Express-PRA[1] for *Strauzia longipennis* – Occurrence –

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Initiation: Occurrence in sunflowers in Berlin and Brandenburg

***Reason for the revision**: New information on the damage potential*

Express-PRA	***Strauzia longipennis* (WIEDEMANN)**		
Phytosanitary risk for Germany	**high** ☐	**medium** ☐	**low** ☒
Phytosanitary risk for EU Member States	**high** ☐	**medium** ☒	**low** ☒
Certainty of the assessment	**high** ☐	**medium** ☒	**low** ☐
Conclusion	*The sunflower maggot (*Strauzia longipennis*), native to North America is so far found in the EU only in the Federal States Berlin and Brandenburg in Germany.* Strauzia longipennis *is not explicitly listed in the Annexes of Regulation (EU) 2019/2072, but in principle, it belongs to the category of non-European Tephritidae, regulated as Union quarantine pests. It was listed in the EPPO Alert List, but was deleted.* In 2012/2013, the winter with strong black frosts lead to a significant reduction of the population in the open landscape in Brandenburg, whereas the population survived in Berlin and the protected surroundings. *So far, no further natural distribution was detected in the Federal State Brandenburg within the last 10 years. The infestation is still limited to the Federal States Berlin and Brandenburg. The probability of natural distribution from the infestation area is rather low because only very low population densities were developed in sunflower fields in the open landscape. No damage to Jerusalem artichoke is known in Europe.* In the case of a spacious passive dispersal to southern cultivation areas of sunflowers, damage cannot *totally* be ruled out. *Based on this risk analysis, it is assumed that the pest could establish in further parts of Germany or another EU Member State. Following establishment, no significant damage is expected. Though it is a non-European Tephritidae-species,* Strauzia longipennis *is not classified as a quarantine pest and Article 29 of Regulation (EU) 2016/2031 does not apply.*		

Express-PRA	*Strauzia longipennis* (Wiedemann)
	Nevertheless, it is recommended as a precautionary measure, to destroy infested plant material in order to prevent the distribution of the fruit fly. It should also be noted that the estimation of the pest potential (low to medium) for the southern member states with extensive sunflower cultivation is still subject to uncertainties due to a lack of experience.
Taxonomy[2]	Diptera (flies); Tephritidae (fruit flies)
Common name	Sunflower maggot, peacock fly, mouche du tournesol (FR), Sonnenblumenfruchtfliege
Synonyms	*A series of synonyms is listed by GBIF (Global Biodiversity Information Facility) (https://www.gbif.org/species/1624370). However,* S. longipennis *is a highly variable species with a series of different forms/variants, some of which have since been defined as new species (Hippee et al., 2020, Forbes et al., 2013, Axen et al., 2010).*
Does a relevant earlier PRA exist?	No
Biology	One Generation per year; hibernation as larvae in plant debris in upper soil layer (USA, *Charlet et al., 2004*) or as pupae (*USA, Iowa, (Forbes et al. 2013),* Canada *(Allen et al. 1954),* Germany, (*Baufeld, pers. communication 2020*); pupation (USA) and emergence of the adults take place in June (USA, Canada, Germany). In Germany, the first adults can be expected in the beginning/mid of June; the adults are very active in the sunflower fields until the end of July and fly around. The females lay single eggs into the stem tissue of the young plants. Three larval stages are passed through within app. 6 weeks (Knodel et al. 2015). The larvae feed on the stem pith (Charlet et al. 2004) and produce long tunnels within the stems, but are also capable to destroy the pith nearly completely in case of severe infestation. From mid of August, the larvae (L3) leave the stems and rope down to search for an overwintering ground in plant debris and in the upper soil layers (USA) (Knodel et al. 2015) resp. to pupate (Canada) *(Allen et al. 1954)*; in Germany the fruit fly hibernates as pupae.
Is the pest a vector?[3]	No, but *S. longipennis* prepares the entrance portal for secondary infections with *Sclerotinia* (*Westdal and Barrett, 1962*) and other fungi.
Is a vector needed?[4]	No

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Host plants	Sunflower (*Helianthus annuus*), Jerusalem artichoke (*Helianthus tuberosus*), *Smallanthus uvedalia*, *Ageratina altissima* (Foote et al. 1993)
Symptoms[5]	*In 2014, the following symptoms were detected on the JKI-trial sites in Kleinmachnow and Berlin-Dahlem in local, protected sites:* Necrotic spots caused by oviposition on the stems (Fig. 1); feeding mines in the pith of the sunflower stems caused by the maggots (Fig. 2); maggots (L3) within the sunflower stem (Fig. 3); maggots are capable to reach the receptacle (Fig. 4); lodging of the sunflowers in the case of severe larval feeding (Fig. 5); bending down of the stems in the case of severe infestation (Fig. 6); exit holes of the maggots which go into the soil for pupation (Fig. 7). So far, these symptoms were only detected locally in protected sites in urban areas. *To date, these symptoms were not found in the commercial sunflower cultivation fields in the Federal State Brandenburg. The infestation was only detected by cutting the sunflower stems (Baufeld, personal communication, 2020).*
Presence of the host plants in Germany[6]	Sunflowers: prevalent; *in 2020, cultivation of 28,100 ha of sunflowers in Germany (Anonymous 2020a);* amongst cut flowers the sunflower ranges in place 4 of the share of sales in Germany; *in 2019,* the market share was 5 % in the range of cut flowers *(Anonymous 2020a)*. Jerusalem artichoke: in 2013, app. 800 ha of Jerusalem artichoke were cultivated in Germany (Anonymous 2013); the Rhine valley between Rastatt and Offenburg with app. 300-400 ha is the main cultivation area for Jerusalem artichoke in Germany *(Anonymous 2009)*; small cultivation areas can be found in Lower Saxony and Brandenburg. *Ageratina altissima*: in Germany present as ornamental perennial plant.
Presence of the host plants in the Member States[7]	Sunflowers: *prevalent, in 2019, EU-27 cultivated app. 4.3 Mio. ha of sunflowers; most sunflowers within the EU were cultivated by Romania (1,306,500 ha), followed by Bulgaria (815,600 ha), Spain (700,900 ha) and France (603,900 ha) (Deter 2020);* Jerusalem artichoke: is of low economic importance in southern France and the Netherlands; since 1978, it has been commercially cultivated in Seeland/Switzerland; in Denmark 15 to 20 ha were cultivated in 1990 (Anonymous 2020b).

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Known infested areas[8]	In 2010, first occurrence in Berlin. This was the first detection in Germany and Europe. In the meanwhile, it is widespread in Berlin (sunflowers as ornamentals in allotment gardens); in the Federal State Brandenburg an isolated occurrence is known – see containment zones in 2015 (Fig. 8), an abundance of 0.9 adults/trap resp. of 0.02 larvae per stem was detected, *indicating a very low abundance*.
Pathways[9]	Risk of passive dispersal: with living plant parts (cut flowers) of sunflower, with plants of *Smallanthus uvedalia* and *Ageratina altissima* (maggots), with infested soil (maggots, pupae); with tubers of Jerusalem artichoke (uncertain).
Natural spread[10]	Is described as a good flyer *(Everatt et al. 2015, Baufeld, personal communication, 2020)* and presumably is capable to fly several kilometres.
Expected establishment and spread in Germany[11]	Further establishment and distribution have to be expected because host plants are present and presumably since 2008, the pest is already present in Berlin; climatic conditions in Germany similar to those in parts of North America; though black frost below -20°C might lead to a significant reduction or even a 100% mortality of the population in fields; presumably, the establishment in areas with cultivation of sunflowers/ Jerusalem artichoke is generally possible.
Expected establishment and spread in the Member States[12]	Yes: in regions with cultivation of sunflowers/Jerusalem artichoke in moderate climate
Known damage in infested areas[13]	Larvae cause damage by feeding on the pith in the stem of sunflowers and rarely in the receptacle of ornamental sunflowers. Damage differs considerably in respect to time and location; it might be minor (mainly in the USA), but also significant damage might be caused (mainly in Canada (Brückner and Korneyev 2010, Rogers 1992) and in one single year *(2014)* in Berlin/Germany). The secondary infection with *Sclerotinia* following the damage caused by *S. longipennis* might be problematical, especially at high infection pressure as in Berlin in 2014 *(Baufeld, personal communication, 2020)*. In the USA: minor damage; however, in case of numerous occurrence, it might lead to reduction of seed yield and to stem break (White und Elson-Harris 1992); in total, the pest is classified as insignificant, so far, no economic damage was observed in the USA. As the pith only strengthens the stem structure and is of secondary importance for the nutrition of the

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	plant, the plant is capable to tolerate a certain amount of maggots. However, secondary infections might be caused by fungi; so far, the application of insecticides was not necessary and there is no economic damage threshold (Knodel et al. 2015). In Canada: if several larvae appear simultaneously in a stem, the pith may be consumed completely. The larvae rarely go into the roots; 10 to 20 exit holes can occur on a stem, with some larvae also using already existing exit holes; secondary infection with *Sclerotinia* occurs. Taller Russian varieties can break in wind (lodging); in general, damage is rather minor; in *single years,* in case of intensive infestation, up to 37 % yield loss may occur. Usually, parasitoids and antagonists hold the pest under the economic threshold; the control of the sunflower beetle (*Zygogramma exclamationis*) from mid of June to July also helps to control the sunflower maggot fly since no insecticides directly against this pest are approved; *S. longipennis* belongs to the significant stem destroyers of sunflowers in Canada (Rogers 1992). Normally, the sunflower fruit fly has no damaging effect on the diameter of the flower head, the seed yield and the shape of the seeds (Westdal und Barett, 1962). In Germany: in Berlin in the experimental field of the JKI (Berlin-Dahlem) severe damage occurred in one year (dieback of the plants in August 2014), especially in combination with secondary infection at humid weather conditions (Fig. 9). 15 % of a total of 1,600 inspected sunflowers were physically healthy, 33 % showed necrotic spots on the stems and 52 % had died. No quantitative investigation in respect to yield losses was conducted. *Very low abundance of* S. longipennis *and no damage were detected on the sunflower cultivation fields in the Federal State Brandenburg.*
Delimitation of the endangered area in Germany	Sunflowers are present throughout Germany as ornamentals in gardens and in horticulture; *field cultivation of sunflowers mainly in Brandenburg (10,500 ha), Saxony-Anhalt (3,900 ha) and Saxony (1,500 ha) (Anonym 2019);* Jerusalem artichoke is cultivated locally in Baden *(Anonymous 2009).*
Expected damage in endangered area in Germany[14]	*Low:* in breeding and under outdoor conditions *S. longipennis* pupated before winter, indicating the Canadian biotype. The economic damage depends on the abundance and in turn, this depends on the frequency of strong black frosts over several days and on the winter mortality of *S. longipennis*. The climatic

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	conditions for a high winter mortality can be expected more frequently in the continental influenced Federal State Brandenburg with strong winter frosts and minor snowfall (low winter precipitation), but for the greater part of Germany these are extreme conditions. *To date, no damage in field crops was detected in the infested area in the Federal State Brandenburg since 2010.* Parasitization of the pupae by *Coptera strauziae* (Hymenoptera, Diapriidae) in the endemic areas was detected (Anonymous 2015a); thus, the damage is also likely *to be influenced* by parasitization. Up to now, *Coptera strauziae* was not found in Germany. *Once a case of parasitization by the endemic species* Olethreutes arcuella *(Tortricidae) was observed in 2020. Furthermore, Assilidae were found in one experimental area in Kleinmachnow, which hunt their insect prey in flight. It would be conceivable that they use the sunflower fruit fly as prey (Baufeld, personal communication 2020).*
Expected damage in endangered area in the Member States[15]	*Low to medium:* in all Member States where sunflower (field crop, ornamental), Jerusalem artichoke (field crop) and *Ageratina altissima* (ornamental) are cultivated (see also presence of the host plants in the Member States); the conditions for hibernating (lower winter mortality) are considerably better in southern Member States, *so that an increase of the abundance cannot be ruled out. The extent of the damage, depending on the abundance and the sunflower species cannot be assessed. Since so far, with a few exceptions, damage has been found only in single years in Canada and Germany (2014 in Berlin-Dahlem), it is assumed that the damage potential is very limited and no permanent economic damage is caused.*
Control feasibility and measures[16]	In North America, several applications with an insecticide (Malathion) during the growing season (*Anonymous 2020c*) and crop rotation are recommended. New sunflower fields should be located as far as possible from old ones, because *S. longipennis* is a relatively good flyer; in the endemic areas, the fruit fly normally is held below the economic damage threshold via antagonists and parasitoids (mainly *Coptera strauziae*). Control trials in Germany in the years 2013/2014 (continued in 2015) showed that the insecticide Karate Zeon (Lambda-cyhalothrine) against the adults reached an efficiency of app. 70 % in the application year (Fig. 14) and of app. 75 % in the

	subsequent year (Fig. 15); mouldboard ploughing (25 cm) had an efficiency of app. 55 % and the combination of an insecticide treatment and mouldboard ploughing of app. 80 %. In a further variant with use of a rotary tiller, no adults were found (Fig. 15). There are still high uncertainties in respect to the measures. Currently, no efficient eradication measures are known. In Berlin, there is no obligation for measures in gardens and city areas. <u>Sunflower as field crop:</u> *If infestation with* S. longipennis *is detected in a sunflower field, this should be ploughed (mouldboard ploughing of 20-25 cm, preferably in spring (winter mortality)). If infestation is high, additionally an insecticide (z. B. Karate Zeon) can be used. Alternatively, a motor tiller can be used.* Crop rotation is recommended for sunflowers. New sunflower fields should be located as far as possible from old ones. <u>Sunflowers as pot plants and cut flower:</u> In horticultural companies, it should be ensured that no infested sunflowers as pot plants or cut flowers are removed from the infested area. Also, soil from fields in infested areas that formerly were used for the cultivation of sunflowers can be infested with larvae or pupae and be conducive to the passive dispersal. Companies that produce sunflowers and are located in the infested area must be informed and appropriate measures for the prevention of the movement of infested sunflowers and infested soil from infested areas must be provoked. On the infested fields, the motor tiller should be used preferentially.
Detection and diagnosis[17]	The adults are app. 6 mm long and have a wing span of app. 13 mm (Anonymous 2015b). Distinctive wing marking with broad dark bands that form an „F“ at the wing end (Fig. 10 and 11). In addition there are further characteristics on the wings and the chaetotaxis (arrangement of the bristles) on the head, as described and shown in pictures by Steyskal (1986) for a clear definition of the species (Steyskal 1986). The white longish eggs are app. 1 mm long and are dimpled into the plant tissue (Fig. 12); the typical fly maggots are yellowish-white and in the third and last stage 7 mm long (Knodel et al. 2015) (Fig. 3); typical puparium (Fig. 13). Monitoring: Kairomone traps of Hungarian production (*CSALOMON PALz,*

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	http://www.csalomontraps.com/4listbylatinname/strauzialongipennis.htm) or yellow traps (high by-catch) can be used for the survey of the adult animals; the cutting of sunflower stems and the presence of mines and maggots in the pith also indicates the presence of *S. longipennis*.
Remarks	
Literature	*Allen, W. R., Westdal, P. D., Barrett, C. F., Askew, W. L., 1954: Control of the Sunflower Maggot, Strauzia longipennis (Wied.) (Diptera: Trypetidae), with Demeton. 85th Annual Report of the Entomological Society of Ontario, 53-56.* *Anonymous (2020a): Beliebteste Schnittblumen in Deutschland nach Marktanteil in den Jahren 2017 bis 2019. https://de.statista.com/statistik/daten/studie/206579/umfrage/beliebteste-schnittblumen-nach-marktanteil/#statisticContainer* *Anonymous (2020b): Topinambur. https://de.wikipedia.org/wiki/Topinambur (accessed on 14-12-2020).* *Anonymous (2020c): Sunflower (Helianthus) Plant Health Problems. https://portal.ct.gov/CAES/Plant-Pest-Handbook/pphS/Sunflower-Helianthus (accessed on 02-12-2020)* *Anonymous (2019): Land- und Forstwirtschaft, Fischerei - Wachstum und Ernte – Feldfrüchte. Statistisches Bundesamt. Fachserie 3 Reihe 3.2.1. Statistisches Bundesamt (Destatis); https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Landwirtschaft-Forstwirtschaft-Fischerei/Feldfruechte-Gruenland/Publikationen/Downloads-Feldfruechte/feldfruechte-jahr-2030321197164.html (accessed on 18-12-2020)* Anonymous (2015a): Parasitoids of Fruit-Infesting Tephritidae – *Coptera* Say. http://paroffit.org/public/public_content/show/13179?content_template_id=54 *(accessed on 04-12-2020)* Anonymous (2015b): Sunflower maggots. Agriculture, Food and Rural Development Manitoba. http://www.gov.mb.ca/agriculture/crops/insects/sunflower-maggots.html *(accessed on 04-12-2020)* Anonym (2013): Deutsche Bauern setzen auf Indianer-Wunderknolle. Die Welt. http://www.welt.de/wirtschaft/article113594163/Deutsche-

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Fig. 1: Necrotic spots caused by oviposition of *Strauzia longipennis*

Fig. 2: Feeding galleries in the stem pith caused by the maggots of *Strauzia longipennis*

Fig. 3: Maggot (larva stage 3) of *Strauzia longipennis* within a sunflower stem

Fig. 4: Maggots of *Strauzia longipennis* can feed into the flower receptacle

Fig. 5: Tendency to lodging of sunflowers in case of significant larvae feeding

Fig. 6: Bending of the sunflower stems in case of significant infestation with *Strauzia longipennis*

Fig. 7: Exit hole of themaggots that rope down for soil for pupation

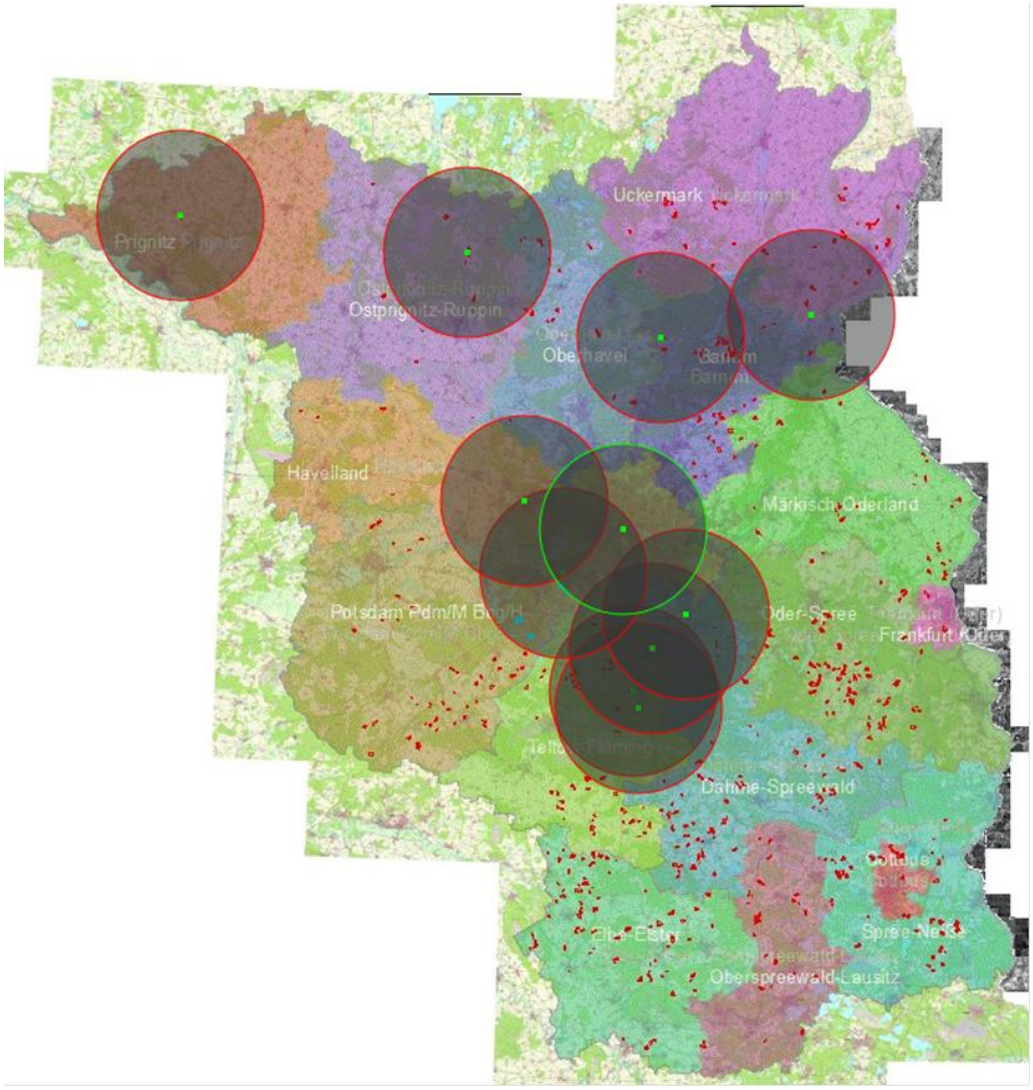

Fig. 8: Distribution of the sunflower fields (red), the infested zones with *Strauzia longipennis* in Berlin (green circle) and in the Federal State Brandenburg (red circles), each with 20 km limitation zones in the year Jahr 2015 (Source: LELF)

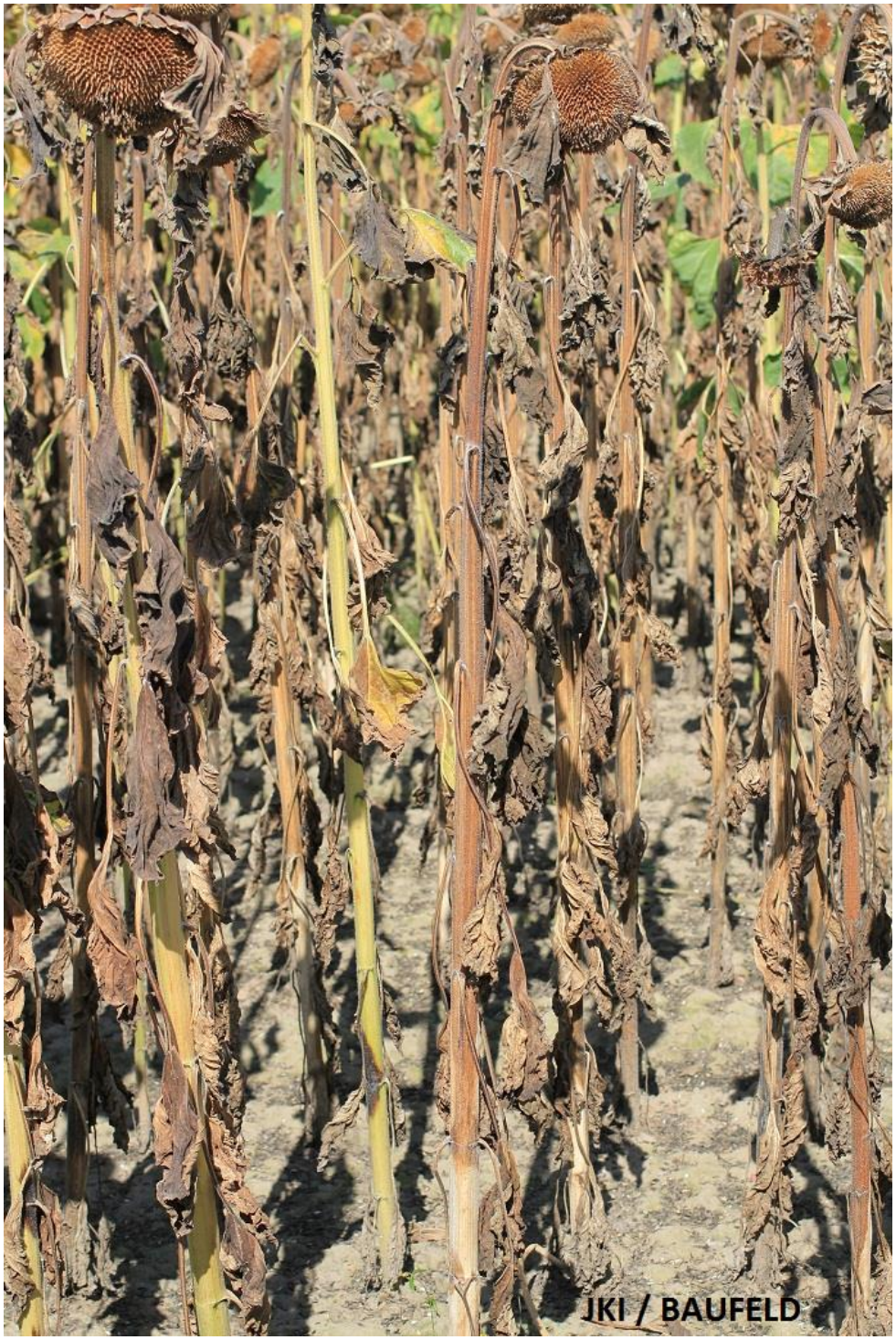

Fig. 9: Dead sunflower plants after damage caused by *Strauzia longipennis* and a secondary infection by a fungus in Berlin-Dahlem in August 2014

Fig. 10: Adult female of *Strauzia longipennis*

Fig. 11: Adult male of *Strauzia longipennis*

Fig. 12: Oviposition of female *Strauzia longipennis*

Fig. 13: Puparrium of *Strauzia longipennis*

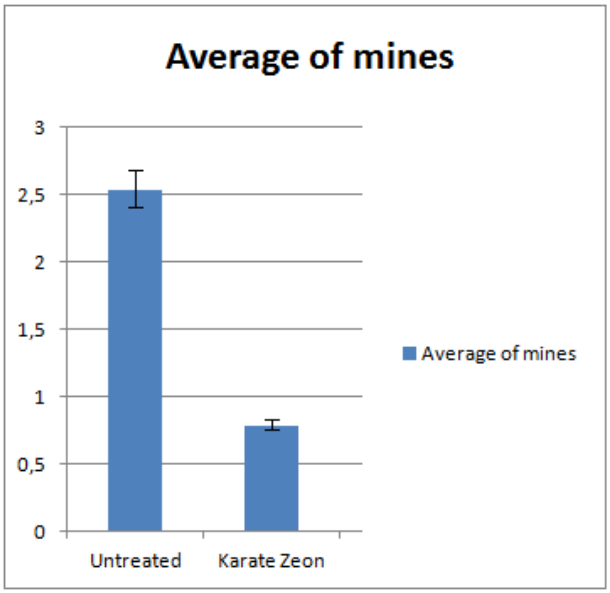

Fig. 14: Quantitiy of mines per stem in an untreated and a treated variant (annual results)

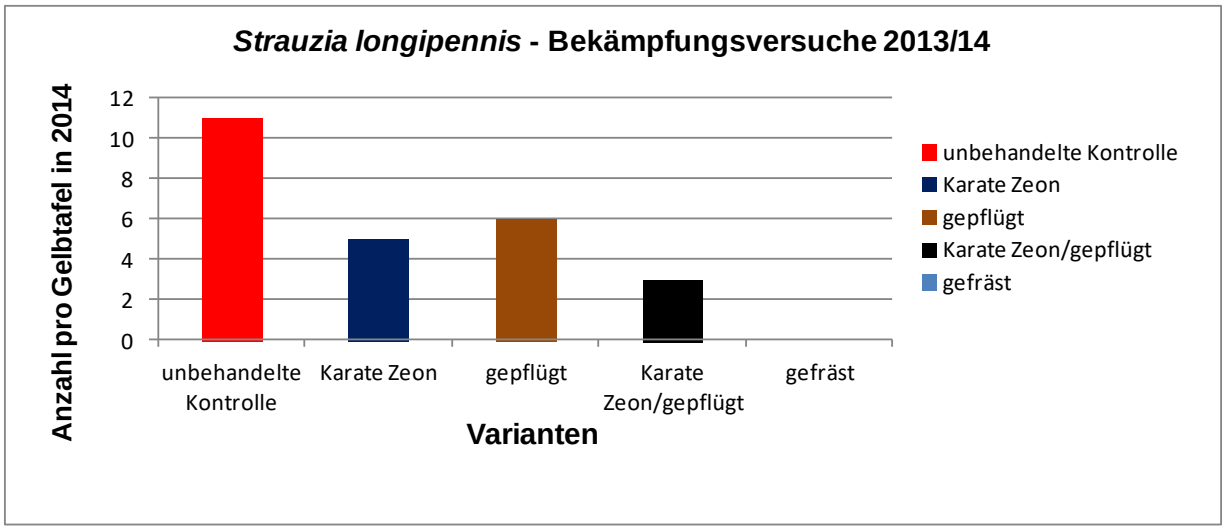

Fig. 15: Quantitiy oft he caught adults in yellow traps in the five control variants

Erläuterungen

Remarks

1 Compilation of the most important and directly available information that renders possible a first preliminary evaluation of the phytosanitary risk. This short evaluation is necessary for the decision on a notification to EU and EPPO as well as the preparation of a complete risk analysis, to inform the countries and as the basis for the possible initiation of eradication measures. In the case of phytosanitary risk especially the possibility of the introduction and spread in Germany and in the Member States as well as possible damage are taken into account

2 Taxonomic classification - also subspecies - as the case may be; in the case that the taxonomic classification is uncertain the JKI-scientist initiates the taxonomic classification as far as possible.

3 If so, which organism (organisms) is (are) transmitted and does it (do they) occur in Germany / the Member States?

4 If so, which organism serves as a vector and does it occur in Germany/ the MS?

5 Description of the pattern of damage and the strength of the symptoms/damage on the different host plants.

6 Presence of the host plants in protected cultivation, open field, public gardens, forest,....;
Where, in which regions are the host plants present and to which extent?
How important are the host plants (economic, ecological, ...)?,

7 Presence of the host plants in protected cultivation, open field, public gardens, forest,....;
Where, in which regions are the host plants present and to which extent?
How important are the host plants (economic, ecological, ...)?, possible origin

8 E.g. according to CABI, EPPO, PQR, EPPO Datasheets.

9 Which ways pathways are known for the pest and how important are they for the probability of introduction. Primarily the transport of the pest over long distances is meant, normally with infested traded plants, plants products or other contaminated articles. This does not comprise the natural spread resulting from introduction.

10 Which pathways are known for the pest and of which relevance are they in respect of the probability of the spread? In this case, the natural spread resulting from introduction is meant.

11 Under the given/prevalent environmental conditions.

12 Under the given/prevalent environmental conditions (domestic areas and areas of introduction).

13 Description of the economic, ecological /environmental relevant and social damage in the area of origin resp. areas of previous occurrence

14 Description of the economic, ecological /environmental relevant and social damage to be expected in Germany, as far as possible and required, differentiated between regions.

15 Description of economic, ecological/ environmental relevant and social damage to be expected in the EU / other Member States, as far as possible and required, differentiated between regions.

16 Can the pest be controlled? Which possibilities of control are given? Are plant health measures conducted in respect to this pest (in the areas of previous occurrence resp. by third countries)?

17 Description of possibilities and methods of detection. Detection by visual inspections? Latency? Uneven distribution in the plant (sampling)?