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Pest categorisation of *Neomaskellia andropogonis*

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Abstract

The EFSA Panel on Plant Health performed a pest categorisation of *Neomaskellia andropogonis* (Hemiptera: Aleyrodidae), the sugarcane whitefly, for the EU territory. *N. andropogonis* is a tropical and subtropical species that originates in south central Asia and has recently established in Iran and Iraq. *N. andropogonis* is not listed in Commission Implementing Regulation (EU) 2019/2072. It is oligophagous on Poaceae and most frequently reported on sugarcane (*Saccharum officinarum*), on which it has become an important emerging pest in western Iran. The larvae feed on the foliage and stalks and can cause a reduction of photosynthesis rate and growth. In heavy infestations, the sugar purity and content are greatly decreased. Honeydew egested by feeding *N. andropogonis* larvae can promote the growth of black sooty mould over the host. No evidence was found indicating economic damage to other grasses. The ornamental grass hosts *Andropogon* sp. and *Imperata cylindrica* are ornamental grasses in the subfamily Panicoideae and are exempt from a general prohibition on Poaceae entering the EU and together with fresh sugarcane, provide potential pathways for entry. An estimated threshold for development from egg to adult of 7.2°C with approximately 500 degree days required for a generation suggests that climatic conditions, together with the availability of grass hosts in the southern EU, would support establishment. Adults disperse naturally by flying and all stages can be moved over long distances by the trade of infested plant material. The pest has the potential to impact sugarcane production in Portugal and Spain. *N. andropogonis* satisfies all of the criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union quarantine pest. However, this conclusion has high uncertainties regarding the likelihood of entry and the magnitude of potential impact within the EU as the insect is only recorded as an economically important pest in Iran, and its host range is poorly known and understood.

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1. Introduction

1.1. Background and Terms of Reference as provided by the requestor

1.1.1. Background

The new Plant Health Regulation (EU) 2016/2031, on the protective measures against pests of plants, is applying from 14 December 2019. Conditions are laid down in this legislation in order for pests to qualify for listing as Union quarantine pests, protected zone quarantine pests or Union regulated non-quarantine pests. The lists of the EU regulated pests together with the associated import or internal movement requirements of commodities are included in Commission Implementing Regulation (EU) 2019/2072. Additionally, as stipulated in the Commission Implementing Regulation 2018/2019, certain commodities are provisionally prohibited to enter in the EU (high risk plants, HRP). EFSA is performing the risk assessment of the dossiers submitted by exporting to the EU countries of the HRP commodities, as stipulated in Commission Implementing Regulation 2018/2018. Furthermore, EFSA has evaluated a number of requests from exporting to the EU countries for derogations from specific EU import requirements.

In line with the principles of the new plant health law, the European Commission with the Member States are discussing monthly the reports of the interceptions and the outbreaks of pests notified by the Member States. Notifications of an imminent danger from pests that may fulfil the conditions for inclusion in the list of the Union quarantine pest are included. Furthermore, EFSA has been performing horizon scanning of media and literature.

As a follow-up of the above-mentioned activities (reporting of interceptions and outbreaks, HRP, derogation requests and horizon scanning), a number of pests of concern have been identified. EFSA is requested to provide scientific opinions for these pests, in view of their potential inclusion by the risk manager in the lists of Commission Implementing Regulation (EU) 2019/2072 and the inclusion of specific import requirements for relevant host commodities, when deemed necessary by the risk manager.

1.1.2. Terms of reference

EFSA is requested, pursuant to Article 29(1) of Regulation (EC) No 178/2002, to provide scientific opinions in the field of plant health.

EFSA is requested to deliver 53 pest categorisations for the pests listed in Annex 1A, 1B, 1D and 1E (for more details see mandate M-2021-00027 on the [Open.EFSA portal](#)). Additionally, EFSA is requested to perform pest categorisations for the pests so far not regulated in the EU, identified as pests potentially associated with a commodity in the commodity risk assessments of the HRP dossiers (Annex 1C; for more details see mandate M-2021-00027 on the [Open.EFSA portal](#)). Such pest categorisations are needed in the case where there are not available risk assessments for the EU.

When the pests of Annex 1A are qualifying as potential Union quarantine pests, EFSA should proceed to phase 2 risk assessment. The opinions should address entry pathways, spread, establishment, impact and include a risk reduction options analysis.

Additionally, EFSA is requested to develop further the quantitative methodology currently followed for risk assessment, in order to have the possibility to deliver an express risk assessment methodology. Such methodological development should take into account the EFSA Plant Health Panel Guidance on quantitative pest risk assessment and the experience obtained during its implementation for the Union candidate priority pests and for the likelihood of pest freedom at entry for the commodity risk assessment of High Risk Plants.

1.2. Interpretation of the Terms of Reference

Neomaskellia andropogonis is one of a number of pests listed in Annex 1D to the Terms of Reference (ToR) to be subject to pest categorisation to determine whether it fulfils the criteria of a potential Union quarantine pest for the area of the EU excluding Ceuta, Melilla and the outermost regions of Member States referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores, and so inform EU decision making as to its appropriateness for potential inclusion in the lists of pests of Commission Implementing Regulation (EU) 2019/ 2072. If a pest fulfils the criteria to be potentially listed as a Union quarantine pest, risk reduction options will be identified.

1.3. Additional information

This pest categorisation was initiated as a result of media monitoring, PeMoScoring and subsequent discussion in PAFF, resulting in it being included in the current mandate within the list of pests identified by horizon scanning and selected for pest categorisation.

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on *N. andropogonis* was conducted at the beginning of the categorisation in the ISI Web of Science bibliographic database, using the scientific name of the pest as search term. Papers relevant for the pest categorisation were reviewed, and further references and information were obtained from experts, as well as from citations within the references and grey literature.

2.1.2. Database search

Pest information, on host(s) and distribution, was retrieved from the EPPO Global Database, the CABI databases and scientific literature databases as referred above in Section 2.1.1.

Data about the import of commodity types that could potentially provide a pathway for the pest to enter the EU and about the area of hosts grown in the EU were obtained from EUROSTAT (Statistical Office of the European Communities).

The Europhyt and TRACES databases were consulted for pest-specific notifications on interceptions and outbreaks. Europhyt is a web-based network run by the Directorate General for Health and Food Safety (DG SANTÉ) of the European Commission as a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. TRACES is the European Commission's multilingual online platform for sanitary and phytosanitary certification required for the importation of animals, animal products, food and feed of non-animal origin and plants into the European Union, and the intra-EU trade and EU exports of animals and certain animal products. Up until May 2020, the Europhyt database managed notifications of interceptions of plants or plant products that do not comply with EU legislation, as well as notifications of plant pests detected in the territory of the Member States and the phytosanitary measures taken to eradicate or avoid their spread. The recording of interceptions switched from Europhyt to TRACES in May 2020.

GenBank was searched to determine whether it contained any nucleotide sequences for *N. andropogonis* which could be used as a reference material for molecular diagnosis. GenBank® (www.ncbi.nlm.nih.gov/genbank/) is a comprehensive publicly available database that as of August 2019 (release version 227) contained over 6.25 trillion base pairs from over 1.6 billion nucleotide sequences for 450,000 formally described species (Sayers et al., 2020).

2.2. Methodologies

The Panel performed the pest categorisation for *N. andropogonis*, following guiding principles and steps presented in the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018), the EFSA guidance on the use of the weight of evidence approach in scientific assessments (EFSA Scientific Committee, 2017) and the International Standards for Phytosanitary Measures No. 11 (FAO, 2013).

The criteria to be considered when categorising a pest as a potential Union quarantine pest (QP) is given in Regulation (EU) 2016/2031 Article 3 and Annex I, Section 1 of the Regulation. Table 1 presents the Regulation (EU) 2016/2031 pest categorisation criteria on which the Panel bases its conclusions. In judging whether a criterion is met the Panel uses its best professional judgement (EFSA Scientific Committee et al., 2017) by integrating a range of evidence from a variety of sources (as presented above in Section 2.1) to reach an informed conclusion as to whether or not a criterion is satisfied.

The Panel's conclusions are formulated respecting its remit and particularly with regard to the principle of separation between risk assessment and risk management (EFSA founding regulation (EU) No 178/2002); therefore, instead of determining whether the pest is likely to have an unacceptable impact, deemed to be a risk management decision, the Panel will present a summary of the observed

impacts in the areas where the pest occurs, and make a judgement about potential likely impacts in the EU. Whilst the Panel may quote impacts reported from areas where the pest occurs in monetary terms, the Panel will seek to express potential EU impacts in terms of yield and quality losses and not in monetary terms, in agreement with the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018). Article 3 (d) of Regulation (EU) 2016/2031 refers to unacceptable social impact as a criterion for quarantine pest status. Assessing social impact is outside the remit of the Panel.

Table 1: Pest categorisation criteria under evaluation, as derived from Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest (article 3)
Identity of the pest (Section 3.1)	Is the identity of the pest clearly defined, or has it been shown to produce consistent symptoms and to be transmissible?
Absence/presence of the pest in the EU territory (Section 3.2)	Is the pest present in the EU territory? If present, is the pest in a limited part of the EU or is it scarce, irregular, isolated or present infrequently? If so, the pest is considered to be not widely distributed.
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Is the pest able to enter into, become established in, and spread within, the EU territory? If yes, briefly list the pathways for entry and spread.
Potential for consequences in the EU territory (Section 3.5)	Would the pests' introduction have an economic or environmental impact on the EU territory?
Available measures (Section 3.6)	Are there measures available to prevent pest entry, establishment, spread or impacts?
Conclusion of pest categorisation (Section 4)	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential quarantine pest were met and (2) if not, which one(s) were not met.

3. Pest categorisation

3.1. Identity and biology of the pest

3.1.1. Identity and taxonomy

Is the identity of the pest clearly defined, or has it been shown to produce consistent symptoms and/or to be transmissible?

Yes, the identity of species is established. *Neomaskellia andropogonis* Corbett is the accepted name.

N. andropogonis Corbett is an insect of the family Aleyrodidae, within the order Hemiptera. It is commonly known as sugarcane whitefly, although this name is shared with two other whitefly pests of sugarcane, *Aleurolobus barodensis* (Maskell) and *Neomaskellia bergii* (Signoret). *N. andropogonis* was described by Corbett (1926) from specimens collected from a grass (*Andropogon* sp., Poaceae) in Sri Lanka. *Neomaskellia hainanensis* Chou and Yan, 1988 is a synonym of *N. andropogonis* (Martin and Mound, 2007).

The EPPO code¹ (Griessinger and Roy, 2015; EPPO, 2019) for this species is: NEOMAN (EPPO, online).

3.1.2. Biology of the pest

The life cycle of *N. andropogonis* consists of eggs, four larval (also referred to as nymphal) instars and adults. Eggs are laid on the lower surface of immature leaves, where the larval stages develop. The first larval instar has well-developed legs and crawls over the host plant in search of a suitable feeding site,

¹ An EPPO code, formerly known as a Bayer code, is a unique identifier linked to the name of a plant or plant pest important in agriculture and plant protection. Codes are based on genus and species names. However, if a scientific name is changed the EPPO code remains the same. This provides a harmonized system to facilitate the management of plant and pest names in computerized databases, as well as data exchange between IT systems (Griessinger and Roy, 2015; EPPO, 2019).

usually settling a short distance from the egg. The later three larval instars have reduced legs and are sessile. The fourth-larval instar is known as the pupa or puparium, from which the winged adult emerges. Askarianzadeh and Minaeimoghadam (2018) record *N. andropogonis* as parthenogenetic whereas other sources report the presence of adult males (Malekmohammadi et al., 2012).

The majority of research on *N. andropogonis* has been undertaken in Iran, where it has become an important economic pest of sugarcane since it was first reported in 2006 (Askarianzadeh and Manzari, 2006). Its biology has been studied on different cultivars of sugarcane and at different temperatures by Askarianzadeh and Minaeimoghadam (2018). Whitefly populations increase from early August until late November, and large infestations retard the growth of the host plants. Mean pre-adult developmental times ranged from 25 to 29 days on different cultivars, and only adult females were produced. Mean longevity of adult females on the same cultivars ranged from 4 to 9 days. Adult females laid an average of 40–62 eggs. The optimum temperature for development of *N. andropogonis* was $30 \pm 1^\circ\text{C}$ during the day and $25 \pm 1^\circ\text{C}$ at night. At these temperatures, egg and nymphal duration and adult longevity were 6.2, 17.0 and 7.6 days, respectively. Therefore, development time from egg to adult took 23.2 days.

Using data in Askarianzadeh and Minaeimoghadam (2018) we estimate the threshold temperature for development from egg to adult to be 7.2°C with approximately 500 degree days required for a generation. However, this estimate is based on a small amount of data and is therefore uncertain.

Two parasitoid wasps were found attacking the whitefly larvae in Iran: *Encarsia inaron* (Walker) and *Eretmocerus delhiensis* Mani (Hymenoptera, Aphelinidae).

N. andropogonis is not known to vector any plant virus (Jones, 2003).

3.1.3. Host range/Species affected

N. andropogonis is oligophagous on Poaceae and has been recorded feeding on grasses assigned to 10 genera (see Appendix A). It is a pest of sugarcane (*Saccharum officinarum*) and this appears to be the preferred host (Askarianzadeh and Manzari, 2006; Nikpay, 2017). It is also recorded on two other crops, pearl millet (*Cenchrus americanus*) and common sorghum (*Sorghum bicolor*), and several ornamental and wild grass hosts, particularly on cogon grass, also known as Japanese blood grass (*Imperata cylindrica*), but no economic damage was reported (Nikpay and Sharafzadeh, 2017).

The host range of *N. andropogonis* and how frequently wild grasses are used and whether they can sustain populations of this insect is poorly understood because the whitefly has only relatively recently been studied after it developed into an economic pest of sugarcane in Iran (See also Appendix A).

There is a single record of *N. andropogonis* occurring on cabbage (*Brassica oleracea* Capitata group) in the family Brassicaceae in the Punjab, Pakistan, but this is in an unpublished thesis by Tayyib (2013). The author also recorded *Neomaskellia bergii* on cabbage, whereas this whitefly is recorded as feeding exclusively on Poaceae by other authors (Evans, 2008). The record of cabbage as a host for *N. andropogonis* is considered here to be unreliable.

3.1.4. Intraspecific diversity

Martin and Lau (2011) reported variation in the size and prominence of pores submedially on abdominal segments IV–VII in a population of *N. andropogonis* collected in Hong Kong from plants suspected to be *Neyraudia reynaudiana*.

3.1.5. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes, detection and identification methods are available for *N. andropogonis*.

Detection

Visual examination of plants is an effective way for the detection of *N. andropogonis*. The yellow adults with wings dusted with white powdery wax, and the dense colonies of yellow or brown pupae are found on the lower surface of the leaves, are easily detectable. In addition, the sooty mould growing on honeydew egested by the larval stages found on the stems and foliage is often conspicuous.

Identification

The identification of *N. andropogonis* requires microscopic examination of slide-mounted pupa and verification of the presence of diagnostic morphological characteristics as given by Corbett (1926) and

David (1993). The characters that distinguish the genus *Neomaskellia* from all other genera in the Aleyrodidae are listed by Askarianzadeh and Manzari (2006). There are only two species assigned to the genus *Neomaskellia* (Martin and Mound, 2007): *N. andropogonis* and *N. bergii*. *N. andropogonis* can be distinguished by the presence of groups of simple pores in the submedian areas of abdominal segments V–VII (irregularly present on segments III–IV). *N. andropogonis* may be identified using the key to common whitefly pests of the World by Martin (1987).

The complete mitochondrial genome of *N. andropogonis* has been sequenced (Thao et al., 2004) and deposited at GenBank – NCBI (<https://www.ncbi.nlm.nih.gov/nuccore/AY572539.1>). This could be further used to develop molecular ID tools.

Symptoms

Black sooty mould growing on foliage and stems can indicate the presence of *N. andropogonis*, and large infestations can cause the plants to be stunted. These symptoms are not specific and may be caused by other species of whitefly and sap-sucking insects.

Description

There appear to be no detailed descriptions published for the different life stages, except for the pupae which were described by Corbett (1926). Adults of *N. andropogonis* are yellow with whitish wings with broad pale grey transverse bands and mottling, that are dusted with white powdery wax. The pupae are yellow or pale brown, often darker in the median area, oval, with 16 pairs of long submarginal setae, and an irregularly crenulate margin (Askarianzadeh and Manzari, 2006).

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

N. andropogonis is native to southern central Asia and has recently established in Iran and Iraq (Askarianzadeh and Manzari, 2006) (see Appendix B and Figure 1).

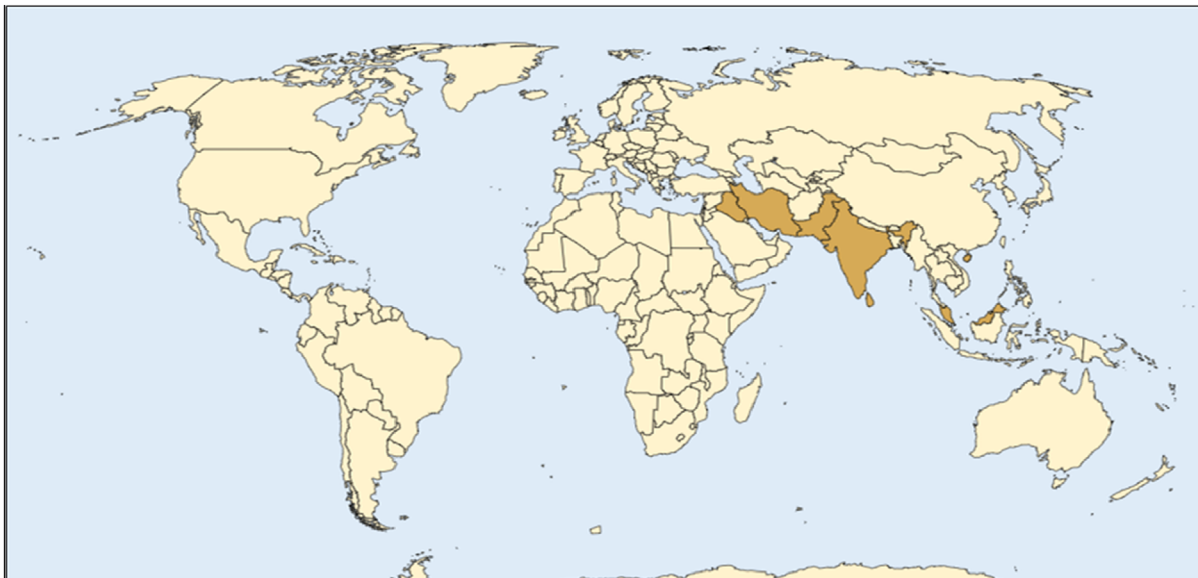


Figure 1: Global distribution of *Neomaskellia andropogonis* (Data source: literature)

3.2.2. Pest distribution in the EU

Is the pest present in the EU territory? If present, is the pest in a limited part of the EU or is it scarce, irregular, isolated or present infrequently? If so, the pest is considered to be not widely distributed.

No, *N. andropogonis* is not known to occur in the EU.

3.3. Regulatory status

3.3.1. Commission Implementing Regulation 2019/2072

N. andropogonis is not listed in Annex II of Commission Implementing Regulation (EU) 2019/2072, an implementing act of Regulation (EU) 2016/2031, or in any emergency plant health legislation.

3.3.2. Hosts or species affected that are prohibited from entering the Union from third countries

The introduction to the Union of some of the known host genera as plants for planting is prohibited from certain third countries (see Table 2).

Table 2: List of plants, plant products and other objects that are *Neomaskellia andropogonis* hosts whose introduction into the Union from certain third countries is prohibited (Source: Commission Implementing Regulation (EU) 2019/2072, Annex VI)

List of plants, plant products and other objects whose introduction into the Union from certain third countries is prohibited			
	Description	CN Code	Third country, group of third countries or specific area of third country
14.	Plants for planting of the family Poaceae, other than plants of ornamental perennial grasses of the subfamilies Bambusoideae and Panicoideae and of the genera <i>Buchloe</i> , <i>Bouteloua</i> Lag., <i>Calamagrostis</i> , <i>Cortaderia</i> Stapf., <i>Glyceria</i> R. Br., <i>Hakonechloa</i> Mak. ex <i>Honda</i> , <i>Hystrix</i> , <i>Molinia</i> , <i>Phalaris</i> L., <i>Shibataea</i> , <i>Spartina</i> Schreb., <i>Stipa</i> L. and <i>Uniola</i> L., other than seeds	ex 0602 90 50 ex 0602 90 91 ex 0602 90 99	Third countries other than Albania, Algeria, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Egypt, Faeroe Islands, Georgia, Iceland, Israel, Jordan, Lebanon, Libya, Liechtenstein, Moldova, Monaco, Montenegro, Morocco, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo- Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Syria, Tunisia, Turkey, Ukraine and the United Kingdom

3.4. Entry, establishment and spread in the EU

3.4.1. Entry

Is the pest able to enter into the EU territory? If yes, identify and list the pathways.

Yes, pathways for entry into the EU territory exist via plants (grasses) for planting and the import of raw sugarcane.

Comment on plants for planting as a pathway.

Plants for planting (excluding seed) would be the primary pathway for entry.

Annex VI, point 14 of 2019/2072 provides for a general prohibition of Poaceae plants for planting, other than seed, from many third countries although ornamental perennial grasses from the subfamily Panicoideae are exempt from the prohibition (Table 2). Within the known hosts of *N. andropogonis*, *Andropogon* sp. and *Imperata cylindrica* satisfy the criteria to be exempt from prohibition (Appendix A).

N. andropogonis can spread over long distances through infested plants for planting and potentially with raw sugarcane (Tables 3 and 4). Movement with seed is less likely as *N. andropogonis* does not feed on seed; as a result, seed is not regarded as providing a realistic pathway. Natural dispersal occurs locally by the adults flying, or potentially over longer distances via passive transport by wind.

As this pest moves on plants for planting, and its hosts include grass weeds that are common in the EU, transfer to a suitable host would be highly likely. The ornamental, Japanese blood grass (*I. cylindrica*) is a host that is exempt from the general prohibition on Poaceae. It is unknown how much, if any, of this grass is imported into the EU each year as growing plants.

Table 3: Potential pathways for *Neomaskellia andropogonis* into the EU

Pathways	Life stage	Relevant mitigations [e.g. prohibitions (Annex VI), special requirements (Annex VII) or phytosanitary certificates (Annex XI) within Implementing Regulation 2019/2072]
Plants (grasses) for planting, excluding seed	Eggs and larvae	Prohibition (Annex VI) although ornamental perennial grasses from the subfamily Panicoideae are exempt.
Sugarcane stems for processing	Eggs and larvae	Phytosanitary certificates are required from third countries other than Switzerland (Annex XI, Part B)

Table 4: Annual EU imports of sugarcane*, host of *Neomaskellia andropogonis* from countries where the pest is present (2016–2020, hundreds of kg, HS Code: 1212 93) (Eurostat – Accessed 29 March 2022)

Country/Year	2016	2017	2018	2019	2020
India	55.23	79.71	65.23	92.49	72.68
Pakistan	91.53	59.59	56.87	67.02	48.20
Sri Lanka	2.06	7.06	12.62	8.05	7.48
Hong Kong	:	:	:	1.92	:

*: Sugarcane, fresh, chilled, frozen or dried, whether or not ground.

Note that statistics reporting sugarcane imports (Table 4) do not distinguish between fresh, chilled, frozen or dried sugarcane. We assume *N. andropogonis* would only survive on fresh sugarcane. It is unknown how much, if any, of the sugarcane that the EU imports is transported fresh.

Notifications of interceptions of harmful organisms began to be compiled in Europhyt in May 1994 and in TRACES in May 2020. As at July 29th 2022 there were no records of interception of *N. andropogonis* in the Europhyt and TRACES databases.

Given the lack of information of imported ornamental grass hosts and the uncertainty as to whether fresh sugarcane is imported into the EU, the likelihood of entry is uncertain.

3.4.2. Establishment

Is the pest able to become established in the EU territory?

Yes, the pest is able to become established outdoors in the EU territory. Suitable climates may occur in southern EU around the Mediterranean and there are grass hosts available that could support establishment.

Climatic mapping is the principal method for identifying areas that could provide suitable conditions for the establishment of a pest taking key abiotic factors into account (Baker, 2002). Availability of hosts is considered in Section 3.4.2.1. Climatic factors are considered in Section 3.4.2.2.

3.4.2.1. EU distribution of main host plants

The main host plant for *N. andropogonis* is sugarcane which in the EU is primarily produced in the French overseas departments and, in small amounts, in the Portuguese and Spanish islands (Rossi, 2018). Some sugarcane is also grown in mainland Spain. Table 5 shows sugarcane production for Portugal and Spain. Table 6 shows harvested area of sorghum in the EU. However, *N. andropogonis* also feeds on wild grasses, some of which occur throughout the EU except for the far north (e.g. Bermuda grass, *Cynodon dactylon*).

Table 5: Harvested area of sugarcane in EU, 2016–2020 (ha). (Source: FAOSTAT, Accessed on 29/3/22)

MS/Year	2016	2017	2018	2019	2020
EU	79	81	:	:	:
Portugal	62	62	:	:	:
Spain	17	29	:	:	:

Table 6: Harvested area of sorghum in EU, 2016–2020 (1,000 ha). (Source: Eurostat, Accessed on 27/9/22)

MS/Year	2016	2017	2018	2019	2020
EU	123.77	135.66	147.85	190.32	217.57
Bulgaria	3.29	4.24	8.86	7.04	3.26
Greece	2.74	3.01	2.62	2.36	2.24
Spain	8.12	6.96	5.97	6.56	5.25
France	48.46	56.24	60.77	83.09	115.10
Croatia	0.06	0.00	0.00	0.00	0.00
Italy	43.84	40.90	39.60	46.80	52.91
Hungary	4.45	6.25	9.62	23.32	22.82
Austria	2.26	2.99	3.53	3.94	4.64
Romania	9.16	13.99	15.93	15.71	9.59
Slovenia	0.11	0.14	0.08	0.13	0.09
Slovakia	0.97	0.64	0.57	1.07	1.36

‘:’ Data not available.

3.4.2.2. Climatic conditions affecting establishment

N. andropogonis is a thermophilic insect found mainly in areas with tropical and subtropical climates in parts of south-central Asia and the Middle East. Figure 2 shows the World distribution of selected Köppen–Geiger climate types (Kottek et al., 2006) that occur in the EU and which occur in countries where *N. andropogonis* has been reported (BSh, BSk, Csa and Csb). Southern EU MSs provide climatic matches. It is unlikely that the whitefly could establish in the central and northern EU MS. However, there is a possibility that *N. andropogonis* could occur in greenhouses and on indoor plantings in these cooler areas of the EU.

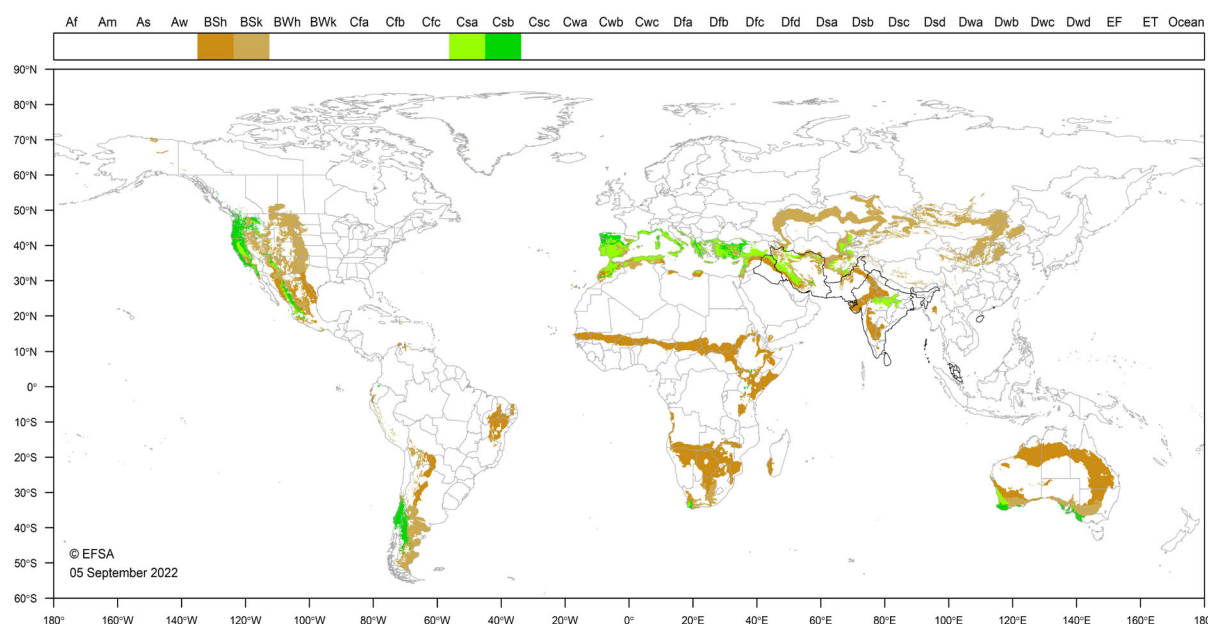


Figure 2: World distribution of Köppen–Geiger climate types that occur in the EU and which occur in countries where *Neomaskellia andropogonis* has been reported

Referring back to Section 3.1.2, the threshold for egg to adult development (T_o) was estimated to be 7.2°C with 500 degree days (DD) required for a generation. Table 7 provides reports of T_o and DD required for development of other tropical and sub-tropical whitefly species that have established in the EU.

Table 7: Development thresholds and degree days required for development (egg to adult) of tropical whitefly species that have established in the EU

Whitefly	T_o	Degree days	EU distribution	References
<i>Aleurothrixus floccosus</i> (Maskell)	9.8	526	Cyprus, France, Greece, Italy, Malta, Portugal, Spain	Martin et al. (2000); CABI (online_a)
<i>Dialeurodes citri</i> (Ashmead)	11.5	641	Croatia, France, Greece, Italy, Malta, Slovenia	Olu (1985); Martin et al. (2000)
<i>Parabemisia myricae</i> (Kuwana)	12.8	265	Cyprus, Greece, Italy, Spain	CABI (online_b); Martin et al. (2000)

Comparing the thermal requirements of the introduced species in Table 7 with the estimated thermal requirements for *N. andropogonis*, we conclude that climatic conditions and availability of hosts in the EU would support the establishment of *N. andropogonis*.

3.4.3. Spread

Describe how the pest would be able to spread within the EU territory following establishment.

Adults disperse naturally by flying and all stages (mainly the eggs and larvae) can be moved over long distances by the trade of infested plant material.

Comment on plants for planting as a mechanism of spread.

Plants for planting are the main mechanism for long distance spread.

Natural dispersal occurs locally by adults flying, or over longer distances via passive transport by wind. *N. andropogonis*, particularly the eggs and larval stages which are firmly attached to the host, can be spread over long distances through infested plants for planting.

3.5. Impacts

Would the pests' introduction have an economic or environmental impact on the EU territory?

Yes, the introduction of *N. andropogonis* into the EU is likely to have an economic impact on sugarcane production.

N. andropogonis is an important emerging pest of sugarcane in Iran. The larvae feed on phloem sap and can cause a reduction of photosynthesis rate and growth leading to a reduction in quantity and quality of sugar. Indeed, damage was positively correlated with the number of infested leaves. Whitefly damage differed among cultivars with early maturing cultivars being more susceptible. In heavy infestations, the sugar purity and content are greatly decreased. Honeydew egested by feeding *N. andropogonis* larvae can promote the growth of black sooty mould on the foliage and stalks (Koozhad-Mohammadi et al., 2021).

N. andropogonis is not recorded having a significant impact in other sugarcane producing regions and the reasons for this are not understood. It is present in India where two other whitefly species (*A. barodensis* and *N. bergii*) are important pests of sugarcane. It is possible that *N. andropogonis* is overlooked and confused with the related species, *N. bergii*, or it may be better controlled by natural enemies. Parasitoids have a prominent role in the reduction of whitefly populations in sugarcane in India. For example, Ananthanarayana et al. (1994) showed that *Encarsia ochai* Viggiani (Hymenoptera: Aphelinidae) and *Amitus minervae* Silvestre (Hymenoptera: Platygasteridae) parasitised the pupa of *A. barodensis* and the later species was the most efficient with 80% pupae parasitised under field conditions. Pastagia et al. (2002) evaluated the efficacy of two parasitoids *Encarsia isaaci* Mani and *E. macroptera* Viggiani in sugarcane field conditions. They found that 97.7% of pupae were parasitised

after four successive releases of parasitoids. However, Nikpay (2017) recorded high levels of parasitism of *N. andropogonis* by *E. inaron* on some sugarcane varieties in Iran, yet the whitefly is having an increasing impact.

The pest significance of *N. andropogonis* to the other cultivated hosts, such as pearl millet and common sorghum, is unknown. There are also uncertainties regarding potential impacts on wild Poaceae.

3.6. Available measures and their limitations

Are there measures available to prevent pest entry, establishment, spread or impacts such that the risk becomes mitigated?

Yes, the import of some of the known host plants for planting from outside Europe is prohibited. This regulation does not specifically target *N. andropogonis* but does mitigate the likelihood of its entry into the EU on some hosts.

3.6.1. Identification of potential additional measures

Phytosanitary measures (prohibitions) are currently applied to some of the known host plants for planting (see 3.3.2) and these could be extended to the ornamental grasses *Imperata cylindrica* and *Andropogon* sp. that are currently exempt.

Additional potential risk reduction options and supporting measures are shown in sections 3.6.1.1 and 3.6.1.2.

3.6.1.1. Additional potential risk reduction options

Potential additional control measures are listed in Table 8.

Table 8: Selected control measures (a full list is available in EFSA PLH Panel et al., 2018) for pest entry/establishment/spread/impact in relation to currently unregulated hosts and pathways. Control measures are measures that have a direct effect on pest abundance

Control measure/Risk reduction option (Blue underline = Zenodo doc, Blue = WIP)	RRO summary	Risk element targeted (entry/establishment/spread/impact)
Require pest freedom	Source hosts from pest free areas.	Entry/Spread
<u>Growing plants in isolation</u>	Description of possible exclusion conditions that could be implemented to isolate the crop from pests and if applicable relevant vectors. E.g. a dedicated structure such as glass or plastic greenhouses. Production of nursery plants in insect-proof greenhouses	Entry (reduce contamination/infestation)/Spread
<u>Crop rotation, associations and density, weed/volunteer control</u>	Crop rotation, associations and density, weed/volunteer control are used to prevent problems related to pests and are usually applied in various combinations to make the habitat less favourable for pests. The measures deal with (1) allocation of crops to field (over time and space) (multi-crop, diversity cropping) and (2) to control weeds and volunteers as hosts of pests/vectors. Management of grass weeds around sugarcane crops may remove the reservoir of infection.	Entry/Establishment/Spread/Impact
<u>Use of resistant and tolerant plant species/varieties</u>	The impact of <i>N. andropogonis</i> varies with cultivar and it may be possible to select tolerant cultivars (Nikpay, 2017; Askarianzadeh and Minaeimoghadam, 2018)	Entry/Establishment/Impact

Control measure/Risk reduction option (Blue underline = Zenodo doc , Blue = WIP)	RRO summary	Risk element targeted (entry/establishment/spread/impact)
Biological control and behavioural manipulation	Augmentative and conservation biological control exploiting hymenopteran parasitoids already present, such as <i>Encarsia inaron</i> (Nikpay, 2017).	Impact
Chemical treatments on crops including reproductive material	Pesticides can be effective for whitefly control (Koozad-Mohammadi et al., 2021)	Entry/ Establishment/Spread/ Impact
Physical treatments on consignments or during processing	Importing raw sugarcane free of any foliage will reduce the risk of transporting eggs and larvae.	Entry/ Spread
Post-entry quarantine and other restrictions of movement in the importing country	This information sheet covers post-entry quarantine (PEQ) of relevant commodities; temporal, spatial and end-use restrictions in the importing country for import of relevant commodities; Prohibition of import of relevant commodities into the domestic country. 'Relevant commodities' are plants, plant parts and other materials that may carry pests, either as infection, infestation, or contamination.	Entry/Establishment

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 9.

Table 9: Selected supporting measures (a full list is available in EFSA PLH Panel, 2018) in relation to currently unregulated hosts and pathways. Supporting measures are organisational measures or procedures supporting the choice of appropriate risk reduction options that do not directly affect pest abundance

Supporting measure (Blue underline = Zenodo doc , Blue = WIP)	Summary	Risk element targeted (entry/establishment/spread/impact)
Inspection and trapping	Inspection is defined as the official visual examination of plants, plant products or other regulated articles to determine if pests are present or to determine compliance with phytosanitary regulations (ISPM 5). The effectiveness of sampling and subsequent inspection to detect pests may be enhanced by including trapping and luring techniques.	Entry/Establishment/Spread
Laboratory testing	Examination, other than visual, to determine if pests are present using official diagnostic protocols. Diagnostic protocols describe the minimum requirements for reliable diagnosis of regulated pests.	Entry
Sampling	According to ISPM 31, it is usually not feasible to inspect entire consignments, so phytosanitary inspection is performed mainly on samples obtained from a consignment. It is noted that the sampling concepts presented in this standard may also apply to other phytosanitary procedures, notably selection of units for testing. For inspection, testing and/or surveillance purposes the sample may be taken according to a statistically based or a non-statistical sampling methodology.	Entry

Supporting measure (Blue underline = Zenodo doc, Blue = WIP)	Summary	Risk element targeted (entry/establishment/ spread/impact)
Phytosanitary certificate and plant passport	An official paper document or its official electronic equivalent, consistent with the model certificates of the IPPC, attesting that a consignment meets phytosanitary import requirements (ISPM 5) (a) export certificate (import) (b) plant passport (EU internal trade)	Entry
Surveillance	Surveillance to guarantee that plants and produce originate from a Pest Free Area could be an option.	Entry/establishment/Spread

3.6.1.3. Biological or technical factors limiting the effectiveness of measures

- Due to its small size, *N. andropogonis* may not be easily detected in cases where low densities occur.
- Limited number of available registered active substances for use in sugarcane.
- There are no whitefly pests of sugarcane in the EU. Consequently, there is a lack of experience on the chemical control of *N. andropogonis* under EU conditions.
- The effectiveness of natural enemies already present in the EU, such as *Encarsia inaron*, in controlling the whitefly pest.

3.7. Uncertainty

There are two main sources of uncertainty. Firstly, the likelihood of entry given we lack information on the import of fresh sugarcane and ornamental host grasses; secondly, the magnitude or significance of potential economic impact caused by *N. andropogonis* to sugarcane production within the EU because the whitefly is not reported to be an important pest in the majority of sugarcane-producing regions. Equally, there is a lack of quantitative data regarding impact on millet and sorghum.

4. Conclusions

N. andropogonis satisfies all of the criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union quarantine pest. However, this conclusion has high uncertainties regarding the likelihood of entry and the magnitude of potential impact within the EU as the insect is only recorded as an economically important pest in Iran, and its host range is poorly understood. Table 10 provides a summary of the PLH Panel conclusions.

Table 10: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of the pest is well established. Morphological and molecular diagnostic methods are available.	None
Absence/presence of the pest in the EU (Section 3.2)	The pest is not present in the EU	None
Pest potential for entry, establishment and spread in the EU (Section 3.4)	<i>N. andropogonis</i> is able to enter the EU territory e.g. with Poaceae plants for planting. It would be able to establish in the EU and would spread naturally by flight very locally, and with plants for planting over longer distances.	Likelihood of entry given existing prohibitions.
Potential for consequences in the EU (Section 3.5)	<i>N. andropogonis</i> is an important emerging pest of sugarcane in Iran, and could have a similar economic impact in the EU.	Magnitude of impact in the EU

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Key uncertainties
Available measures (Section 3.6)	The import of many known grass host plants for planting from outside Europe is prohibited (Commission Implementing Regulation (EU) 2019/2072, Annex VI) but there are exemptions.	None
Conclusion (Section 4)	All criteria assessed by EFSA above for consideration as a potential quarantine pest were met	None
Aspects of assessment to focus on/scenarios to address in future if appropriate:		

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Abbreviations

EPPO	European and Mediterranean Plant Protection Organisation
FAO	Food and Agriculture Organisation
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
MS	Member State
PAFF	EC Standing Committee on Plants, Animals, Food and Feed
PLH	EFSA Panel on Plant Health
PZ	Protected Zone
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference

Glossary

Containment (of a pest)	Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 2021)
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 2021)
Entry (of a pest)	Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO, 2021)
Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2021)
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2021)
Greenhouse	A walk-in, static, closed place of crop production with a usually translucent outer shell, which allows controlled exchange of material and energy with the surroundings and prevents release of plant protection products (PPPs) into the environment.
Hitchhiker	An organism sheltering or transported accidentally via inanimate pathways including with machinery, shipping containers and vehicles; such organisms are also known as contaminating pests or stowaways (Toy and Newfield, 2010).
Impact (of a pest)	The impact of the pest on the crop output and quality and on the environment in the occupied spatial units
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO, 2021)
Pathway	Any means that allows the entry or spread of a pest (FAO, 2021)
Phytosanitary measures	Any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (FAO, 2021)
Quarantine pest	A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (FAO, 2021)
Risk reduction option (RRO)	A measure acting on pest introduction and/or pest spread and/or the magnitude of the biological impact of the pest should the pest be present. A RRO may become a phytosanitary measure, action or procedure according to the decision of the risk manager
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO, 2021)

Appendix A – Neomaskellia andropogonis host plants/species affected

Source: Literature as indicated.

Host name	Subfamily	Common name	References
<i>Andropogon</i> sp. +	Panicoideae	Beard grass	Mound and Halsey (1978)
<i>Cenchrus americanus</i> *	Panicoideae	Pearl millet	Tayyib (2013)
<i>Cynodon dactylon</i> +	Chloridoideae	Bermuda grass	Koohzad-Mohammadi et al. (2017)
<i>Diplachne fusca</i>	Chloridoideae	Bearded sprangle top	Koohzad-Mohammadi et al. (2017)
<i>Echinochloa colona</i>	Panicoideae	Barnyard grass	Koohzad-Mohammadi et al. (2017)
<i>Echinochloa crus-galli</i>	Panicoideae	Barnyard millet	Nikpay et al. (2018)
<i>Imperata cylindrica</i> +	Panicoideae	Japanese blood grass	Al-Mallo and Abdul-Rassoul (2017)
<i>Neyraudia reynaudiana</i>	Panicoideae	Burma reed	Martin and Lau (2011)
<i>Paspalum dilatatum</i>	Panicoideae	Dallis grass	Koohzad-Mohammadi et al. (2017)
<i>Saccharum arundinaceum</i>	Panicoideae	Hardy sugarcane grass	Mound and Halsey (1978)
<i>Saccharum bengalense</i>	Panicoideae	Baruwa grass	Mound and Halsey (1978)
<i>Saccharum officinale</i> *	Panicoideae	Sugarcane	Askarianzadeh and Manzari (2006)
<i>Sorghum bicolor</i> *	Panicoideae	Common sorghum	Mound and Halsey (1978)

Key: + ornamental grass * cultivated agricultural crop.

Annex VI, point 14 of 2019/2072 provides for a general prohibition of Poaceae plants for planting, other than seed, from many third countries although ornamental perennial grasses from the subfamily Panicoideae are exempt from the prohibition. Within the known hosts of *N. andropogonis*, *Andropogon* sp. and *Imperata cylindrica* satisfy the criteria to be exempt from prohibition.

Ornamental *Andropogon* sp. <https://www.rhs.org.uk/plants/374035/i-andropogon-gerardii-i-red-arrow/details>.

Ornamental *Imperata cylindrica* <https://www.rhs.org.uk/plants/94352/i-imperata-cylindrica-i-rubra/details>.

Uncertainty: The host range may increase.

The host range of *N. andropogonis* has only recently been studied in detail since it emerged as a new pest in Iran, and 6 of the 10 host genera have only been recorded since 2017. It is highly likely that the host range will increase as the whitefly is researched further.

Appendix B – Distribution of *Neomaskellia andropogonis*

Distribution records based on literature.

Region	Country	Sub-national (e.g. State)	Status	References
Asia	China	Hainan	Present	Chou and Yan (1988)
	China	Hong Kong	Present	Askarianzadeh and Manzari (2006)
	India		Present	Askarianzadeh and Manzari (2006)
	Iran		Present	Askarianzadeh and Manzari (2006)
	Iraq		Present	Al-Mallo and Abdul-Rassoul (2017)
	Malaysia	Peninsular Malaysia	Present	Askarianzadeh and Manzari (2006)
	Pakistan		Present	Askarianzadeh and Manzari (2006)
	Sri Lanka		Present	Askarianzadeh and Manzari (2006)