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

Quick scan National Plant Protection Organization, the Netherlands

Quick scan number: QS2021ENT003

Quick scan date: 23-6-2021

No.	Question	Quick scan answer for *Cryphalus* spp.
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*.	*Cryphalus* spp. Erichson (1836) (Coleoptera: Curculionidae, Scolytinae).   **A)** **B)** **A)** The bark beetle *Cryphalus ruficollis* Hopkins, 1915 (Photo: Pest and Diseases Image Library , Bugwood.org) and **B)** the mango bark beetle *Cryphalus* (synonym: *Hypocryphalus*) *mangiferae* (Stebbing, 1914) (Photo: Javier E. Mercado, Bark Beetle Genera of the U.S., USDA APHIS PPQ, Bugwood.org)

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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.*	Events prompting the quick scan: The quick scan was prompted by a finding of a non-European species of *Cryphalus* on *Ficus lyrata* and *Artocarpus altilis* trees in a greenhouse in the Netherlands that imports and trades (sub)tropical plants. The plants found infested had been imported from Malaysia. This quick scan primarily assesses the risk of non-European *Cryphalus* species of (sub)tropical origin, other than *C. dilutus* (which is established in the EU) that are known to live on *Ficus* and/or *Artocarpus* spp. Molecular identification of the found species was not possible due to a lack of molecular data in online databases, but it is unlikely to be *C. dilutus* because available sequences of that species (Johnson et al., 2017) cluster as a distant sister group from our sequences. However, information of *C. dilutus* is included in the present quick scan as example of an invasive *Cryphalus* species. Rationale behind quick scan: Since 14 December 2019, all non-European Scolytinae are listed (as non-European Scolytidae) as EU quarantine organisms (Implementing Regulation (EU) 2019/2072, Annex II). Before that date only non-European species that attack conifers were regulated in the EU (Council Directive 2000/29/EC, Annex IIAI). More specifically, non-European Scolytinae were regulated for "*plants of conifers (Coniferales), over 3 m in height, other than fruit and seeds, wood of conifers (Coniferales) with bark, and isolated bark of conifers (Coniferales), originating in non-European countries*". EFSA-Panel-on-Plant-Health et al. (2020) has categorised non-EU Scolytinae of coniferous hosts and identified 139 out of the 705 non-EU species that meet all the criteria of an EU quarantine pest. However, all Scolytinae species are still listed as quarantine pests. Only one of the species, attacking conifers (*Polygraphus proximus*) has been fully evaluated and is listed separately in EU phytosanitary legislation (Implementing Regulation (EU) 2019/2072, Annex II). Species on non-coniferous hosts have thus far not been categorised. There are more than 6000 Scolytinae species with the majority being (sub)tropical (EPPO, 2020) and there may be about 5000 non-European Scolytinae species of non-coniferous species that have got the EU-quarantine status since 14 December 2019. Only two of these species have been fully evaluated by the EU and these species are listed separately: *Pseudopityophthorus minutissimus* and *P. pruinosus*. A third species, *Euwallacea fornicatus sensu lato* is currently being discussed for listing. Thus, for the majority of non-European Scolytinae species, including non-European *Cryphalus* species, it remains uncertain if they meet the criteria of an EU quarantine pest.
3.	What is the current area of distribution?	The genus *Cryphalus* (including the now synonymized genus *Hypocryphalus*) has a worldwide distribution, occurring in a wide variety of climate zones although most are present in the (sub)tropics. *Cryphalus* spp. are present in Oriental, Austro-Pacific, Palearctic, Afro-tropical, Neotropical and Nearctic regions and the former *Hypocryphalus* is

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		known from Afrotropical, Oriental and Austro-Pacific regions (Hulcr et al. 2015). Most species originate from Asia and Australasia (Johnson et al., 2020). According to Yang (2020), 253 species have been described with more being discovered regularly through modern taxonomic and molecular techniques. Five species are known to naturally occur in Europe (*C. intermedius*, *C. abietis*, *C. piceae*, *C. numidicus*, and *C. saltuarius*). Information on invasive species within the genus is limited and hard to find because of many misidentifications and taxonomic revisions over the past decade (Johnson et al., 2020). One species, *C. dilutus* (syn. *C. scabricollis*, *C. discretus, C. brevisetosus*, *Hypocryphalus scabricollis* and *H. dilutus* and often misidentified as *C. mangiferae* and synonyms thereof) has been introduced to Oman, Pakistan, Israel, Bangladesh, Tunisia and Mexico (Yang, 2020) and was first reported in Malta in 1991 (Mifsud & Knizek, 2009), in Sicily in 2014 (Faccoli, Campo, Perrotta, & Rassati, 2016) and in southern France in 2020 (Barnouin et al., 2020). The species may be native to the humid (sub)tropics in China (Yunnan, Guangdong) and Myanmar (Johnson et al., 2020). However, this nominally subtropical species is apparently well-adapted to the Mediterranean climate and has become widely distributed in Malta (Mifsud et al. 2012). There are no records of other *Cryphalus* species introduced to Europe. *C. mangiferae*, native to South-East Asia, has been introduced to South America, southern USA, sub-Saharan Africa and Australia (Johnson et al., 2020). Several other non-native *Cryphalus* species have been reported from the Americas but without information on their establishment (Johnson et al., 2020).
4.	What are the hostplants?	Several species of *Cryphalus* are known to have *Ficus* species among their host plants. These include *C. abbreviatus* (Kanzaki, Ekino, Kajimura, & Degawa, 2021), *C. artocarpus, C. itinerans* (Johnson et al., 2020), *C. kivuensis, C. wapleri, C. dorsalis, C. pallidus, C. densepilosus, C. exiguus, C. bellus, C. ficivorus* and *C. furukawai* (Wood & Bright, 1992). Also *Artocarpus* is known as a host plant for *Cryphalus* species. These include *C. trypanoides* (on *A. altilis*), *C. tenuis*, *C. dorsalis*, *C. mollis*, *C. sylvicola* and *C. artocarpus* (Wood & Bright, 1992). In general, host plants of *Cryphalus* species vary widely and a comprehensive list of host plants is unavailable for most species. <u>*Cryhalus dilutus*</u> <u>introduced to Europe</u> One non-native *Cryphalus* species has been reported from Europe that attacks *Ficus*: *C. dilutus*. In its native range, *C. dilutus* has many host species, including *Afzelia bijuga, Albizzia stipulata, Bassia latifolia, Bombax malabaricum, Buchanania lanzan, Canarium euphyllum, Excoecaria agallocha, Garuga pinnata, Mesua ferrea, Odina wodier,* and *Ficus* spp. (Wood & Bright, 1992). In Southern Europe, the species has been reported from several *Ficus* species (Barnouin et al., 2020; Faccoli et al., 2016).

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		<u>*Cryphalus* species native to Europe</u> There are five *Cryphalus* species known that are native to Europe: *Cryphalus intermedius, Cryphalus abietis* (syn. *C. asperatus*), *Cryphalus piceae, Cryphalus numidicus* and *Cryphalus saltuarius.* Each of these five species are specialists on conifers and have been recorded on members of the following genera: *Larix, Picea, Pinus, Abies, Pseudotsuga* and *Cedrus* spp.
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.).*	Most *Cryphalus* species live on recently dead or dying plant tissue but a few species have been reported to attack weakened parts of trees (Johnson et al. 2020). It is unknown if the species found in the *Ficus* and *Artocarpus* plants causes any significant damage to plants. Examples of non-European *Cryphalus* species that are considered pests on fruits and forestry products in China are *C. morivorus* on mulberry (Yin et al. 1984), *C. scopiger* on Manchurian walnut and ash (Fraxinus) (Wu et al. 1991) and *C. eriobotryae* on loquat (Zheng et al. 2019). The role of pathogens in the decline of trees associated with these Scolytinae has not been investigated (Johnson et al. 2020). <u>*Cryhalus dilutus* introduced to Europe</u> *C. dilutus*, introduced to Europe, has caused major damage to fig trees in Malta with over 50% of infested trees dying within 6 years (Barnouin et al. 2020). The species attacks weakened and healthy trees and is considered a major threat to fig production in southern France (Barnouin et al. 2020). It is also considered a major pest of mango trees in Oman, Pakistan, Bangladesh and Mexico whereas *C. mangiferae*, although globally distributed, seems harmless to mango trees (Johnson et al. 2017).
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)	The species found is most likely of (sub)tropical origin because the infested plants originated from Malaysia and Malaysia has a tropical rainforest climate according to the Köppen Geiger climate classification (Beck et al., 2018). In addition, the vast majority of non-European *Cryphalus* species occur in (sub)tropical regions (Johnson et al., 2020). It is likely that (sub)tropical *Cryphalus* species that live on *Ficus* and *Artocarpus* can establish under indoor conditions in the Netherlands, especially in tropical greenhouses in botanical gardens, zoos etc. The *Cryphalus* species may also be able to establish in commercial greenhouses but establishment may be hampered if host plants only stay for a short period in the greenhouse. Infested plants may have been traded or removed before the species has completed a life cycle and infested other plants present in the greenhouse. *Cryphalus* species known to live on *Ficus* or *Artocarpus* are unlikely to establish outdoors under Dutch climatic conditions. All *Cryphalus* species that have been found associated with these plant genera (see list in section 4) naturally occur in tropical or subtropical climates (Yang 2020). There is, however, some uncertainty related to this assessment because little is known about the climatic tolerances and full range of host plant species of these *Cryphalus* species.

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		Temperate *Cryphalus* species A few *Cryphalus* species such as *Cryphalus viburni* and *C. scopiger*, occur in mild to cold climates and are abundant in certain parts of Russia, North Korea and China. *C. viburni* is only known to live on *Viburnum.* Host plants of *C. scopiger* include *Juglans mandshurica, Fraxinus mandshurica* and *Prunus* spp., although the identification of specimens of this last record have not been verified (Johnson et al. 2020). Climatic conditions in the Netherlands may be suitable for establishment for both species but the host plant density may be a limiting factor for establishment of *C. scopiger* because the known host plants *J. mandshurica* and *F. mandshurica* are rare in the Netherlands. The species may, however, also be able to live on other *Juglans* and *Fraxinus* spp.
7.	Assess the probability of establishment in the EU (i.e. the suitability of the environment for establishment).	Climatic conditions in (parts of) southern EU may be suitable for establishment of (sub)tropical *Cryphalus* spp. but there may be a difference between species that are of true tropical origin and those that are more native to subtropical areas. *C. dilutus* has established in the Mediterranean area but it is unclear if this species originates from both tropical and subtropical regions or only from subtropical regions (Myanmar which seems to be part of its native area (see Question 3) has both tropical and subtropical regions).
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)?	The most likely pathway for *Cryphalus* species to spread along large distances is transport of wood (packaging material) and plants for planting. Information on natural dispersal capacity of *Cryphalus* spp. is scarce.
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?	Based on available information the extent of economic damage cannot be assessed. Except for *C. dilutus*, which has already established itself in Southern Europe and causes damage to fig trees, threatening fig-fruit production (Barnouin et al. 2020; Faccoli et al. 2016; Mifsud et al. 2012), no other *Cryphalus* species known to live on *Ficus* or *Artocarpus* has been reported as invasive or detrimental for production or the environment.
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, it was detected in plants for planting of *Ficus lyrata* and *Artocarpus altilis.*
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	Traps • *Cryphalus* species are attracted by flight traps baited with ethanol, which may be used for monitoring (Pérez-De La Cruz et al 2009, 2016).

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		Interceptions by EU member states (data from Europhyt and TRACES) • Interceptions of *Cryphalus* species have not been notified by EU member states from 2010 to 2020; there are, however, several hundreds of interceptions of Scolytidae mainly in wood(en products). Interceptions by USA • There are two studies we are aware of that have analysed interceptions of Scolytinae (including *Cryphalus* and *Hypocryphalus*) at US ports. At US ports of entry, 6,825 interceptions of Scolytinae have been recorded from 1985 to 2000 (Haack 2001). *Cryphalus* and *Hypocryphalus* were among the intercepted genera. • A more recent analysis of Haack and Rabaglia (2013) includes interceptions from the period 1984 to 2008. Out of 8,286 interceptions *Hypocryphalus* was intercepted 115 and *Cryphalus* 57 times, with China, Italy (*Cryphalus*), India, Philippines, Brazil, Taiwan and Malaysia as the top countries of origin. Out of the 8,286 interceptions of Scolytinae, 3,446 interceptions have been identified to species level with a very limited number of species identified, mostly from the palearctic region. From these interceptions, 7 *Cryphalus* and 4 Hypocryphalus interceptions were identified to species level. In case of *Cryphalus* spp, all 7 records concerned two EU species *C. abietis* and *C. piceae*, from Germany, Italy and France. All 4 Hypocryphalus interceptions concerned a single species *H. mangiferae* from India and Brazil.
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		Hulcr J., Atkinson T.H., Cognato A.I., Jordal B.H. and McKenna D.D. 2015. Morphology, Taxonomy, and Phylogenetics of Bark Beetles. pp 41 – 84. in F.E. Vega and Hofstetter R.W. (eds) Bark beetles: biology and ecology of native and invasive species. 620 pp. Academic Press, London, UK, ISBN 9780124171565 Johnson, A. J., Knížek, M., Atkinson, T. H., Jordal, B. H., Ploetz, R. C., & Hulcr, J. (2017). Resolution of a Global Mango and Fig Pest Identity Crisis. *Insect Systematics and Diversity, 1*(2). Retrieved from https://doi.org/10.1093/isd/ixx010. doi:10.1093/isd/ixx010 Johnson, A. J., Li, Y., Mandelshtam, M. Y., Park, S., Lin, C. S., Gao, L., & Hulcr, J. (2020). East Asian Cryphalus Erichson (Curculionidae, Scolytinae): new species, new synonymy and redescriptions of species. ZooKeys, 995, 15. Kanzaki, N., Ekino, T., Kajimura, H., & Degawa, Y. (2021). Description of Bursaphelenchus microcarpae n. sp. isolated from Cryphalus abbreviatus emerged from Ficus microcarpa, with a report of B. carpini re-isolation. Nematology, 1(aop), 1-17. Kirkendall R.L., Biedermann P.H.W. and Jordal B.H. 2015. Evolution and diversity of bark and Ambrosia Beetles. pp 85 – 156. in F.E. Vega and Hofstetter R.W. (eds) Bark beetles: biology and ecology of native and invasive species. 620 pp. Academic Press, London, UK, ISBN 9780124171565 Mifsud, D., & Knizek, M. (2009). The Bark Beetles (Coleoptera: Scolytidae) of the Maltese Islands (Central Mediterranean). Mifsud, D., Annushka Falzon, A., Malumphy, C., de Lillo E., Vovlas, N. & Porcelli, F. (2012) On some arthropods associated with Ficus species (Moraceae) in the Maltese Islands. Bulletin of the Entomological Society of Malta, 5, 5–34. Pérez-De La Cruz M., Equihua-Martínez A., Romero-Nápoles J., Sánchez-Soto S. and García-López E. 2009. Diversity, dynamic population and host plants of bark and ambrosia beetles (Coleoptera: Curculionidae) associated to the cocoa agroecosystem in Tabasco, Mexico. Revista Mexicana de Biodiversidad 80, 779- 791. Pérez-De La Cruz M., Hernández-May M.A., De la Cruz-Pérez A. and Sánchez-Soto S. 2016. Scolytinae y Platypodinae (Coleoptera: Curculionidae) de dos áreas de conservación en Tabasco, México. Rev. Biol. Trop. 64, 319-326. Spennemann D.H.R. 2019. Resilience of the date stone beetle, Coccotrypes dactyliperda Fabricius, 1801 (Coleoptera: Curculionidae), following periods of exposure to subzero temperature. Türk. entomol. derg., 2019, 43, 377-383. DOI: http://dx.doi.org/10.16970/entoted.530263 Wood, S., & Bright, D. E. (1992). Hosts of Scolytidae and Platypodidae. Wood, SL. 2007. Bark and Ambrosia Beetles of South America (Coleoptera: Scolytidae). Monte L. Bean Life Science Museum, Brigham Young University, Provo, Utah Wu L, Wang X, Zhang F, Yuan C (1991) Biological Characteristics of Cryphalus viburni Stark and the prevention and control. Journal of Northeast Forestry University 19(4): 209–212. [In Chinese with English abstract]

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		Yang, L. (2020). Checklist of the genus Cryphalus Erichson, 1836 (Coleoptera: Curculionidae: Scolytinae) with special attention to Chinese species. Zoological Systematics. 176-205. 10.11865/zs.2020. Yin H, Huang F, Li Z (1984) Economic Insect Fauna of China, Fasc.29, Coleoptera: Scolytidae. Science Press, Beijing, 205 pp. [+ pls 1–19.] Zheng S, Johnson AJ, Li Y, Chu C, Hulcr J. Cryphalus eriobotryae sp. nov. (Coleoptera: Curculionidae: Scolytinae), a New Insect Pest of Loquat Eriobotrya japonica in China. Insects. 2019 Jun 22;10(6):180. doi: 10.3390/insects10060180
14.	**Conclusions**	This quick scan was prompted by the finding of a non-European *Cryphalus* species on plants for planting of *Ficus* and *Artocarpus* at a Dutch greenhouse company that import and trade (sub)tropical plants. The species was unlikely to be *C. dilutus,* a species that has been introduced in southern Europe. All non-European Scolytinae species are EU quarantine pests (listed as non-European Scolytidae). This EU quarantine status is not based on a pest categorization or risk assessment of each individual Scolytinae species. Therefore, a quick scan was performed to assess if non-European *Cryphalus* species of (sub)tropical origin known to live on *Ficus* and/or *Artocarpus*, other than *C. dilutes,* meets the criteria of an EU quarantine pest. The organism could not be identified to the species level but was most likely of (sub)tropical origin. No information was found on *Cryphalus* species, other than *C. dilutus*, that live on *Ficus* or *Artocarpus* and cause economic impacts. Therefore, it cannot be concluded that the organism meets all of the criteria of an EU quarantine pest (one of the criteria is having an unacceptable impact after introduction).
15.	**Follow-up measures**	Infested plants must be destroyed.