' should be addressed in National Addenda.

Phytotoxicity to target plants (including different cultivars), or to target plant products (6.4.1)

Observations for phytotoxic effects should be made in all effectiveness trials. If there is any indication of such effects e.g. under different climatic conditions, more detailed specific crop safety trials should be carried out clarifying under which conditions such effects may occur (see PP 1/135 *Phytotoxicity assessment*). Yield data (see below) are only needed if there were indications of phytotoxicity in efficacy trials.

Specific trials should always be performed for germination tests of the different crops with a range of common cultivars soon after treatment and also after storage of seed for 1 year in ambient storage conditions. These types of trials need to be carried out for all intended crops separately. See EPPO PP 1/135 *Phytotoxicity assessment* for further details.

Effects on the yield of treated plants or plant products (6.4.2)

Yield data are only needed if there were indications of phytotoxicity in effectiveness trials and then this should be addressed in the same way as for herbicides.

Effects on the quality of plants or plant product (6.4.3.)

Generally, this is of little relevance for insecticidal seed treatments. Appropriate quality assessments relevant to that crop should be made. In some instances, additional observations in the effectiveness trials may be sufficient to address the relevant point. See EPPO PP 1/135 *Phytotoxicity assessment* for further details.

Effects on transformation processes (6.4.4)

Generally, this is of little relevance for insecticidal seed treatments. Reference may be made to EPPO Standard PP 1/243 *Effects of plant protection products on transformation processes*, which provides an indication of the circumstances under which data on transformation processes are required.

Taint

Reference may be made to EPPO Standard PP 1/242 *Taint tests.*

Impact on treated plants or plant products to be used for propagation (6.4.5)

Reference may be made to EPPO Standard PP 1/135 *Phytotoxicity assessment*, which provides an indication of the circumstances under which data on plant parts for propagation are required.

Impact on succeeding crops (6.5.1)

The decision frameworks in EPPO Standards PP 1/207 *Effects on succeeding crops* should be followed when addressing these points. For wireworm control, data are not usually necessary if there is no indication of such effects from the pre-emergence screening tests, and no significant adverse effects were visible in effectiveness trials.

Impact on other plants, including adjacent crops (6.5.2)

The decision frameworks in EPPO Standards PP 1/256 *Effects on adjacent crops* should be followed when addressing these points. For wireworm control, data are not usually necessary if there is no indication of such effects from the post-emergence screening tests and such effects were not visible in effectiveness trials. (If the product is to be authorized on a wide range of crops, then observations in the effectiveness trials may be sufficient, otherwise, the post-emergence data on a range of typical crops provides additional support).

Effects on beneficial and other non-target organisms (6.5.3)

When there are claims on the label for use as part of an Integrated Management Strategy, special trials may be required on a national basis.

Relevant data produced for the Ecotoxicology section or existing IOBC classifications for the active substance may be used.

Extrapolation to other crops

This example may be used for other crops which are sensitive in the seedling stage to wireworm attack if the dosing per seed is similar (± 10%) to one of the tested crops. Extrapolation to crops sown at higher densities (e.g. cereals) for which a lower rate per seed is likely would need supporting data. In such case, the rate of product per m² needs to be comparable to the crop on which the extrapolation is based. Especially for major crops sensitivity data may be needed.

An extrapolation to crops, which are sensitive to wireworm attack during late plant developmental stages, e.g. potato, is not possible. A lethal effect on wireworms is not assessed using the trial methodology proposed in EPPO PP 1/46 *Wireworms* and, in addition, wireworm species active at later crop stages may not have been active in the spring. Due to this time difference the wireworm may not get exposed to PPP treated to seed and the product being tested may have no or insufficient residual activity.

More information may be found in PP 1/257 *Efficacy and crop safety extrapolations for minor uses*.

References

- Commission Regulation (EU) No 284/2013 of 1 March 2013 setting out the data requirements for plant protection products, in accordance with Regulation (EC) No 1107/2009 of the European Parliament and of the Council concerning the placing of plant protection products on the market
- Furlan, L. *IPM thresholds for Agriotes wireworm species in maize in Southern Europe*, Journal of Pest Science, December 2014, Volume 87, Issue 4, pp 609–617
- Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directive 79/117/EEC and 91/414/EEC. Official Journal of the European Union L 309, 1-50.
- OECD Guidance Documents for Pesticide Registration http://www.oecd.org/env/ehs/pesticides-biocides/oecdguidancedocumentsforpesticideregistration.htm

Appendix I - Trapping of wireworms (adapted from Furlan, 2014)

For trapping wireworms, bait traps as described may be used. Each trap comprises a plastic pot (10 cm diameter) with holes in the bottom. The pots are filled with 2cm vermiculite, 30 ml of untreated wheat seeds and 30 ml of untreated maize seeds and then covered up with vermiculite. They are then soaked with water for 24h to ensure start of germination, before being placed into the soil 4–5 cm below the soil surface, covered with an 18-cm diameter plastic lid placed 1–2 cm above the pot rim in the soil. Traps are hand-sorted after 7 days, when the average temperature 10 cm beneath the surface is above 8°C to ensure that the bait traps stay in the soil for an equal period of wireworm activity. Agriotes larvae do not feed, or feed very little, at lower temperatures. Generally, the traps are removed from the fields 2 to 8 days before the crop is seeded. No considerable difference in wireworm feeding activity was observed between 8 and 13°C.

Appendix II - Wireworm identification key for common genera and species in agricultural crops

1. -Last abdominal segment divided into two urogomphi[1] with a gap between them (Fig.1) 2

   -Last abdominal segments undivided, more or less pointed (Fig.2) 7

2. -Gap between urogomphi basally rounded (Fig.3) 3

   - Gap between urogomphi basally pointed (Fig.4) 6

3. -Gap between urogomphi large, with wide opening (Fig.5) 4

   - Gap between urogomphi small, with narrow opening, nearly closed by the inner branches of the two urogomphi (Fig.6) 5

4. -Each urogomphus forked with two pointed ends (Fig.5, left and middle) *Hemicrepidius* sp.

   - Each urogomphus short and wide, forked with curved claw as outer branch, and two-tipped inner branch (Fig.5,right) *Selatosomus aeneus*

5. -Each urogomphus forked with outer branch like a curved claw *Athous* sp.

   -Each urogomphus with outer branch reduced to a small wart or spine *Cidnopus* sp.

6. -Last segment darker than others, at the sides with many teeth regularly decreasing in size from the urogomphi to the base of the segment (Fig.4) *Agrypnus murinus*

   -Last segment not darkened, with less teeth, which are less regularly shaped *Prosternon tesselatum, Ctenicera* sp., *Hypnoidus riparius*

7. - Last segment with a flat area on the upper side and ending in a more or less rounded tip *Melanotus punctolineatus*

   -Last segment with a pointed tip, more or less conical 8

8. -Last segment with two dark edged holes at the base of the segment (Fig.2, left) *Agriotes* sp.

   -Last segment without these holes, but often very conical and with last setae (bristles) before the pointed end of the last segment on small raised bases (Fig.2 Middle), wireworm less than 15mm long when fully grown *Adrastus* sp.

Key to genus **Agriotes** (if further differentiation needed, e.g. in case of biological products)

1. -Small raised bump before the pointed end of the last segment, seen from the side, the bump is protruding from the bulge of the segment. The end of the last segment is compressed concave laterally when seen from below or above (Fig.7) *Agriotes sordidus* and *A. rufipalpis*

   -No such bump and last segment not compressed concave laterally 2

[1] urogomphi (noun, plural; singular urogomphus) In Coleoptera larvae, a pair of outgrowths of the tergum of segment 9 in the form of spines or multiarticulate processes.

2.- Last setae (bristles) before the pointed end of the last segment on small raised bases (Fig.8) *Agriotes ustulatus*

-Last setae of the last segment not on small raised bases 3

3.-1.+8. Abdominal segment: Small seta above spiracle, before the large seta (Fig.9) 4

-1.+8. Abdominal segment without small seta above spiracle; no granulation at the beginning of segments and between coxae *Agriotes lineatus*

4.-No granulation at the beginning of segments and between coxae (Fig.10) *Agriotes obscurus*

-Granulations at the beginning of segments and between coxae (Fig.11) *Agriotes sputator*

Agriotes brevis

Additional information concerning occurrence in fields:

Hemicrepidius: mainly *H. niger*, less commonly *H. hirtus*

Athous: *A. haemorrhoidalis* or *A. bicolor* most common in Middle Europe, rarely other species

Selatosomus: *Selatosomus aeneus* common in Middle Europe in sandy soil, there rarely others like *S. latus*

Hypnoidus riparius, Ctenicera sp., *Prosternon tesselatum:* all rare on agricultural land

Agrypnus murinus: not in high numbers on agricultural land, mainly on grassland

Adrastus sp.: small, rarely cause damage

Dalopius marginatus: Only where fields are adjacent towoodland

Melanotus sp.: *M. punctolineatus* most common in Middle Europe, rarely other species

Agriotes litigiosus: Currently not enough data to include the species

Agriotes sordidus and *Agriotes rufipalpis*: larvae probably not distinguishable by morphological criteria

Agriotes sputator and *Agriotes brevis*: larvae probably not distinguishable by morphological criteria

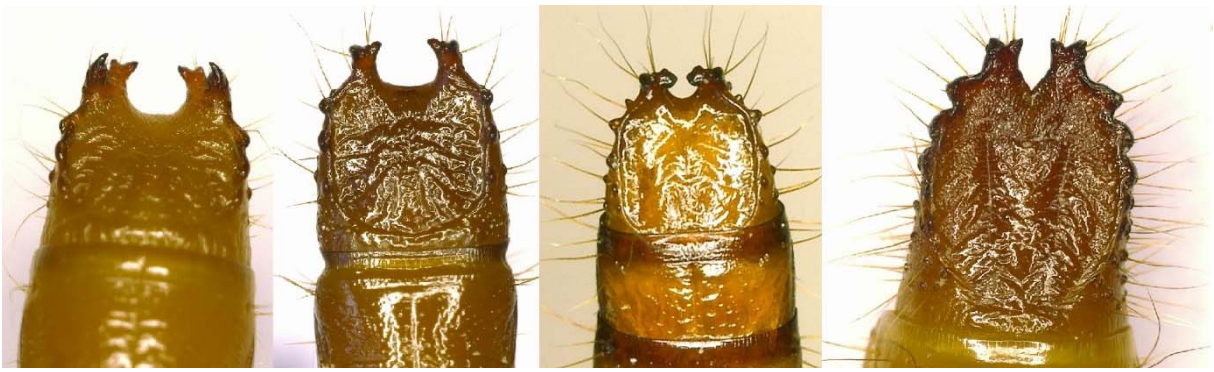

Fig.1: Last abdominal segment at the end divided into two urogomphi

Fig.2: Last abdominal segment pointed or rounded with a single tip

Fig.3: Gap between urogomphi rounded at base

Fig.4: Gap between urogomphi pointed at base

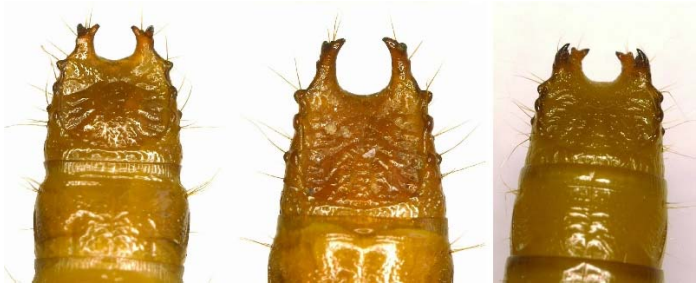

Fig.5: Gap between urogomphi large and wide open

Fig.6: Gap between urogomphi small and opening nearly closed by inner branches of urogomphi

Fig.7: *Agriotes sordidus/rufipalpis*

Fig.8: *Agriotes ustulatus*

Fig.9: Small seta above stigma (not always easy to see)

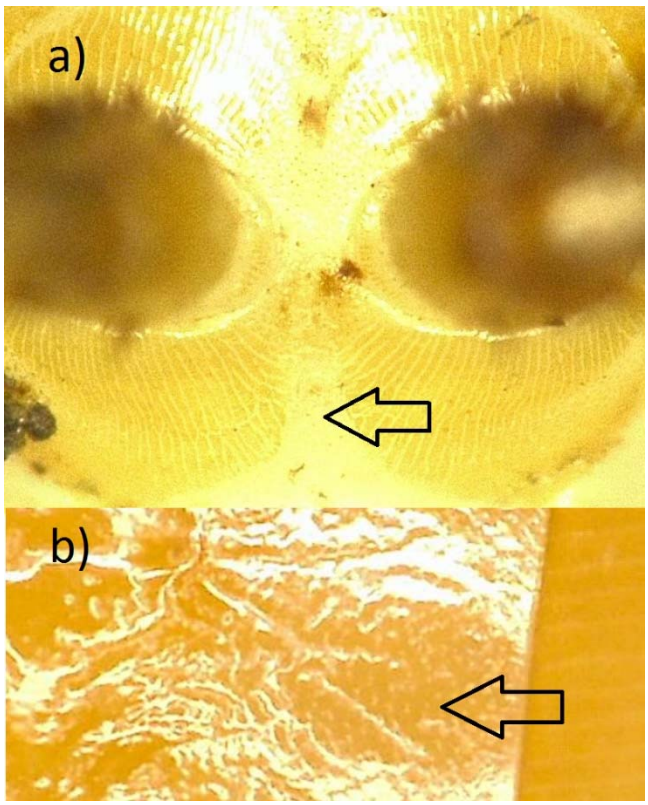

Fig.10: No granulation a) between legs and b) at begin of segments

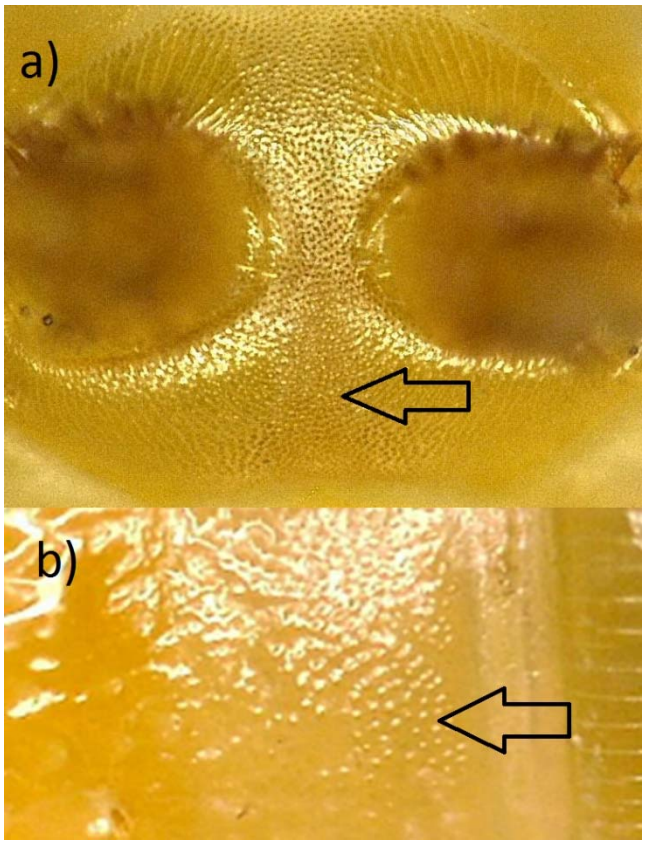

Fig.11: Granulation a) between legs and b) at begin of segments