Netherlands Food and Consumer
Product Safety Authority
Ministry of Agriculture,
Nature and Food Quality

Quick scan for *Atherigona reversura*

National Plant Protection Organization, the Netherlands

Quick scan number: QS2021ENT009

Quick scan date: 6 December 2021

No.	Question	Quick scan answer for ***Atherigona reversura***
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*.	*Atherigona reversura* Villeneuve (Diptera; Muscidae)
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 organism was found during a post-import survey in a small consignment consisting of bundles of (rootless) bermudagrass (*Cynodon dactylon,* Poaceae) from Sri Lanka. This is the second time this fly is intercepted by the Dutch NPPO. The first interception dates from October 2016 when it was found in a consignment of fruit of *Momordica charantia* from Surinam, probably as a secondary infection.
3.	What is the current area of distribution?	The species is native to south Asia (Hudson et al., 2013) and has been introduced into Hawaii, North America and South America. It is also present in Papua New Guinea (Oceania). No information has been found if it is native to Papua New Guinea or that it has been introduced. Below are more details about its distribution on different continents.

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		Asia: - The species has a wide geographic distribution throughout Asia. Pont & Magpayo (1995) mentions the following locations where the species has been collected in Asia: Japan (Kyushu), Burma, China (Sichuan, Hopeh, Kiangsu, Guangdong), India (UP, Delhi, west Bengal, Assam, Sikkim, Maharashtra, AP), Indonesia (Java, Lombok, Sulawesi, Sumbawa), Malaysia (Sabah), Philippines (Luzon, Palawan, Balabac, Busuanga, Mindanao, Sulu Is), Sri Lanka, Taiwan, Arabian Peninsula (Oman). North America: - United States of America (USA): Hawaii (Baxter et al., 2014); southern states (Hudson, 2010). Massachusetts (three specimens were found in a malaise trap(Savage, 2016) but the paper makes no statement whether it is established in that state - Canada Ontario: first record published by Savage (2016). Malaise trap specimens; oldest dating back to 2010. Savage (2016) notes that there is uncertainty whether the species is established in southern Ontario or whether the caught specimens refer to multiple entries through import of infested material. - Mexico (Grzywacz et al., 2013) South America: - Argentina: first collected in 2014, in temperate and subtropical regions (Patitucci et al., 2016). - Brazil (Ribeiro et al., 2016). - Uruguay (Remedios-De León et al., 2021). Oceania - Papua New Guinea (Pont & Magpayo, 1995)
4.	What are the hostplants?	The fly is a pest species of *Cynodon dactylon* (bermudagrass) (McCullers et al. 2012; Grzywacz et al. 2013). It has also been recorded from other Poaceae: *Echinochloa colona*, *Eleusine coracana*, *Eriochloa procera*, *Sehima nervosum, Sorghum bicolor* and *Zea mays* (Pont & Magpayo, 1995).
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.*	The fly lay eggs on the stem. The larvae burrows in the stem where it feeds. The leaves above the feeding site wither and die. The lower leaves remain green (Hudson et al., 2013). In Hawaii and the southern states of the USA, *A. reversura* infests bermudagrass in turf, pastures and hay fields (Baxter et al., 2014). Most economic damage occurs in hay fields because mowing and grazing prevents extensive population build-up (Hudson et al., 2013). In much of the southern USA, bermudagrass is the most important forage grown

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	Please indicate also when the organism is otherwise harmful (e.g. predator, human/veterinary pathogen vector, etc.).	for pasture and hay production (Burton & Utley, 2016). *A. reversura* is an important pest of bermudagrass forage in the southeastern and southcentral USA (Knutson & Mitchell, 2019). Damage appears to be more severe in areas with a hotter and more humid climate (Baxter et al., 2014). In Mississippi, production of bermudagrass for grazing an hay production is hampered by *A. reversura* which can cause up to 50% loss in forage fields if left unattended (Lemus, 2013). In Texas, yield loss in hay fields was estimated to be 9.97 kg/ha for each percentage of stems with bermudagrass stem maggot damage (Knutson & Mitchell, 2019). Little information is known on damage in turfgrass. Knutson & Mitchell (2019): "*Although reported as damaging turfgrass in Hawaii in 1974…, it has not been reported as a pest of bermudagrass in turf in the continental United States*".
6.	Assess the probability of establishment in the Netherlands (NL) (i.e. the suitability of the environment for establishment). a. In greenhouses b. Outdoors c. Otherwise (e.g. storage facilities, human environment)	Not assessed. Establishment of *A. reversura* seems most likely in southern EU given its current area of distribution and assuming that the findings in northern USA-states and Canada are not from established populations.
7.	Assess the probability of establishment in the EU (i.e. the suitability of the environment for establishment).	*Atherigona reversura* can likely establish in (parts of) southern EU. The climate in (parts of) southern EU seems suitable for establishment of *A. reversura* given its presence in southern USA including states with a dry climate (California) and humid climate (most southern states). Bermudagrass, the preferred host, is widely present in Europe and may be found as far as 50°N in Europe (Heuzé 2015). Besides the preferred host, other host plants such as maize and sorghum are also widely present in central and southern Europe.
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)?	No information has been found on natural dispersal distances. Over large distances, the pest may spread with transport of hay containing grasses of host plants, especially bermudagrass.
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?	The species may damage turf, pastures and hay production in a similar way as in southern USA (see Q5). However, damage may be less due to less favourable climatic conditions for population development. Summer temperatures in the EU are generally lower than in the southern USA states where economic damage has been reported. The number of annual growing degree days above 10°C ($GDD_{10\ °C}$) is higher in southern USA than in southern EU (Annex VII in Van der Gaag & Loomans (2013)). In addition, damage seems to be highest in the hotter, more humid areas of southeast USA (Baxter et al., 2014) while the southernmost part of the EU has a dry summer climate or Mediterranean climate (Beck et al., 2018).

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		The potential economic impact will very much depend of the use of bermudagrass in the EU. No quantitative data have been found but the use of bermudagrass in lawns has been reported to increase rapidly in Mediterranean Europe (Schiavon et al., 2021). It is one of the most widely used warm-season grass species in turfgrass in Europe and is also used in the transition zone for warm- and cool-season turfgrasses (Anderson et al., 2007, Rimi et al., 2011; Giolo et al. 2014, Schiavon et al. 2021). However, *A. reversura*, appears to be less important as a pest in turf (see Q5). Economic impact is most likely in pastures that are not extensively being grazed and in hay fields. No information has been found on the use of bermudagrass in pastures and forage crops in the EU. Therefore, the potential economic impact of *A. reversura* is difficult to assess. If bermudagrass is mainly used for lawns that are frequently being mowed, the potential impact may be limited. Besides damage to *C. dactylon* and other grass species, additional damage to grain species listed as hosts cannot be excluded (Pont and Magpayo 1995). However, economic impact has thus far only reported from bermudagrass.
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*	Yes, larvae were found in a box containing bundles of grass without roots
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.*	The intended use of the grass is not known. Therefore, the probability of transfer is difficult to assess and subsequently the probability of entry and introduction.
12.	Additional remarks	The product, cut bermudagrass, on which *A. reversura* was intercepted is not subject to regular import inspections in the EU (i.e. not listed in Annex XI, Part B of Implementing Regulation (EU) 2019/2072).
13.	References	Anderson JA, Taliaferro CM & Wu YQ, 2007. Freeze tolerance of seed-and vegetatively-propagated bermudagrasses compared with standard cultivars. Applied Turfgrass Science, 4 (1), 1-7 Baxter LL, Anderson WF, Hudson WG, Hancock DW, Prevatt CG & Moore Z, 2019. Quantifying the Damage Potential of the Bermudagrass Stem Maggot. Crop science, 59 (5), 2280-2286. Baxter LL, Hancock DW & Hudson WG, 2014. The bermudagrass stem maggot (Atherigona reversura Villeneuve): a review of current knowledge. Forage & Grazinglands, 12 (1), 1-8. Beck HE, Zimmermann NE, McVicar TR, Vergopolan N, Berg A & Wood EF, 2018. Present and future Köppen-Geiger climate classification maps at 1-km resolution. Scientific data, 5 (1), 1-12.

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		Burton GW, Utley, PR, 2016. Bermudagrass for forage. Available online : https://www.ars.usda.gov/southeast-area/tifton-ga/crop-genetics-and-breeding-research/docs/bermudagrass-for-forage/ (accessed 26-11-2021). Giolo M, Ferrari F, Macolino S 2014. Estimation of base germination temperature of ten seeded-type *bermudagrass cultivars. European Journal of Horticultural Science. 79, 129-134.* Grzywacz A, Pape T, Hudson WG & Gomez S, 2013. Morphology of immature stages of Atherigona reversura (Diptera: Muscidae), with notes on the recent invasion of North America. Journal of Natural History, 47 (15-16), 1055-1067. Heuzé V., Tran G., Delagarde R., Lebas F., 2015. *Bermudagrass (Cynodon dactylon)*. Feedipedia, a programme by INRAE, CIRAD, AFZ and FAO. https://feedipedia.org/node/471. Last updated on October 20, 2015, 10:33 Hudson W, 2010. New exotic invasive fly found damaging Bermudagrass forage crops in Georgia. Athens (GA): University of Georgia College of Agricultural and Environmental Sciences [Web page]. Available online: https://www.caes.uga.edu/research/impact/impact-statement/3278/-new-exotic-invasive-fly-found-damaging-bermudagrass-forage-crops-in-georgia.html [Accessed: 24-11-2021]. Hudson W, Hancock D, Flanders K & Dorough H, 2013. Biology and management of bermudagrass stem maggot. Alabama Cooperative Extension Systems. ANR-1462. Knutson AE & Mitchell F, 2019. Economic Injury Level for Bermudagrass Stem Maggot (Diptera: Muscidae) in Bermudagrass Forage Production in Texas. Journal of Economic Entomology, 112 (5), 2215-2221. Lemus R, 2013. Bermudagrass Stem Maggot: Pest on the Move Across MS. Mississippi State University, Extension Service. Available online: https://extension.msstate.edu/sites/default/files/newsletter/forage-news/2013/20130801.pdf McCullers JT (2012) Sampling techniques and population estimation for Atherigona reversura Villenueve (Diptera: Muscidae) in Bermudagrass hay fields. Master's thesis, University of Georgia, Athens, USA, 42 pp. Patitucci LD, Dufek MI & Mulieri PR, 2016. First reports of the invasive pest bermudagrass stem maggot, atherigona reversura villeneuve, 1936 (diptera: muscidae), in south america. Pont AC and Magpayo FR 1995. Muscid shoot-flies of the Philippine Islands (Diptera: Muscidae, genus *Atherigona* Rondani). Bulletin of Entomological Research. Suppl. 3, 1-121. Remedios-De León M, Patitucci LD & Morelli E, 2021. First report of Atherigona reversura Villeneuve, 1936 (Diptera, Muscidae) in Uruguay. Check List, 17, 719. Ribeiro LdP, Netto ACM, Jochims F, Haseyama KLF & de Carvalho CJ, 2016. First record of Atherigona reversura Villeneuve (Diptera: Muscidae) feeding on Bermudagrass (Cynodon dactylon cv. Jiggs, Poaceae) in Brazil: morphological and molecular tools for identification. Revista Brasileira de Entomologia, 60, 270-274.

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		Rimi F, Macolino S, Leinauer B, Ziliotto U 2011. Green-up of seeded bermudagrass cultivars as influenced by spring scalping. Horttechnology. 21, 230-235. 10.21273/HORTTECH.21.2.230 Savage J, 2016. First Canadian records of the Bermudagrass stem maggot, Atherigona reversura (Diptera: Muscidae). The Journal of the Entomological Society of Ontario, 147. Schiavon M, Pornaro C, Macolino S 2021. Clipping return decreases mineral nitrogen requirements for bermudagrass lawns in Mediterranean Europe. Crop Science. 61, 2916-2925. 10.1002/csc2.20265 Van der Gaag D & Loomans A, 2013. Pest Risk Analysis for Anthonomus eugenii. Netherlands Food and Consumer Product Safety Authority. Available online: https://english.nvwa.nl/topics/pest-risk-analysis/documents/plant/plant-health/pest-risk-analysis/documents/pest-risk-analysis-anthonomus-eugenii
14.	**Conclusions**	This Quick scan was prompted by the interception of *Atherigona reversura* on cut bermudagrass (*Cynodon dactylon*) imported from Sri Lanka. The organism is not known to be present in the EU. The species is native to Asia but has been introduced into North America, South America and Hawaii. The species can likely establish (in parts of) southern EU. The species can damage turf grass, pastures and hay fields with bermudagrass (*Cynodon dactylon*). Less damage is expected in turf grass and pastures that are frequently mowed and grazed, respectively. If bermudagrass is mainly used for lawns that are frequently being mowed, the potential impact may be limited.
15.	**Follow-up measures**	The consignment was rejected.