EUROPEAN AND MEDITERRANEAN PLANT PROTECTION ORGANIZATION

23-28430

Summary of EPPO Prioritization process[1] for: *Lupinus polyphyllus*

In 2022/23, a number of species on the EPPO Observation List were re-prioritized with current information to assess if they should remain on the Observation List or be moved to another list. This is the prioritization summary for *Lupinus polyphyllus* where the outcome is the species should be moved to the EPPO List of Invasive Alien Plants.

Section A. Prioritization process scheme for the elaboration of different lists of invasive alien plants (pests or potential pests) for the area under assessment

A.1 Is the plant species known to be alien in all, or a significant part, of the area under assessment?
Yes. *Lupinus polyphyllus* is native to western North America, from British Columbia in the west to western Alberta in the east, and western Wyoming, and south to Utah, New Mexico, and California (Eckstein et al., 2022). Some databases (e.g. CABI 2023, USDA 2023) include eastern North America and Alaska in the native range; however, these appear to be non-native populations.

A.2 Is the plant species established in at least a part of the area under assessment? (if yes go to A5)
Yes. The species is widely established in the EPPO region. It is reported from at least 33 EPPO countries, established in at least 19 and considered invasive in at least 13 (Annex 1).

A. 3 Is the plant species known to be invasive outside the area under assessment?
A yes for question A.2 means this question is skipped.

A.4 Based on ecoclimatic conditions, could the species establish in the area under assessment?
A yes for question A.2 means this question is skipped.

A.5 How high is the spread potential of the plant in the area under assessment?
High spread potential with low uncertainty. Reproduction is mainly by seed, with each plant producing hundreds to thousands of seeds (Aniszewski et al., 2001). Germination rates are relatively high, ranging from between 19% in a greenhouse to 69% in a common garden (Eckstein et al., 2022 - and references therein). Seeds are heavy, without appendages, and are released ballistically falling up to 5.5m from the mother plant (Volz, 2003). Apart from intentional use, the main cause of spread in its non-native range is by unintentional anthropogenic spread (spreading seeds >500-1000m from the parent plant). For example, in Sweden the main causes of spread were mowing machinery, soil movements and spread by the public, with self-seeding considered of least importance (Eckstein et al., 2022). Grazing can result in the unwanted dispersal of *L. polyphyllus*. Migratory sheep may potentially disperse ingested *L. polyphyllus* seeds over several kilometres (Otte et al., 2002).

L. polyphyllus was introduced to the EPPO region in the early 1800s but appears to have spread particularly rapidly in recent decades. For example, there has been a 50-fold increase in annual records of this plant in Sweden since the 1970s (Eckstein et al., 2022). It is spread widely across the EPPO region; however, this is primarily because of deliberate introduction (i.e. for horticulture, green manure, game fodder and agricultural cultivation), with unintentional spread important at more local scales.

[1] EPPO (2012) EPPO Prioritization process for invasive alien plants. EPPO Bulletin 42, 463-474.

A consideration when assessing potential for spread is that this species is already widespread across the EPPO region (in countries where it is capable to establishing) and in many of those areas it is widely established. For example, it is present in >81% of raster cells (11km x 11km) in Germany (Eckstein et al., 2022). This arguably lowers its potential for spread, as it has already occupied much of its potential range.

A.6 How high is the potential negative impact of the plant on native species, habitats and ecosystems in the area under assessment?
High with low uncertainty: *L. polyphyllus* colonises habitats that have a value for nature conservation where it forms large, dense, persistent populations.

Eckstein et al. (2022) provide a comprehensive review of negative impacts, noting that this species alters the vertical structure of usually low growing vegetation in communities such as alpic mountain hay meadows, alpic mat-grass swards as well as nutrient-poor road verges. In doing so, it alters species diversity and drives homogenisation. It can also cause cascading impacts on arthropod communities (for example reducing abundance of beetles, Diptera, Lepidoptera, and ants). As a nitrogen fixing plant, impacts are particularly high in nutrient poor habitats (Pergl, 2015). Its high alkaloid content may have allelopathic effects on the germination and establishment of native plant species (Wurst et al., 2010; Loydi et al., 2015).

A.7 How high is the potential negative impact of the plant on agriculture, horticulture or forestry in the area under assessment?
Low with low uncertainty. Minimal impacts.

A.8 How high are the potential additional impacts (e.g. on animal and human health, on infrastructures, on recreational activities, other trade related impacts such as market losses)?
Low with low uncertainty. Minimal impacts. Potential harm to livestock if eaten, e.g. in pasture, due to alkaloid content but appears to be of minimal significance (Pergl, 2015).

Outcome of Section A: *Lupinus polyphyllus* is included on the EPPO List of invasive alien plants

		A5 -Spread potential		
		Low	Medium	High
Adverse impacts (maximum rating from questions A6, A7 and A8.	Low	List of minor concern	List of minor concern	List of minor concern
	Medium	List of minor concern	Observation List	Observation List
	High	Observation List	Observation List	List of invasive alien plants

B. Prioritization process scheme for the identification of invasive alien plants for which a PRA is needed

B.1 Is the plant species internationally traded or are there other existing or potential international pathways?

Yes.

B.2 Is the risk of introduction by these international pathways identified to be superior to natural spread?

Uncertain. It has already been introduced to most EPPO countries it will reach, so risk of spread via international trade is no longer a primary concern.

B.3 Does the plant species still have a significant area suitable for further spread in the area under assessment?

No - depending on the scale considered. This species is already established in most EPPO countries that are at risk, and is widespread in many of those. Guidance would suggest the area suitable for further spread is small, i.e. it is already established in >40% of potential area.

Outcome of section B: A PRA is not considered a priority

Selected references

Aniszewski *et al* (2001). Aniszewski, Tadeusz, Mervi Hannele Kupari, and Aki Juhani Leinonen. "Seed number, seed size and seed diversity in Washington lupin (Lupinus polyphyllus Lindl.)." Annals of Botany 87.1 (2001): 77-82.

CABI (2023). CABI invasive Species compendium. https://doi.org/10.1079/cabicompendium.31710

Eckstein et al (2022). Eckstein, R. Lutz, et al. "Biological Flora of Central Europe – *Lupinus polyphyllus* Lindl." Perspectives in Plant Ecology, Evolution and Systematics (2022): 125715.

Loydi A, Donath TW, Eckstein RL, Otte A, 2015. Non-native species litter reduces germination and growth of resident forbs and grasses: allelopathic, osmotic or mechanical effects? Biological Invasions, 17(2):581-595. http://link.springer.com/article/10.1007%2Fs10530-014-0750-x

Otte, A, Obert, S., Volz H., Weigand E. (2002): Effekte von Beweidung auf *Lupinus polyphyllus* Lindl. in Bergwiesen des Biosphärenreservates Rhön. NeoBiota, 1: 101–133.

Pergl, J. (2015). EU non-native species risk assessment (draft). https://circabc.europa.eu/ui/group/98665af0-7dfa-448c-8bf4-e1e086b50d2c/library/309bde5e-d3c9-42ed-9022-d24193ee9bb2?p=1&n=10&sort=modified_DESC

USDA (2023). NRCS. The PLANTS Database. National Plant Data Team, Greensboro, NC USA. https://plants.usda.gov/home/plantProfile?symbol=LUPO2. Accessed 21 April 2023.

Volz, H., 2003. Ursachen und Auswirkungen der Ausbreitung von Lupinus polyphyllus Lindl. im Bergwiesen¨okosystem der Rh¨on und Maßnahmen zu seiner Regulierung. PhD thesis at the Justus-Liebig-Universität Gießen, Gießen, Germany.

Wurst, S., Vender, V., Rillig, M.C., 2010. Testing for allelopathic effects in plant competition: does activated carbon disrupt plant symbioses. Plant Ecol. 211, 19–26. https://link.springer.com/article/10.1007/s11258-010-9767-0

ANNEX 1. Status in EPPO countries

Establishment status from:

- X^1 = CABI (2023
- X^2 = DAISE (2016)
- X^3 = EPPO (2023)
- X^4 = Eckstein et al. (2022)

EPPO Country	Recorded	Established	Invasive
Albania			
Algeria			
Austria	X^1		
Azerbaijan	X^1		
Belarus	X^1		
Belgium	X^1	X^2	
Bosnia and Herzegovina			
Bulgaria	X^1		
Croatia	X^1		
Cyprus			
Czech Republic	X^1	X^1	X^1
Denmark	X^1	X^1	X^1
Estonia	X^1	X^2	
Finland	X^1	X^1	X^1
France	X^1	X^1	X^1
Georgia			
Germany	X^1	X^1	X^1
Greece			
Guernsey			
Hungary	X^1		
Ireland	X^1		
Israel			
Italy	X^1	X^2	
Jersey			
Jordan			
Kazakhstan	X^1		
Kyrgyzstan	X^1		
Latvia	X^1	X^2	
Lithuania	X^1	X^2	X^4
Luxembourg			
The Republic of North Macedonia	X^1		
Malta			
Moldova	X^1		

EPPO Country	Recorded	Established	Invasive
Montenegro			
Morocco			
Netherlands	X[1]	X[2]	
Norway	X[1]	X[1]	X[1]
Poland	X[1]	X[1]	X[1]
Portugal			
Romania	X[1]		
Russia	X[1]	X[1]	X[4]
Serbia			
Slovakia	X[1]		
Slovenia	X[1]	X[3]	X[3]
Spain	X[1]		
Sweden	X[1]	X[2]	
Switzerland	X[1]	X[1]	X[1]
Tunisia			
Türkiye			
Ukraine	X[1]	X[4]	X[4]
United Kingdom	X[1]	X[1]	X[1]
Uzbekistan			
Totals	33	19	13