Netherlands Food and Consumer Product Safety Authority
Ministry of Economic Affairs

National Plant Protection Organization, the Netherlands

Quick scan number: QS.ENT.2014.12

	Quick scan date: 19 December 2014	
1	What is the scientific name (if possible up to species level + author, also include (sub)family and order) and English/common name of the organism? *Add picture of organism/damage if available and publication allowed*.	*Spodoptera cosmioides* (Walker, 1858) (Lepidoptera, Noctuidae) (Silvain & Lalanne-Cassou 1997). Synonyms: *Prodenia cosmioides* Walker 1858. Note: *S.cosmioides* was considered a synonym of *S.latifascia* untill 1997.    Left female, middle male (wingspan 40-45 mm), right 4th instar larva.
2	What prompted this quick scan? *Organism detected in produce for import, export, in cultivation, nature, mentioned in publications, e.g. EPPO alert list, etc.*	The finding of a young caterpillar at import inspection of 13,634 plants of *Dracaena marginata* (Agavaceae) from Costa Rica, intended for further cultivation in a greenhouse (sample number 4715660) on 23 October 2014.
3	What is the current area of distribution?	Tropical America: Central- and South-America from Costa Rica to Argentina, including: Argentina, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, French Guyana, Guyana, Panama, Paraquay, Peru, Trinidad, Venezuela (Pogue 2002). It has been intercepted on produce (*Momordica* sp.) from Surinam.

4	What are the host plants?	Authors refer in the introduction of articles to the polyphagous nature of the pest e.g. Bavaresco *et al*. (2004): "In Brazil, the cultures of pineapple (seedlings), cotton (bolls), rice, eggplant, onions (green parts), eucalyptus trees (seedlings), mango, peppers and tomatoes, among other vegetables, are considered host plants." Bavaresco *et al.* (2004, referring to Nora & Reis Filho (1988) and Nora *et al*. (1989)) also mention damage on apple (both leaves and fruits) [as *S. latifascia*]. References to some plant species mentioned as host, like pepper and tomatoes, are from 1968 or earlier (Bertels 1953, Silva *et al*. 1968 [as *S. latifascia*] in Bavarasco *et al.* 2004). Knowledge of the *Spodoptera* species complex present on crops was poor in those years and the taxonomic status of *S. cosmioides* has been changed since. The status of some plant species as being host plant of *S. cosmioides* is therefore unclear. Recent references to host plants mainly focus on the cash crops grown in Brazil, although pesticides have been registered in Brazil against *S. cosmioides* also on eggplant and pepper (Anonymous 2013). Plant species of which the host status is clear (recent articles) comprise *Glycine max* (Rolim *et al*. 2013), *Gossypium hirsutum* (Rodrigues de Araújo 2009), *Arachis hypogaea* (Boica Junior *et al*. 2013), *Ricinus communis* (Rolim *et al*. 2014), *Allium cepa* and beans (Bavaresca 2003), *Zea mais* (Oleveira *et al*. 2014), *Avena sativa* (Silva *et al.* 2011), *Coleus barbatus, Ocimum basilicum* (Pires *et al*. 2014), seedlings of *Eucalyptus* (Santos *et al*. 1980) [as *S. latifascia*], *Amaranthus* (Silvie 2005), *Crotalaria* (Silva Dias *et al*. 2009, Silvie 2005), *Jatropha curcas, Aleurites fordii* (Cabezas *et al*. 2013) and *Vigna unguiculata* (Moura *et al*. 2014). It has been intercepted and reared from *Momordica* (NPPO-NL) and from *Asparagus officinalis* (Pogue & Passoa 2000). Furthermore, it has been intercepted on plants for planting of *Dracaena* (this Quickscan) and *Zamioculcas* and fruits of *Vitis vinifera* (NPPO-NL). Given the known host plant species so far, species from many different plant families, a broad host plant range seems likely, although probably limited to herbaceous species and seedlings of woody plant species.

5	Does the organism cause any kind of plant damage in the current area of distribution and/or does the consignment demonstrate damage suspected to have been caused by this organism? *Yes/no + plant species on which damage has been reported + short description of symptoms.* *Please indicate also when the organism is otherwise harmful (e.g. predator, human/veterinary pathogen vector, etc.).*	Yes, *S. cosmioides* is considered one of the most important Lepidoptera pests in Brazil, where it is studied as a pest of main cash crops as soybean, cotton, castor oil plant and peanut. Embrapa* published a technical communication on two *Spodoptera* pests, one being *S. cosmioides* (Teodoro *et al.* 2013). Increasing damage has been reported during recent years in soybean (*Glycine max*), where *S. cosmioides* appears to be much less susceptible to Bt soybean then other common Lepidoptera species in this crop (Bernardi *et al.* 2014). *Spodoptera eridania* and *S. cosmioides* are considered species with potential to cause economic damage to cotton plants because they can occur throughout cotton developmental stages causing defoliation and losses of reproductive structures (Santos *et al.* (2010)). In Argentina, populations of the pest are increasing, although little or no economic damage has been reported so far (Casuso 2013, Gauchat 2014). ** Brazilian Corporation of Agricultural Research, linked to the Ministry of Agriculture, Livestock and Food Supply (Mapa).*

<table>
<tr>
<td>6</td>
<td>Assess the probability of establishment in the Netherlands (NL) (i.e. the suitability of the environment for establishment).
a. In greenhouses (low, medium, high)
b. Outdoors (low, medium, high)
c. Otherwise (e.g. storage facilities, human environment)</td>
<td>a) In greenhouses: high. Spodoptera cosmioides is currently distributed in tropical America. S. cosmioides is not know to occur in greenhouses so far, but Bavaresco (2003) reports severe damage on onion in experimental fields under protected cultivation. S. cosmioides has similar developmental requirements as two common Lepidopteran greenhouse pest species in the Netherlands, Chrysodeixis chalcites and Spodoptera exigua (Malais & Ravensberg 2002; Table below). Its polyphagous nature increases the probability to find a suitable host and habitat for establishment after entry. For these reasons, the greenhouse environment in the Netherlands is assessed as suitable for establishment. However, the probability that the pest will establish after entry of a few individuals may be low because of crop management practices such as application of insecticides or, in some crops, the (shorter) length of the cultivation period in relation to the (longer) length of the lifecycle of the pest).

The duration of the life cycle of S. cosmioides is influenced by the host plant. Development on corn for instance takes longer then on soybean (Silva et al. 2011). In castor oil plant and onion, the total life cycle is 39.7 and 40.5 days, respectively, and in soybean 46 days. Also the fecundity was better on onion and castor oil plant (3,224 and 3,206 eggs/female, respectively), than on soybean (1,353 eggs/female). In the laboratory 9.6 to 11.7 generations could develop at the optimum temperature of 25 to 28°C (Bavaresco et al. 2002). At suboptimal temperatures of e.g. 20 °C, in the Netherlands one to a few generations may develop indoors per year.

<table>
<tr><td>Species</td><td>Optimum temperature</td><td>Threshold temperature</td><td>Degree Days</td></tr>
<tr><td>S. cosmioides
(Bavaresco et al. 2002)</td><td>25-28°C</td><td>11.28°C males
11.15°C females</td><td>535.85°C males
513.17°C females</td></tr>
<tr><td>S. exigua
(CABI 2013)</td><td>24-28°C</td><td>13 (egg) - 15°C</td><td>525°C</td></tr>
<tr><td>C. chalcites
(CABI 2013)</td><td>25°C</td><td>Not available</td><td>Not available</td></tr>
</table>

b) Outdoors: low. Based on DD calculations, establishment outdoors in the Netherlands is unlikely to occur. During long and/or hot summers, temporary populations may develop.</td>
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<tr>
<td>7</td>
<td>Assess the probability of establishment in the EU (i.e. the suitability of the environment for establishment).</td>
<td>Several of the known host plants are cultivated outdoors in the EU, and because of its polyphagous nature, S. cosmioides may be able to feed on many other plant species. Given the currently known distribution and its temperature requirements (see # 6), S. cosmioides is likely to establish both indoors and outdoors in the warmer part of the EU. S. littoralis which occurs outdoors in e.g. Spain and Italy has a minimum constant temperature for normal development at all stages of 13-14°C (CABI 2013), which is higher than that of S. cosmioides.</td>
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8	What are the possible pathways that can contribute to spread of the organism after introduction? How rapid is the organism expected to spread (by natural dispersal and human activity)?	*S. cosmioides* may enter the Netherlands through importation of planting materials (live plants), but also through import of cut flowers, vegetables and fruits. Entry through natural spread is very unlikely: there are no records of the species reaching Europe on its own, nor has it been sighted anywhere in Europe. After introduction, *S. cosmioides* is expected to spread moderately rapidly to rapidly by natural dispersal. No data are known on the flight capacity of *S. cosmioides*, but adults of *Spodoptera* species are generally known to be good flyers. Several *Spodoptera* species are migratory and can fly up to hundred kilometres during their lifetime. The related species *S. littoralis* does not migrate however and is known to spread only 3 to 8 kilometres per generation (Ellis 2004). Further spread by human assistance is likely. Larvae can be detected relatively easily due to the symptoms caused by feeding on the foliage and other aboveground plant parts. Eggs may, however, easily be overlooked especially in crops or commodities with densely packed plants. Furthermore, pupation normally takes place in the soil and the species could be spread by soil attached to plants. Adults fly at night and do not move during the day unless disturbed. Their size and colouration resembles that of some other pest species present in greenhouses in the EU. Older larvae of *S. cosmoides* differ clearly from larvae of most of the common pest species in greenhouses. However, there are several common species outdoors of which the larvae are very similar (e.g. *Noctua pronuba)*. For this reason, an infestation of *S. cosmioides* may remain undetected for a long time during which spread can occur.
9	Provide an assessment of the type and amount of direct and indirect damage (e.g. lower quality, lower production, export restrictions, threat to biodiversity, etc.) likely to occur if the organism would become established in NL and the EU, respectively?	Some authors consider that *S. cosmioides* has only become an important pest on certain crops because of the excessive use of broad-spectrum insecticides in these crops which suppress naturally occurring biological control agents of the pest species (Cabezas *et al.* 2013). Nevertheless, in Brazil the importance of *S. cosmioides* as a pest is increasing. In many documents the species is one of the "*Spodoptera*-complex" species, often also including *S. frugiperda* and *S. eridania*, that cause relevant damage or even defoliation (e.g. Casuso 2013, Teodoro *et al.* 2013). Larvae attack above ground plant parts and feed on leaves and on reproductive structures. Research has indicated that *S. cosmioides* destroys more leaf-tissue, flowers and fruits than other well known lepidopteran pest species, including *Spodoptera eridania* and *S. frugiperda* which are regulated in the EU (Santos *et al.* 2010, Bueno *et al.* 2011)). Most research has focussed on damage to soybean, peanut and cotton, because these are important cash crops in Brazil. Impact on other crops has been studied less, but Bavaresco *et al.* (2003) for instance showed in laboratory tests that *S. cosmioides* performs better on onion and *Ricinus* than for example on soybean. It is therefore likely that under suitable conditions cosmetic damage to ornamentals and yield losses in food crops through defoliation and/or damage to fruits can be expected also in the EU. Although several parasitoids and predators are known using *S. cosmioides* as a host (e.g. Goulart *et al*. 2011; Denez *et al*. 2014), their potential as biological control agents remains to be investigated (Zache *et al.* 2012).

		The species is not known to be enlisted on any quarantine list.
10	Has the organism been detected on/in a product other than plants for planting (e.g. cut flowers, fruit, vegetables)? *If "no", go to question 12*	No
11	If the organism has been found on/in a product other than plants for planting (e.g. cut flowers, fruit, vegetables), what is the probability of introduction (entry + establishment)? *Only to be answered in case of an interception or a find.*	-
12	Additional remarks	• Pheromone is commercially available (http://www.chemtica.com/site/?p=3076).
13	References	• Anonymous (2013). Rep. Fed. do Brasil – Impr. Nac.; Diário oficial da União – seção 1, Nº 208; ISSN 1677-7042. http://sites.unasp.edu.br/portal/secretariageral/Documentos/DOU/2013-2/10/DO1_2013_10_25.pdf [acc. 30-10-2014] • Bavaresco, A., M. S. Garcia, Grutzmacher, A. D., Foresti, J. & Ringenberg, R. (2002). Biology and thermal requirements of *Spodoptera cosmioides* (Walk.) (Lepidoptera: Noctuidae). Neotropical Entomology 31(1): 49-54. • Bavaresco, A., Garcia M. S., Grutzmacher, A. D., Foresti, J. & Ringenberg, R. (2003). Compared biology of *Spodoptera cosmioides* (Walk.) (Lepidoptera: Noctuidae) in onion, castor oil plant, soybean and bean. Ciencia Rural 33(6): 993-998. • Bavaresco, A., Garcia M. S., Grutzmacher, A. D., Foresti, J. & Ringenberg, R. (2004). Adaptation of an Artificial Diet for *Spodoptera cosmioides* (Walk.) (Lepidoptera: Noctuidae) in laboratory rearing. Neotropical Entomology 33(2):155-161. • Bernardi, O., Sorgatto R. J., Rodrigues, N. E. L., Souza, B. H. S. de, Bottega, D. B. & Silva, A. G. da. (2014). Low susceptibility of *Spodoptera cosmioides*, *Spodoptera eridania* and *Spodoptera frugiperda* (Lepidoptera: Noctuidae) to genetically-modified soybean expressing Cry1Ac protein. Crop Protection 58: 33-40. • Boica Junior, A. L., Ferrarezi, R., *et al*. (2013). Resistance of straight and runner growing habit peanut cultivars to *Spodoptera cosmioides* in laboratory. Agro@mbiente On line 7(1): 80-88. • Bueno, R. C. O. De, F. Bueno, A. de F. Moscardi, F. Parra, J. R. P. Hoffmann-Campo, C. B (2011). Lepidopteran larva consumption of soybean foliage: basis for developing multiple-species economic thresholds for pest management decisions. Pest Management Science: 67(2):170-174. • CABI (2013). Crop Protection Compendium online. CAB International, Wallingford, UK. http://www.cabi.org.ezproxy.library.wur.nl/cpc/datasheet/13243 and http://www.cabi.org.ezproxy.library.wur.nl/cpc/datasheet/29808 [acc. Nov. 5, 2013] • Cabezas, M.F., Nava D.E., Geissler L.O., Melo M., Garcia M.S. & Krüger R. (2013). Development and Leaf Consumption by *Spodoptera cosmioides* (Walker) (Lepidoptera: Noctuidae) Reared on

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14	**Conclusions**	The present Quickscan was initiated after the interception of the Lepidoptera species *Spodoptera cosmioides* on *Dracaena* plants from Costa Rica. The species is polyphagous and is known as a pest of various crops in Brazil. It can likely establish in the open in southern Europe and possibly in glasshouses in northern Europe and is a potential pest of various crop species in Europe.
15	**Follow-up measures**	The consignment was rejected.