

National regulatory control systems
Systèmes de lutte nationaux réglementaires

***Diabrotica virgifera*: procedure for official control**

Specific scope

This standard describes procedures for official control aiming to monitor, contain and eradicate *Diabrotica virgifera*.

Specific approval and amendment

First approved in 2005-09.

Introduction

Diabrotica virgifera is an EPPO A2 pest. Details on its biology, distribution and economic importance can be found in EPPO/CABI (1997). Its natural means of spread is adult flight. Spread is also possible through the transport of green parts of maize, with plants with growing media attached as well as with soil (since over-wintering eggs, larvae and pupae are all found in the soil). Recent outbreaks in the EPPO region near airports or communication lines suggest that the pest can be carried as a contaminating pest with long distance transport. Experience in USA and Europe has shown that *D. virgifera* has a high spread potential over moderate distances (c. 40 km per year, although dispersal over longer distances has been reported). *D. virgifera* has only one generation per year but is highly fecund. This high fecundity supports pest survival under difficult environmental conditions. *D. virgifera* mainly attacks maize (*Zea mays*), the larvae feeding on the roots and the adults feeding on the leaves, pollen, and silks. A few other *Poaceae*, found mainly in Southern Europe may occasionally serve as host plants for the larvae while the adults may also feed on other *Poaceae*, *Asteraceae*, *Fabaceae* and *Cucurbitaceae*.

The EPPO member countries with areas at risk are advised to prepare a contingency plan for surveillance, eradication and containment of this pest.

This standard presents the basis of a national regulatory control system for the monitoring, eradication and containment of *D. virgifera* and describes:

- Elements of the monitoring programme that should be conducted to detect a new infestation or to delimit an infested area.
- Measures aiming at eradicating recently detected populations (including an incursion).
- Containment measures to prevent further spread in a country or to neighbouring countries, in areas where the pest is present and eradication is no longer considered feasible.

In the case of recently detected populations related to natural spread of the pest, countries may wish to evaluate the prospects for eradication and may decide to implement a containment programme rather than an eradication programme. As regional cooperation is of key importance for the control of *Diabrotica virgifera*, it is necessary for countries to communicate with their neighbours to exchange views on the best programme to implement in order to achieve the regional goal of preventing further spread of the pest within the region. However, countries where *Diabrotica virgifera* is already widespread may decide that they have no reason to apply the standard.

Monitoring of *D. virgifera*

Monitoring of *D. virgifera* is based on trapping of adults. Visual inspection in the field of either silk or root damage or other forms of manual sampling, e.g. sweep nets or suction traps are not suitable for early detection of the pest. Similarly, it may take several years for the population to increase such that the root damage by larval feeding becomes apparent, therefore visual inspection is unsuitable for early detection. Elements on monitoring are described in Appendix 1.

Eradication of *D. virgifera*

The eradication programme for *D. virgifera* in the case of recently detected populations (including an incursion) is based on the delimitation of a demarcated area or areas within the country in which measures are applied to prevent further spread of the pest and to eradicate it. These measures are described in Appendix 2.

Containment of *D. virgifera*

The containment programme for *D. virgifera* in the case of established populations is based on the delimitation of a buffer

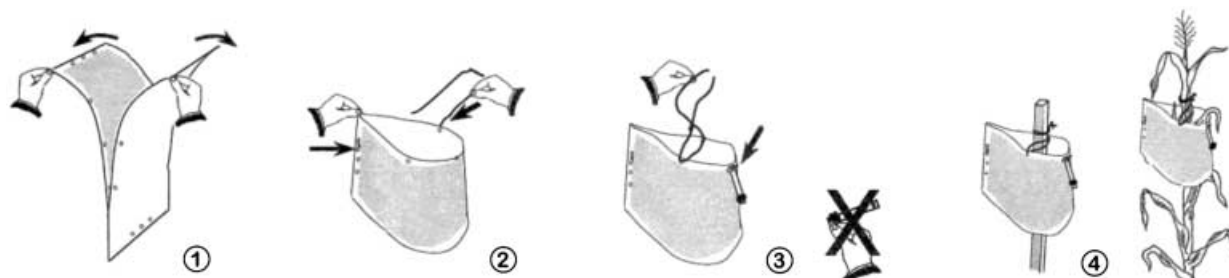


Fig. 1 Installation of PAL type traps.

zone around the infested area in which measures are applied to prevent further spread of the pest in the country or to neighbouring countries. These measures are described in Appendix 3.

References

- EPPO/CABI (1997) *Diabrotica barberi and Diabrotica virgifera. Quarantine Pests for Europe*, 2nd edn, pp. 233–237. CAB International, Wallingford (GB).
- EU (2003) Commission Decision of 24 October 2003 on emergency measures to prevent the spread within the Community of *Diabrotica virgifera* Le Conte, *Official Journal of the European Communities* no. L275, 49–50.
- OEPP/EPPO (2004) EPPO Standards PM 7/36 (1) Diagnostic protocol for *Diabrotica virgifera*. *Bulletin OEPP/EPPO Bulletin* 34, 289–293.

Appendix 1: Monitoring of *Diabrotica virgifera*

NPPOs should ensure that a sufficient number of traps is available. Field inspection staff, including non-permanent staff should be appropriately trained. Field inspection staff should also have access to accurate photographs and mounted specimens.

Types of traps

Pheromone traps should be used for early detection of new infestations. Floral volatile traps may also be used but are mainly recommended where the pest has already been detected. Pheromone and floral volatile traps designs are presented below. Yellow sticky traps are not suitable for early detection but are useful for the estimation of population levels of the pest when it is established (i.e. at higher population densities).

Pheromone and floral volatile traps for *Diabrotica virgifera*

The traps described below are suitable to monitor *D. virgifera*. Pheromone and trap development is an evolving area, and other equivalent traps may also be used.

Sticky 'cloak' traps (PAL and PALs)

The transparent PAL trap is baited with a synthetic pheromone and catches only males on its sticky surface. The yellow PALs attracts the insect with a combination of a floral attractant and

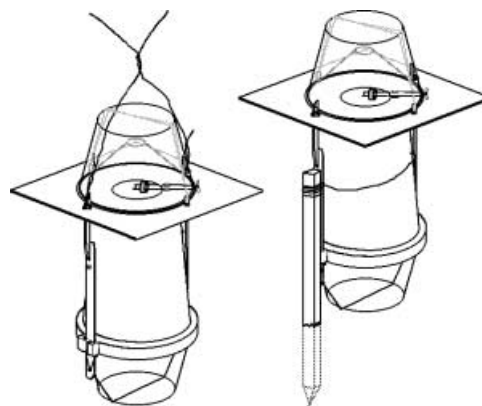


Fig. 2 VARs traps.

a visual stimulus, attracting both males and females. The PALs traps are best suited for the detection in areas of low pest prevalence.

Instructions for installing the traps in the fields are presented in Fig. 1.

Modified funnel trap (VARs) see Fig. 2

This trap can be supplied with two types of baits (pheromone and floral) and catches both males and females depending on the type of the bait (i.e. only males with pheromone bait, both sexes with floral bait). An insecticide should be added to the containers (both in the upper and lower parts). This insecticide should have a long lasting vapour action. In contrast to sticky traps, it does not lose efficacy even when large numbers of insects are caught. The VARs trap is most suitable for determination of the population density of high pest prevalence.

'Hat' trap (KLP)

This trap operates like the modified funnel trap, but its structure is much simple and the set up is easier.

Location of traps

Except for circumstances when they are used in an eradication programme (see density in Appendix 2) trapping density should be tailored to suit local circumstances and assessment of the risk of introduction (presence of host plants, intensity of maize

cropping, possible sites of introduction such as ports or international transport routes, etc).

In countries where *D. virgifera* has never been detected, and which are not close to an infested area, traps should preferably be placed in maize fields where maize has been grown in continuous production for at least two years. Whilst the entry pathway is not known with certainty, the pest has frequently been found to be associated with air or ground transportation. Traps are therefore best located near to airports (civil and military), international railway lines, motorways, ferry terminals, warehouses, and customs stations/border inspection points, in the first instance. Traps may also be placed in Cucurbitaceous crops or other pollen-rich crops.

When *D. virgifera* has already been found in restricted parts of a country but the pest is not widely distributed, traps should be placed around the perimeter of the known infested area(s) as well as in other areas in the country being considered as endangered. Criteria for the selection of fields to locate traps should be as indicated in the previous paragraph.

Period of trapping

The trapping period should correspond to the emergence and activity period of the adults of *D. virgifera*. This should be determined according to local circumstances using relevant information, e.g. climatic data. For example, in the Southern part of the EPPO region, the trapping period is likely to be mid-June until October. In the Northern part of the EPPO region, this is likely to extend from early July until mid October. Traps should be checked regularly for the presence of adults (i.e. every week for eradication programmes, at least every 2 weeks for monitoring and containment programmes). The attractant, and the trap if necessary, should be changed every 4–6 weeks depending on the climatic conditions (as high temperature increases evaporation of the attractants).

Identification/determination on traps

The adults may be confused with some other beetles present in Europe. Laboratories should be familiar with the EPPO Standard PM 7/36 Diagnostic Protocol for *D. virgifera* (OEPP/EPPO 2004). Laboratories should have preserved confirmed specimens of adults available, and if possible, preserved specimens of larvae and pupae available for identifying samples from soil. Diagnostic staff should be suitably trained in determining *Diabrotica virgifera*. As *D. virgifera* may be confused with other beetles, an identification guide comparing the main characters of *D. virgifera* with other similar beetles present in the area should be provided to inspectors examining traps.

When new outbreaks are suspected the specimen should be left *in situ* on the trap and either the entire trap submitted to the laboratory or the trap should be cut around the specimen and submitted to the laboratory. This is because removal of an individual from a sticky trap can result in damage to, or loss of body parts necessary for the diagnosis.

Appendix 2: Eradication programme

The eradication process involves four main activities:

- surveillance to fully investigate the distribution of the pest
- containment to prevent the spread of the pest
- treatment and/or control measures to eradicate the pest when it is found
- verification of pest eradication

Surveillance

Delimitation of demarcated areas

In the case of recently detected populations (including an incursion) a demarcated area should be delimited as soon as possible.

The demarcated area is composed of:

- a quarantine area¹ including the field in which the pest is known to occur and an area of 1 km to 5 km distance from the field boundary where the pest has been captured.
- a buffer zone² of up to 10 km distance from the boundary of the quarantine area.
- an enlarged buffer zone (up to 40 km) from the boundaries of the buffer zone may also be established.

The size of the different areas should be adapted to the climatic conditions affecting the behaviour of the pest, the level of infestation and the production system of host plants in the area concerned (e.g. distribution of host plants in the area). If the presence of *D. virgifera* is confirmed in another point than the original point of capture in the quarantine area, the delimitation of the demarcated area should be immediately adjusted accordingly.

The demarcated area is established for at least two years after the year of first capture.

Trapping in the demarcated area

Countries should more intensively monitor the presence of *D. virgifera* in the demarcated area.

Quarantine area: traps should be placed in the quarantine area preferably in all maize fields. In the absence of maize or other host plants, the trapping density in the buffer zone should be at minimum 1 trap per 10 ha of cultivated land. The traps should be checked every week.

Buffer zone: in the buffer zone and if applicable in the enlarged buffer zone, traps should be placed preferably in all maize fields but also in other host crops such as cucurbits, located in particular near to communication lines from the quarantine area and buffer zone. In the absence of maize or other host plants, the trapping density in the buffer zone should be at minimum between 0.5 and 1 trap per 100 ha of cultivated land.

Identification of susceptible crops in the demarcated area

Identification and locating of susceptible crops is necessary to achieve the eradication programme. Maize grown for game and

¹The quarantine area is referred to as the focus zone in EU, 2003.

²The buffer zone is referred to as the safety zone in EU, 2003.

private gardens should also be included in this inventory. Global Positioning Systems may be useful tools to locate fields for an efficient follow up of eradication measures. Geographic Information Systems may be used to provide information to identify areas of varying risk (because of climate, topography, land use such as continuing cropping of maize, etc.). Such information may also be collected for a wider area which may be at risk.

Containment

- Maize in the quarantine area should not be harvested until the end of the period where there is a risk of adult dispersal. The date for harvesting will be determined by taking into account the level of capture and the climatic conditions in the area concerned.
- Movement of fresh plants or fresh parts of *Zea mays* L. from the quarantine area should be prohibited until the end of the emergence period of the adults.
- Movement of soil from maize fields from the quarantine area should be prohibited.
- Agricultural machinery used on maize fields should be cleaned of all soil and debris before leaving the quarantine area.

Treatment and control programme

Treatment and control programmes for *D. virgifera* are mainly based on action taken to target the larvae of this pest, which feeds preferentially on maize roots and thus, the availability of the host is critical for its survival. Crop rotation is thus the key control measure for this pest.

In-furrow and seed treatments may also be effective, particularly in situations where *D. virgifera* population density is low. In addition, treatments against adults particularly during the pre-oviposition period can be effective in controlling the population by reducing egg-laying potential and minimising further spread. NPPOs should ensure that suitable plant protection products are available in the event of an outbreak. The following measures should be included in the eradication programme:

- A crop rotation should be imposed:
In fields where *D. virgifera* has been trapped, maize should not be grown for 2 years after the year of capture.
In the entire quarantine area, maize should not be grown for 2 years after the year of capture or a crop rotation should be imposed in each field so that maize should not be grown more than one year in three consecutive years.
In each field of the buffer zone maize should not be grown more than one year in two consecutive years. Rotation for one year is more effective than treatments.
- An appropriate treatment against the organism (e.g. foliar spray against adults to prevent further dispersal and oviposition) should be applied in maize fields in the quarantine area as well and may be applied in the buffer zone until the end of the oviposition period for two consecutive years (year of occurrence and the year after).

- Maize crops in the quarantine and buffer zones may also be planted with seed suitably coated with a plant protection product or an in-furrow plant protection product may be used at planting.
- Volunteer maize plants should be removed in fields in the quarantine area.

The measures applied in the buffer zone may also be applied in the enlarged buffer zone.

This programme should also be complemented with information to maize growers to highlight the potential economic losses from this pest in continuous maize production.

Verification of pest eradication

If no capture of the organism is made after two years following the last year of capture, the pest is considered to be eradicated and the measures imposed should be withdrawn. Monitoring should be maintained although with less intensity.

Appendix 3: Containment programme

In the case of an established population eradication is difficult to achieve. Experience in Europe has shown that the population expansion of *D. virgifera* can largely be reduced when pest management measures are applied. Containment measures aiming to prevent further spread of the pest to endangered areas in the country or to neighbouring countries should be applied. These measures are based on the delimitation of a buffer zone around an infested area and aim at suppression in this area.

Buffer zone

A buffer zone should be established around the infested area with a suggested radius of 40 km (corresponding to the average dispersal distance for the pest). The selected radius may be affected by the local ecological and climatic conditions and by economic considerations.

Trapping in the buffer zone

In the buffer zone, traps should preferably be placed in maize to monitor the spread of the pest. Trapping density should be adjusted to density of maize crops, risk (e.g. communication lines), etc. The traps should be checked every 2–3 weeks.

Containment measures

In this buffer zone, a crop rotation should be imposed so that maize should not be grown more than one year in two consecutive years.

In the infested area, crop rotation should be recommended as it is the most effective practice to manage *D. virgifera*. In-furrow and seed treatments may also offer additional protection.

Particular attention should be paid to suppress the pest around airports, ports and main international communication lines.