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Weed Risk Assessment for *Coleostephus myconis* (L.) Cass. (Asteraceae) - Mediterranean marigold

Coleostephus myconis (Source: Alberto, 2009)

Agency Contact:

Plant Epidemiology and Risk Analysis Laboratory
Center for Plant Health Science and Technology

Plant Protection and Quarantine
Animal and Plant Health Inspection Service
United States Department of Agriculture
1730 Varsity Drive, Suite 300
Raleigh, NC 27606

Introduction

Plant Protection and Quarantine (PPQ) regulates noxious weeds under the authority of the Plant Protection Act (7 U.S.C. § 7701-7786, 2000) and the Federal Seed Act (7 U.S.C. § 1581-1610, 1939). A noxious weed is defined as "any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment" (7 U.S.C. § 7701-7786, 2000). We use the PPQ weed risk assessment (WRA) process (PPQ, 2015) to evaluate the risk potential of plants, including those newly detected in the United States, those proposed for import, and those emerging as weeds elsewhere in the world.

The PPQ WRA process includes three analytical components that together describe the risk profile of a plant species (risk potential, uncertainty, and geographic potential; PPQ, 2015). At the core of the process is the predictive risk model that evaluates the baseline invasive/weed potential of a plant species using information related to its ability to establish, spread, and cause harm in natural, anthropogenic, and production systems (Koop et al., 2012). Because the predictive model is geographically and climatically neutral, it can be used to evaluate the risk of any plant species for the entire United States or for any area within it. We then use a stochastic simulation to evaluate how much the uncertainty associated with the risk analysis affects the outcomes from the predictive model. The simulation essentially evaluates what other risk scores might result if any answers in the predictive model might change. Finally, we use Geographic Information System (GIS) overlays to evaluate those areas of the United States that may be suitable for the establishment of the species. For a detailed description of the PPQ WRA process, please refer to the *PPQ Weed Risk Assessment Guidelines* (PPQ, 2015), which is available upon request.

We emphasize that our WRA process is designed to estimate the baseline—or unmitigated—risk associated with a plant species. We use evidence from anywhere in the world and in any type of system (production, anthropogenic, or natural) for the assessment, which makes our process a very broad evaluation. This is appropriate for the types of actions considered by our agency (e.g., Federal regulation). Furthermore, risk assessment and risk management are distinctly different phases of pest risk analysis (e.g., IPPC, 2015). Although we may use evidence about existing or proposed control programs in the assessment, the ease or difficulty of control has no bearing on the risk potential for a species. That information could be considered during the risk management (decision-making) process, which is not addressed in this document.

	***Coleostephus myconis* (L.) Cass. - Mediterranean marigold**
Species Information	Family: Asteraceae Synonyms: *Chrysanthemum myconis* L. (basionym) and *Pyrethrum myconis* (L.) Moench (NGRP, 2016). GBIF (2014) considers *C. myconis* (L.) Cass. as a heterotypic synonym of *C. myconis* (L.) Rchb.f., however, we followed the U.S. National Germplasm System's taxonomy. Common names: Mediterranean-marigold (NGRP, 2016), tongue-leaved chrysanthemum (WSSA, n.d.), corn marigold (Brusati et al., 2014). French common name: Chrysanthème de Myconos (INRA, 2000). Botanical description: *Coleostephus myconis* is an annual to perennial, herbaceous plant that reaches 80 cm in height (Edgecombe, 1970; Marzocca, 1976). It has alternate, serrate leaves up to 6 cm long (Cullen et al., 2011; WSSA, n.d.). Lower leaves have petioles, whereas upper leaves are half-clasping at the base (Post, 1883). The daisy-like flower heads are yellow, or occasionally white, and measure 2-4 cm in diameter (Huxley et al., 1999; Polunin, 1969). The seed is a 1.2-1.8 mm achene with a pappus about as long as the achene (Alavi, 1976). The pappus is membranous and tubular (Huxley et al., 1999). Initiation: PPQ received a market access request for wheat seed for planting from the government of Italy (MPAAF, 2010). A commodity import risk assessment determined that *C. myconis* may be associated with this commodity as a seed contaminant. The Canadian Food Inspection Agency was also concerned about the entry and spread of this weed into Canada. In this assessment, both agencies jointly evaluated the risk of this species. Foreign distribution and status: *Coleostephus myconis* is a Mediterranean species, native to northern Africa (Algeria, Morocco, and Tunisia), southern Europe (Albania, France, Greece, Italy, Portugal, and Spain) and western Asia (Israel, Lebanon, Syria, and Turkey) (NGRP, 2016). It has naturalized beyond its native range in Brazil, Argentina, Chile, Uruguay, Montenegro, Libya, the Canary Islands, Madeira Islands and the Azores (Guía Sata, 2014; Holm et al., 1991; Matthei, 1995; NGRP, 2016). Furthermore, it is considered adventive in the United Kingdom and parts of middle and eastern Europe, including Ukraine (NGRP, 2016). U.S./Canada distribution and status: We found no evidence that *C. myconis* is naturalized (e.g., EDDMapS, 2016; Kartesz, 2016; NGRP, 2016; NRCS, 2016) in the United States or Canada. It is cultivated by at least one nursery in the United States (Anonymous, 2016); however, a review of several major gardening websites and other sources suggests that it is not widely cultivated in the United States or Canada (e.g., Bailey and Bailey, 1976; Brenzel, 1995; Brouillet et al., 2016; Dave's Garden, 2016; McKenzie Seeds, 2016; Page and Olds, 2001; Thompson & Morgan, 2016; UBC Herbarium, 2016; Univ. of Minn., 2016). It is cultivated as an

ornamental plant in other countries (Cullen et al., 2011; GRIN, 2016). *Coleostephus myconis* was one of several hundred species identified by USDA botanists for listing as U.S. Federal Noxious Weeds (Gunn and Ritchie, 1988).

WRA area[1]: Entire United States, including territories.

1. *Coleostephus myconis* analysis

Establishment/Spread Potential *Coleostephus myconis* is a daisy-like herbaceous plant that has naturalized beyond its native range in Europe and has become invasive in southern South America (Mérola and Raimondo, 2007; Rios, 2006; Ugarte et al., 2011; Zenni and Ziller, 2011). It reproduces prolifically by seed, forming seed densities of about 40,000 seeds/m^2 in normal infestations in Uruguay (Rios, 2006). The seeds are dispersed naturally by wind (I3N Brazil, 2014; Instituto Hórus, 2014), water (Contarin, 2005; Rios, 2006), and animals, both externally and internally (Astor and Silveria, 2006; Walther, 2012). Seeds can also be unintentionally dispersed by people through contaminated seed (Contarin, 2005) or by machinery (INIA La Estanzuela, 2006). The seeds are reported to form a persistent seed bank (INIA La Estanzuela, 2006). Photographs show *Coleostephus myconis* growing in dense, nearly monotypic stands in meadows or pastures (Biorede, 2014; Flora-On, 2014). Herbicide-resistant biotypes have been detected in Spain (Fraga et al., 1999). We had average uncertainty for this risk element. Contributing to this was the lack of information on self-compatibility and tolerance to mutilation, cultivation, or fire.

Risk score = 21 Uncertainty index = 0.13

Impact Potential *Coleostephus myconis* is mainly a threat to production systems, as it can be aggressive in crops and pastures (Marzocca, 1976; Rios, 2006). In Uruguay, it is reported to cause significant losses to annual crops and is also problematic in dairy farms, where it interferes with pasture establishment (INIA La Estanzuela, 2006). Uruguay has declared *Coleostephus myconis* to be a national agricultural pest and is actively surveying and controlling this species to prevent further spread (Astor and Silveria, 2006; FAOLEX, 2014; Rios, 2006). In its native range, *Coleostephus myconis* is found in many crops, but usually not at high densities (INRA, 2000). However, in Portugal, it is one of the most significant weeds of carrots (Rocha, 2002) and is also reported as a weed of wheat (Calado et al., 2013). To a lesser extent, *Coleostephus myconis* is a weed of anthropogenic areas, as it colonizes roadsides, railway lines, and other disturbed areas (Parker et al., 2007). It is being controlled along roadsides in Uruguay (MGAP Servicios Agrícolas, 2015). *Coleostephus myconis* is not reported as an invader of natural areas

[1] "WRA area" is the area in relation to which the weed risk assessment is conducted (definition modified from that for "PRA area") (IPPC, 2012).

where it has been introduced. We had very low uncertainty for this risk element because impacts of this species in South America and in some parts of Europe (i.e., Portugal) have been fairly well documented. However, it is unclear if this species is likely to impact trade.
Risk score = 2.8 Uncertainty index = 0.05

Geographic Potential Based on three climatic variables, we estimate that about 23 percent of the United States and 0.1 percent of Canada are suitable for the establishment of *Coleostephus myconis* (Fig. 1). This predicted distribution is based on the species' known distribution elsewhere in the world and includes point-referenced localities and areas of occurrence. The map for *Coleostephus myconis* represents the joint distribution of Plant Hardiness Zones 8-11, areas with 10-80 inches of annual precipitation, and the following Köppen-Geiger climate classes: steppe, Mediterranean, humid subtropical, and marine west coast.

The area of the United States and Canada shown to be climatically suitable (Fig. 1) is likely overestimated since our analysis considered only three climatic variables. Other environmental variables, such as soil and habitat type, may further limit the areas in which this species is likely to establish. In its native range, *Coleostephus myconis* grows in cultivated fields, meadows, edges of meadows, and waste places (Alavi, 1976; Hanf, 1983; Post, 1883; Tutin et al., 1976). In cultivation, it is associated with olive groves, vineyards, pome and stone fruit trees, non-irrigated orchards, and to a lesser extent, irrigated orchards, citrus, cereals, grain legumes, maize, sugar beets, and other vegetable crops (INRA, 2000). In Syria and Palestine, *Coleostephus myconis* grows in interior plains and on coastal and lower mountains (Post, 1883). It is a prevalent weed in cereal-pasture rotations in Portugal (Calado et al., 2011). In Italy, it is known to grow on unproductive soils and has adapted to survive human disturbance (Bretzel et al., 2009). It usually prefers sandy, sandy-clay, or loam soils that are acidic to neutral. Where introduced, it is a weed of crops, pastures, and urban areas, including roadsides (Arévalo et al., 2005; Biondi and Pedrosa-Macedo, 2008; WSSA, n.d.).

Entry Potential Horticultural trade is the most likely pathway for the entry and dissemination of *Coleostephus myconis.* This species is cultivated as an ornamental plant in Europe (Cullen et al., 2011) and in other parts of the world (e.g., Brazil, southern Africa; Lorenzi, 1991; Sheat and Schofield, 1995). It is available online from various garden centers, nurseries, and seed suppliers, including one in the United States (Anonymous, 2016). However, its absence from major U.S. commercial growers, distributors, retailers, and horticultural references (Bailey and Bailey, 1976; Odenwald and Pope, 2014) suggests that in the United States it is of minor horticultural interest only. We found no evidence suggesting that it has been intentionally introduced into Canada as seed or live plants. *Coleostephus myconis* may also enter and spread as a seed contaminant (Contarin, 2005; Rios, 2006), and could potentially enter either country through seed or grain commodities, although no evidence was found to suggest that this has happened to date. In addition, there is a very low probability that *Coleostephus myconis* could enter either country in association with livestock, hay, straw, or motorized vehicles (Astor and Silveria, 2006). Natural dispersal vectors, including wind, water, birds, and wild animals, are not considered potential entry pathways as there are no known naturalized populations of *Coleostephus myconis* near the United States or Canada.

Risk score = 0.6 Uncertainty index = 0.09

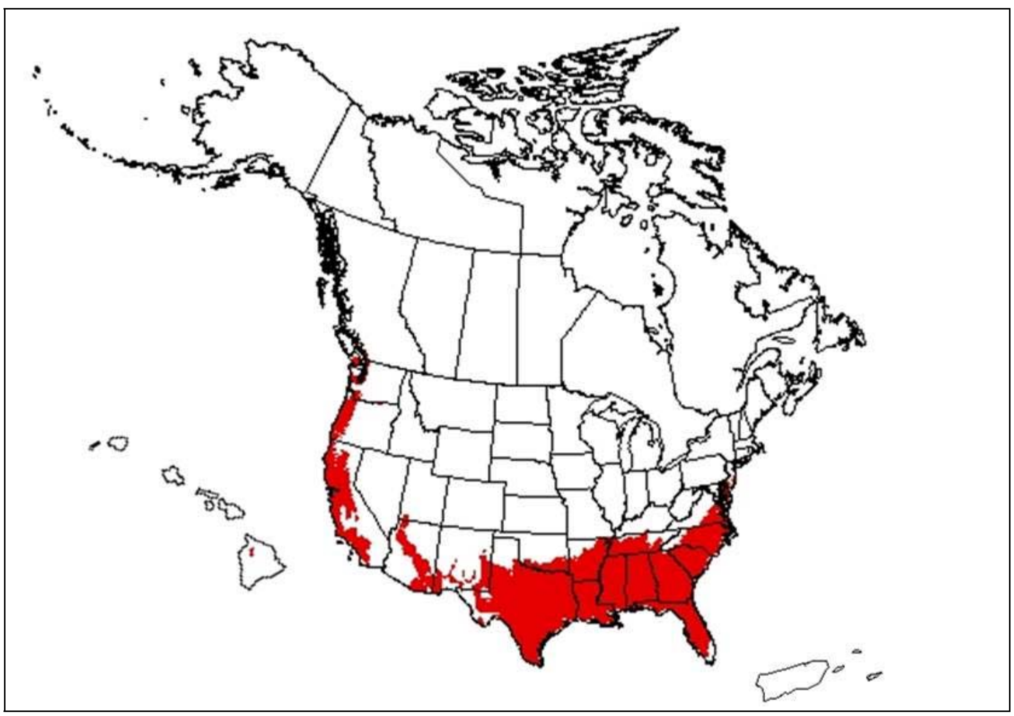

Figure 1. Potential geographic distribution of *Coleostephus myconis* in the United States and Canada. Map insets for Hawaii and Puerto Rico are not to scale.

2. Results

Model Probabilities: P(Major Invader) = 92.4%
P(Minor Invader) = 7.4%
P(Non-Invader) = 0.2%

Risk Result = High Risk

Secondary Screening = Not Applicable

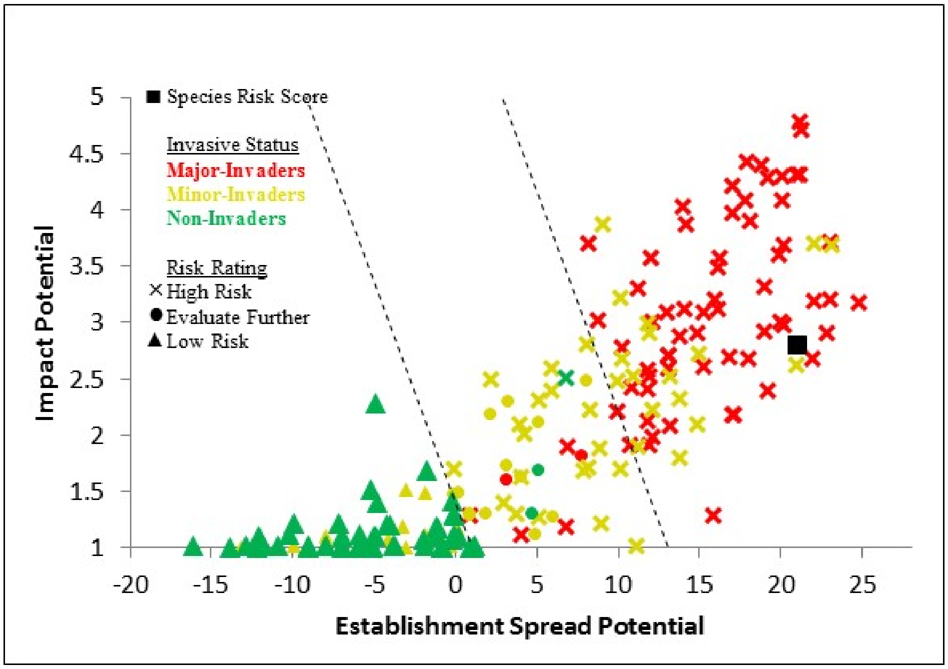

Figure 2. *Coleostephus myconis* score (black box) relative to the risk scores of species used to develop and validate the PPQ WRA model (other symbols). See Appendix A for the complete assessment.

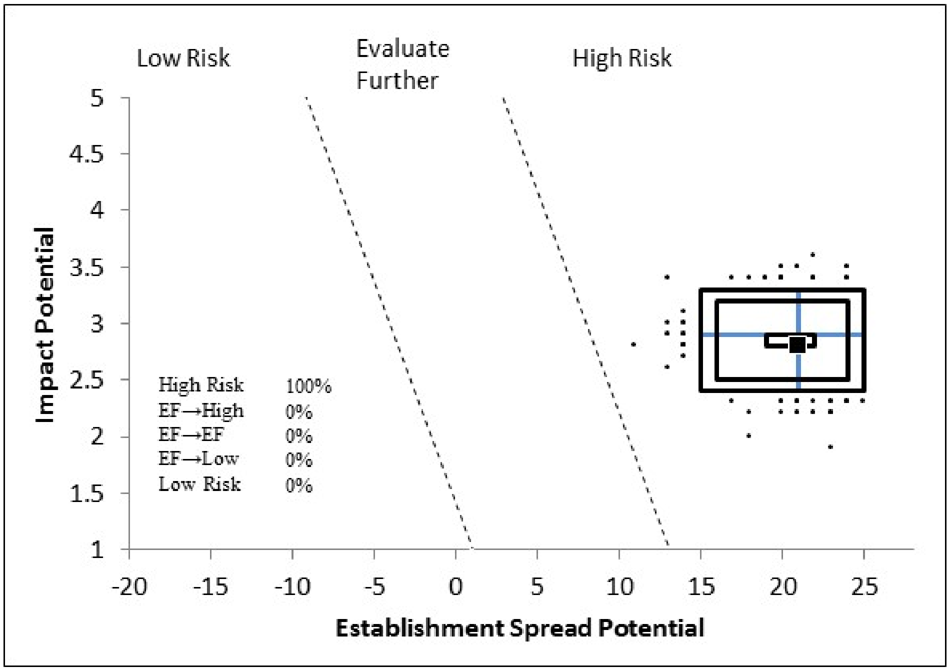

Figure 3. Model simulation results (N=5,000) for uncertainty around the risk score for *Coleostephus myconis.* The blue "+" symbol represents the medians of the simulated outcomes. The smallest box contains 50 percent of the outcomes, the second 95 percent, and the largest 99 percent.

3. Discussion

The result of the weed risk assessment for *Coleostephus myconis* is High Risk (Figure 2); however, this does not consider its potential geographic distribution. The amount of literature available on this species was adequate for answering most of the questions, leading to an average level of uncertainty for the establishment/spread risk element and a very low level of uncertainty for the impact risk element. All of the simulated risk scores resulted in a conclusion of High Risk, indicating that the conclusion from the risk assessment is robust (Figure 3). *Coleostephus myconis* is a prolific seed producer that spreads via several natural and human-mediated dispersal vectors, including contaminated seed. It is also cultivated as an ornamental and is available for purchase online. In South America, *Coleostephus myconis* infests crops, impedes pasture establishment, and is a nuisance along roadsides (Marzocca, 1976; MGAP Servicios Agrícolas, 2015). Control measures are in effect in Uruguay, where this species has been declared a national agricultural pest (FAOLEX, 2014). It is also known as a significant weed of agriculture in parts of its native range (Rocha, 2002). The result of High Risk does not consider the species' potential geographic distribution, which primarily includes the southeastern and western United States (Figure 1). Thus, this species poses a high risk potential for these areas.

4. Literature Cited

7 U.S.C. § 1581-1610. 1939. The Federal Seed Act, Title 7 United States Code § 1581-1610.

7 U.S.C. § 7701-7786. 2000. Plant Protection Act, Title 7 United States Code § 7701-7786.

Alavi, S. A. 1976. Genus *Coleostephus* Cassini in Europe (Asteraceae). Phyton 17(3-4):319-328.

Alberto, L. N. (Photographer). 2009. *Coleostephus myconis*. Retrieved from https://commons.wikimedia.org/wiki/File:Coleostephus_myconis_1.jpg.

Anonymous. 2016. Daisy yellow buttons heirloom seeds. Botanical Interests. Last accessed September 2, 2016, https://www.botanicalinterests.com/product/daisy-yellow-buttons-heirloom-seeds/srch:coleostephus.

Arévalo, J. R., J. D. Delgado, R. Otto, A. Naranjo, M. Salas, and J. M. Fernández-Palacios. 2005. Distribution of alien vs. native plant species in roadside communities along an altitudinal gradient in Tenerife and Gran Canaria (Canary Islands). Perspectives in Plant Ecology, Evolution and Systematics 7(3):185-202.

Astor, D., and C. Silveria. 2006. Diagnóstico preliminar de situación en la campaña de control de Margarita de Piria. Seminario-Taller de Actualización Técnica Manejo Integrado para el Control: Proyecto: Campaña de Control de Margarita de Piria Serie Actividades de Difusión, Montevideo, Uruguay.

B&T World Seeds. 2016. *Coleostephus myconis*. B&T World Seeds. Last accessed November 29, 2016, https://b-and-t-world-seeds.com/.

Bailey, L. H., and E. Z. Bailey. 1976. Hortus Third: A Concise Dictionary of Plants Cultivated in The United States and Canada (revised and expanded by The Staff of the Liberty Hyde Bailey Hortorium). Macmillan, New York, U.S.A. 1290 pp.

Biondi, D., and J. Pedrosa-Macedo. 2008. Invasive plants observed in the urban area of Curitiba-Brazil. Floresta 38(1):129-144.

Biorede. 2014. Vegetação ruderal dos campos agrícolas. [Ruderal vegetation of farmlands]. Last accessed October 20, 2016, http://www.biorede.pt/page.asp?id=1008

Brenzel, K. N. (ed.). 1995. Sunset Western Garden Book. Sunset Publishing Corporation, Menlo Park, California. 624 pp.

Bretzel, F., B. Pezzarossa, S. Benvenuti, A. Bravi, and F. Malorgio. 2009. Soil influence on the performance of 26 native herbaceous plants suitable for sustainable Mediterranean landscaping. Acta Oecologica 35(5):657-663.

Brouillet, L., F. Coursol, S. J. Meades, M. Favreau, M. Anions, P. Bélisle, and P. Desmet. 2016. VASCAN, the Database of Vascular Plants of Canada. http://data.canadensys.net/vascan/search. (Archived at PERAL).

Bruneton, J. 1999. Toxic Plants Dangerous to Humans and Animals. Lavoisier Publishing, Paris, France. 545 pp.

Brusati, E. D., D. W. Johnson, and J. DiTomaso. 2014. Predicting invasive plants in California. California Agriculture 68(3):89-95.

Burrows, G. E., and R. J. Tyrl. 2013. Toxic Plants of North America, 2nd ed. Wiley-Blackwell, Ames, IA. 1383 pp.

Calado, J., G. Basch, J. Barros, and M. Carvalho. 2013. Weed management in winter wheat (*Triticum aestivum* L.) influenced by different soil tillage systems. African Journal of Agricultural Research 8(21):2551-2558.

Calado, J., G. Basch, and M. Carvalho. 2011. Weed emergence in autumn under temperate conditions. Planta Daninha 29(2):343-349.

Carneiro, M., M. Ferreira, A. Fabiao, L. Hilário, M. Lousã, J. Tomé, and M. Madeira. 2013. Does slash management in a *Eucalyptus globulus* labill. plantation influence the potential seed germination and early growth of understory species? Forest Science 59(4):494-503.

Contarin, S. 2005. Margarita de Piria y Capin Annoni (*Coleostephus myconis* y *Eragrostis plana*, Nees). Pages 31-33 *in* Conservación y Uso Sostenible delLa Biodiversidad: Seminario Biodiversidad., Uruguay.

Cullen, J., S. G. Knees, and H. S. Cubey (eds.). 2011. The European Garden Flora, Flowering Plants: A Manual for the Identification of Plants Cultivated in Europe, Both Out-of-Doors and Under Glass, Volumes I-V, vI:665, vII:642, vIII:620, vIV:619, and vVI:639 edition. Cambridge University Press, Cambridge. 665+642+620+619+639 pp.

da Silva, F. 1962. Les graines de mauvaises berbes dans les lots certifies pour l'exportation [The occurrence of weed seeds in lots of certified seed for export] [French]. Proceedings of the International Seed Testing Association 27(2):489-497.

Dave's Garden. 2016. Plant files database. Dave's Garden. http://davesgarden.com/guides/pf/go/1764/. (Archived at PERAL).

EDDMapS. 2016. Early Detection & Distribution Mapping System (EDDMapS) [Online Database]. The University of Georgia - Center for Invasive Species and Ecosystem Health. http://www.eddmaps.org/. (Archived at PERAL).

Edgecombe, W. S. 1970. Weeds of Lebanon, Third edition. American University of Beirut, Beirut, Lebanon. 457 pp.

FAOLEX. 2014. Uruguay: Decreto que adecúa el marco reglamentario vigente para el control de la plaga *Coleostephus myconis* «Margarita de Piria». FAOLEX - legislative database of FAO Legal Office. http://faolex.fao.org/cgi-bin/faolex.exe?database=faolex&search_type=query&table=result&query=ID:LEX-FAOC046400&format_name=ERALL&lang=eng (Archived at PERAL).

Flora-On. 2014. Flora-On database. Sociedade Portuguesa de Botanica. http://www.flora-on.pt/index.php#. (Archived at PERAL).

Fraga, M., M. Areses, J. Baleato, M. Duran, M. González, A. Rey, M. Tasende, and E. Sahuquillo. 1999. The occurrence of Simazine resistant biotypes in weed species of Galician crops (NW [North West] Spain).7.

Congreso de la Sociedad Española de Malherbología, Logroño (España), 23-25 Nov 1999. SEM.
GBIF. 2014. GBIF, Online Database. http://www.gbif.org/species/7494535. (Archived at PERAL).
GRIN. 2016. Germplasm Resources Information Network - (GRIN). National Germplasm Resources Laboratory. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysimple.aspx. (Archived at PERAL).
Guía Sata. 2014. Guía Sata. Guía Uruguaya para la Protección y Nutrición Vegetal. 13a Edición. http://www.laguiasata.com/joomla/index.php. (Archived at PERAL).
Gunn, C. R., and C. A. Ritchie. 1988. Identification of Disseminules Listed in the Federal Noxious Weed Act (Technical Bulletin Number 1719.). United States Department of Agriculture, Agricultural Research Service, U.S.A. 316 pp.
Hanf, M. 1983. The Arable Weeds of Europe: With their Seedlings and Seeds. BASF, United Kingdom. 494 pp.
Heap, I. 2016. The international survey of herbicide resistant weeds. Weed Science Society of America. Weed Science Society of America. www.weedscience.com. (Archived at PERAL).
Hessayon, D. G. 1999. The New Flower Expert. Random House, New York. 256 pp.
Holm, L. G., J. V. Pancho, J. P. Herberger, and D. L. Plucknett. 1991. A Geographical Atlas of World Weeds. Kreiger Publishing Company, Malabar, Florida. 391 pp.
Huxley, A., M. Griffiths, and M. Levy (eds.). 1999. The New Royal Horticultural Society Dictionary of Gardening. The Royal Horticultural Society, London, U.K. 3000 (3004 vols.) pp.
I3N Brazil. 2014. Invasive alien species database. Horus Institute for Environmental Conservation and Development. http://i3n.institutohorus.org.br/www/?p=NTkwc3c%2FYjNibTBxJkFaEENRAFVSAhAfGU8Namhtezo%2BOA%3D%3D. (Archived at PERAL).
Inderjit, and K. I. Keating. 1999. Allelopathy: Principles, procedures, processes, and promises for biological control. Advances in Agronomy 67:142-231.
INIA La Estanzuela. 2006. Seminario-taller de actualización técnica manejo integrado para el control de Margarita de Piria (Serie Actividades de Difusión N°469). Institute Nacional de Investigacion Agropecuaria (INIA), Montevideo, Uruguay. 47 pp.
INRA. 2000. HYPPA Hypermedia for Plant Protection. Weed Science & Agronomy INRA-Dijon. Last accessed 10/20/2016, http://www2.dijon.inra.fr/hyppa/hyppa-a/hyppa_a.htm.
Instituto Hórus. 2014. Análise de risco para plantas invasoras. Instituto Hórus de Desenvolvimento e Conservação Ambiental. http://www.institutohorus.org.br/index.php?modulo=inf_analise_risco_plantas_horus. (Archived at PERAL).

IPPC. 2012. International Standards for Phytosanitary Measures No. 5: Glossary of Phytosanitary Terms. Food and Agriculture Organization of the United Nations, Secretariat of the International Plant Protection Convention (IPPC), Rome, Italy. 38 pp.

IPPC. 2015. International Standards for Phytosanitary Measures No. 2: Framework for Pest Risk Analysis. Food and Agriculture Organization of the United Nations, Secretariat of the International Plant Protection Convention (IPPC), Rome, Italy. 18 pp.

Kartesz, J. 2016. The Biota of North America Program (BONAP). North American Plant Atlas. http://bonap.net/tdc. (Archived at PERAL).

Koop, A., L. Fowler, L. Newton, and B. Caton. 2012. Development and validation of a weed screening tool for the United States. Biological Invasions 14(2):273-294.

Lorenzi, H. 1991. Plantas Daninhas do Brasil: Terrestres, Aquáticas, Parasitas, Tóxicas e Medicinais. Editora Plantarum, Nova Odessa, Sao Paulo. 440 pp.

Mabberley, D. J. 1997. The Plant-Book: A portable dictionary of the vascular plants (2nd edition). Cambridge University Press, Cambridge, UK.

Marzocca, A. 1976. Manual De Malezas: Plantas indeseables, perjudiciales o cuyos frutos o semillas son impurezas de los granos de cereales, oleaginosos y forrajeras, y que crecen principalmente en la region pampeana de Argentina y en el Uruguay. Pages 456, 462. Editonial Hemisferio Sur, S. R.L, Argentina.

Matthei, O. J. 1995. Manual de las Malezas que Crecen en Chile. Alfabeta Impresores, Santiago, Chile. 545 pp.

McKenzie Seeds. 2016. McKenzie Seeds. http://www.mckenzieseeds.com/default.aspx. (Archived at PERAL).

Mérola, S., and F. M. Raimondo. 2007. European and Mediterranean plants in the wild flora of Uruguay. Bocconea 21:391-404.

MGAP Servicios Agrícolas. 2015. Campañas: Division Operaciones - Departamento de Servicios Fitosanitarios - Margarita de Piria (*Coleostephus myconis*). Ministerio de Ganadería Agricultura y Pesca, Dirección General de Servicios Agrícolas, Montevideo, Uruguay. Last accessed October 20, 2016, http://www.mgap.gub.uy/dgssaa/divoperaciones/Doper_Serfitos_CAM_MPiria.htm.

MPAAF. 2010. § 319.5 Requirements for submitting requests to change the regulations in 7 CFR part 319. Ministero delle Politiche Agricole, Alimentari e Forestali (MPAAF), Rome. 29 pp.

NGRP. 2016. Germplasm Resources Information Network (GRIN). United States Department of Agriculture, Agricultural Research Service, National Genetic Resources Program (NGRP). https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch.aspx?language=en. (Archived at PERAL).

NRCS. 2016. The PLANTS Database. United States Department of Agriculture, Natural Resources Conservation Service (NRCS), The

National Plant Data Center. http://plants.usda.gov/cgi_bin/. (Archived at PERAL).

Oberprieler, C., S. Himmelreich, and R. Vogt. 2007. A new subtribal classification of the tribe Anthemideae (Compositae). Willdenowia:89-114.

Oberprieler, C., and R. Vogt. 2000. The position of *Castrilanthemum* Vogt & Oberprieler and the phylogeny of Mediterranean Anthemideae (Compositae) as inferred from nrDNA ITS and cpDNAtrnL/trnF IGS sequence variation. Plant Systematics and Evolution 225(1-4):145-170.

Odenwald, N., and T. Pope. 2014. Online Plant Guide. OnlinePlantGuide.com. Last accessed October 20, 2016, http://www.onlineplantguide.com/Index.aspx.

Ozelenenierterras. 2012. Koleostefus. Last accessed October 20, 2016, http://ozelenenieterras.ru/terrasa/english/katalog_odnoletnih_rastenii/koleostefus.html.

Page, S., and M. Olds (eds.). 2001. The Plant Book: The World of Plants in a Single Volume. Mynah, Hong Kong. 1020 pp.

Parker, C., B. P. Caton, and L. Fowler. 2007. Ranking nonindigenous weed species by their potential to invade the United States. Weed Science 55(4):386-397.

Polunin, O. 1969. Flowers of Europe: A Field Guide. Oxford University Press, London. 662 pp.

Post, G. E. 1883. Flora of Syria, Palestine, and Sinae, from the Taurus to Ras Muhammad, and from the Mediterranean Sea to the Syrian Desert. Syrian Protestant College, Beirut, Syria. 919 pp.

PPQ. 2015. Guidelines for the USDA-APHIS-PPQ Weed Risk Assessment Process. United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ). 125 pp.

Qasem, J., and C. Foy. 2001. Weed allelopathy, its ecological impacts and future prospects: A review. Journal of crop production 4(2):43-119.

Randall, R. P. 2012. A Global Compendium of Weeds, 2nd edition. Department of Agriculture and Food, Western Australia, Perth, Australia. 1107 pp.

Rios, A. 2006. Consideraciones para el control de Margarita de Piria. Pages 1-24 *in* Seminario-Taller de Actualización Técnica Manejo Integrado para el Control: Proyecto: Campaña de Control de Margarita de Piria Serie Actividades de Difusión. Institute Nacional de Investigacion Agropecuaria (INIA), Montevideo, Uruguay.

Rocha, F. 2002. Weeds and weed management in carrot: Details from single countries - Portugal. European Weed Research Society. http://www.agr.unipg.it/ewrsveg/carrotdetails.htm#portugal. (Archived at PERAL).

Santi, C., D. Bogusz, and C. Franche. 2013. Biological nitrogen fixation in non-legume plants. Annals of Botany 111(5):743-767.

Sheat, W. G., and G. Schofield. 1995. Complete Gardening in Southern Africa. Struik Publishers 488 pp.

Silva, F. 1962. Les graines de mauvaises herbes dans les lots certifies pour l'exportation. Proceedings of the International Seed Testing Association 27(2):489-497.

Thompson & Morgan. 2016. Thompson & Morgan. Online catalogue. Last accessed October 20, 2016, http://search.thompson-morgan.com/

TOXNET. 2016. TOXNET. U.S. National Library of Medicine. https://toxnet.nlm.nih.gov. (Archived at PERAL).

Tutin, T. G., V. H. Heywood, N. A. Burges, D. M. Moore, D. H. Valentine, S. M. Walters, and D. A. Webb (eds.). 1976. Flora Europaea. Vol. 4: Plantaginaceae to Compositae (and Rubiaceae). Cambridge University Press, Cambridge, U.K. 505 pp.

UBC Herbarium. 2016. UBC Herbarium. Beaty Biodiversity Museum. http://bridge.botany.ubc.ca/herbarium/details.php?db=vwsp.fmp12&layout=vwsp_web_details&recid=88143&ass_num=V81204. (Archived at PERAL).

Ugarte, E., F. Lira, N. Fuentes, and S. Klotz. 2011. Vascular alien flora, Chile. Check List 7(3):365-382.

Univ. of Minn. 2016. Plant Information Online Database. University of Minnesota. https://plantinfo.umn.edu/default.asp. (Archived at PERAL).

Walker, R. 2016. Parasitic Plants Database. Parasitic Plants Database. http://www.omnisterra.com/bot/pp_home.cgi (Archived at PERAL).

Walther, D. 2012. The effect of grazing and management measures on the vegetation of a dehesa–an agro-ecosystem formed during centuries by agro-sylvopastoral exploitation, Biology and Clinical Medicine University of Regensburg.

WSSA. n.d. Invasive plant fact sheets. Weed Science Society of America and United States Department of Agriculture Animal and Plant Health Inspection Service (USDA-APHIS). 4 pp.

Zenni, R. D., and S. R. Ziller. 2011. An overview of invasive plants in Brazil. Brazilian Journal of Botany 34(3):431-446.

Zomlefer, W. B. 1994. Guide to Flowering Plant Families. The University of North Carolina Press, Chapel Hill, NC. 430 pp.

Appendix A. Weed risk assessment for *Coleostephus myconis* (L.) Cass. The following information came from the original risk assessment, which is available upon request (full responses and all guidance). We modified the information to fit on the page.

Question ID	**Answer - Uncertainty**	**Score**	**Notes (and references)**
ESTABLISHMENT/SPREAD POTENTIAL			
ES-1 (Status/invasiveness outside its native range)	f - low	5	This species is native to the Mediterranean region, naturalized beyond its native range in Portugal (Azores and Madeira Islands), Spain (Canary Islands), Libya, Montenegro, Brazil, Argentina, Chile, and Uruguay (Holm et al., 1991). Marzocca (1976) describes it as an aggressive weed that can form very large colonies, spreading in all agricultural areas of Uruguay. It continues to spread in Uruguay (Contarin, 2005). It is also described as invasive in Brazil (Zenni and Ziller, 2011). Of 205 species not in U.S. cultivation, *Coleostephus myconis* ranked 33rd for its "potential to invade" (Parker et al., 2007). The alternate answers for the uncertainty simulation were both "e."
ES-2 (Is the species highly domesticated)	n - low	0	This species is cultivated, and it is apparent from gardening books and websites that there are a few cultivars of this species available [e.g., 'Moonlight', 'Gold Plate' (Hessayon, 1999)]. However, evidence of selection to reduce weediness potential was not found, and the species is fairly well known.
ES-3 (Weedy congeners)	n - mod	0	There are three species in the genus *Coleostephus* (Mabberley, 1997). *Coleostephus myconis* is the only one reported to be weedy (Holm et al., 1991; Randall, 2012). We considered expanding the scope of this question to include *Chrysanthemum*, as *C. myconis* was once placed in this genus; however, we decided against this as *Coleostephus* and *Chrysanthemum* have been placed in different subtribes (Oberprieler et al., 2007).
ES-4 (Shade tolerant at some stage of its life cycle)	n - low	0	A gardening website recommends full sun for *C. myconis* (Anonymous, 2016). Species in the genus *Coleostephus* require "an open, sunny position" (Cullen et al., 2011). This species occurs in meadows, fields, waste places, all of which are high light habitats. This evidence suggests that this species is not shade adapted.
ES-5 (Climbing or smothering growth form)	n - negl	0	*Coleostephus myconis* is an erect, often-branched, daisy-like plant, usually about 10-45 cm tall (INRA, 2000) but reaching 90-100 cm (Bretzel et al., 2009). It is not a vine. Although it produces rosettes, they are not tightly appressed.
ES-6 (Forms dense thickets)	y - low	2	In Chile, it forms dense populations across extensive areas in the provinces of Curicó and Talca (Matthei, 1995). There are photos showing dense, almost monotypic growth of *Coleostephus myconis* in meadows or pastures in Portugal (Flora-On, 2014). A weed risk assessment for Brazil answered “yes” to a question about forming dense clumps, but supporting evidence was not given (Instituto Hórus, 2014).

Question ID	Answer - Uncertainty	Score	Notes (and references)
ES-7 (Aquatic)	n - negl	0	*Coleostephus myconis* is a terrestrial species, growing in cultivated ground, meadows, edges of meadows, and waste places (Hanf, 1983; WSSA, n.d.). It is not an aquatic.
ES-8 (Grass)	n - negl	0	*Coleostephus myconis* is not a grass. It is in the Asteraceae family (Alavi, 1976).
ES-9 (Nitrogen-fixing woody plant)	n - negl	0	*Coleostephus myconis* is in the Asteraceae family (Alavi, 1976), which is not one of the families known to contain nitrogen-fixing species (Santi et al., 2013).
ES-10 (Does it produce viable seeds or spores)	y - negl	1	Reproduction is by seed (Cullen et al., 2011). Seeds of this species germinated from soil samples taken from a *Eucalyptus globulus* plantation (Carneiro et al., 2013). It is sown from seeds (Cullen et al., 2011; Hessayon, 1999). Seeds for sowing are available for purchase on the internet (e.g., B&T World Seeds, 2016).
ES-11 (Self-compatible or apomictic)	? - max	0	Perennials of the tribe Anthemideae are mostly self-incompatible, whereas annuals are nearly all self-compatible (Oberprieler et al., 2007). *Coleostephus myconis*, a member of this tribe (Oberprieler and Vogt, 2000), is described as annual (Cullen et al., 2011) and a perennial (Marzocca, 1976). It is not clear if *Coleostephus myconis* is self-compatible or not.
ES-12 (Requires special pollinators)	n - low	0	Pollinators of the Asteraceae include Lepidoptera, flies and beetles (Zomlefer, 1994). Within the tribe Anthemideae, which includes *C. myconis*, genera are insect- or wind-pollinated (Oberprieler et al., 2007). This question was answered “no” in a weed risk assessment for Brazil, although no supporting references were given (Instituto Hórus, 2014). Based on the available evidence, *C. myconis* seems unlikely to require specialist pollinators.
ES-13 (Minimum generation time)	B - low	1	*Coleostephus myconis* is an annual plant (Alavi, 1976), but it is also described as behaving as a perennial in South America (Marzocca, 1976). It produces seeds in one year or less (I3N Brazil, 2014). It is described in an online seed catalogue as an annual that blooms spring through to frost (Anonymous, 2016). The alternate answers for the uncertainty simulation were both "c."
ES-14 (Prolific reproduction)	y - negl	1	In Uruguay, 20-25 plants/m^2 constitutes a normal infestation, and each plant can produce more than 2,000 seeds, for a total of 40,000-50,000 seeds/m^2 (Rios, 2006). In Portugal, 11.8 plants/m^2 have been observed in wheat (Calado et al., 2011). In a study by Bretzel et al. (2009), the number of inflorescences per plant ranged from 25.8-49.5. Each capitulum can produce 70 viable seeds (Rios, 2006). This latter set of figures gives a similar seed density to the first set (i.e., 11.8 plants/m^2 x 49.5 capitula/plant x 70 seeds/capitulum = 40,887 seeds/m^2). Thus, we answered yes with negligible uncertainty.
ES-15 (Propagules likely to be dispersed unintentionally by people)	y - mod	1	*Coleostephus myconis* is frequently found in roadside and railway flora, and in disturbed habitats in general (Arévalo et al., 2005; Hanf, 1983; Rios, 2006). It is

Question ID	Answer - Uncertainty	Score	Notes (and references)
			spreading along roads and highways (Rios, 2006). Machinery, including road machinery, is considered a potential vector (Astor and Silveria, 2006; I3N Brazil, 2014). This question was answered “no” in a weed risk assessment for Brazil, although no supporting information was provided (Instituto Hórus, 2014). The weight of evidence suggests that the seeds are moved unintentionally by humans; however, we used moderate uncertainty due to conflicting information.
ES-16 (Propagules likely to disperse in trade as contaminants or hitchhikers)	y - negl	2	This species spreads through contaminated forage seed (Contarin, 2005). It (as *Chrysanthemum myconis*) was one of the main contaminating weeds of a 1-kg sample of serradella (*Ornithopus sativus*) in an investigation of the occurrence of weed seeds in certified seed lots for export from Portugal (Silva, 1962). It is dispersed in hay bales (Astor and Silveria, 2006).
ES-17 (Number of natural dispersal vectors)	4	4	Propagule traits for questions ES-17a through ES-17e: The seed is a 1.2-1.8 mm cypsela (achene) with a pappus about as long as the cypsela (Alavi, 1976). The pappus is a membranous, tubular appendage on the seed rather than a tuft of bristles (Tutin et al., 1976). Another author describes the pappus as a "whitish, translucent, oblique corona or auricle" (Cullen et al., 2011). Seeds also contain resiniferous canals (Alavi, 1976).
ES-17a (Wind dispersal)	y - low		This species is wind-dispersed (I3N Brazil, 2014). The tubular pappus likely functions to a limited extent similar to a wing, to assist in wind dispersal.
ES-17b (Water dispersal)	y - mod		This species is advancing along waterways in Uruguay (Rios, 2006). Movement of seeds by watercourses or in runoff are an important means of spread in Uruguay (Rios, 2006). This question was answered “no” in a weed risk assessment for Brazil (Instituto Hórus, 2014), although a similar source from Brazil lists water as a potential vector (I3N Brazil, 2014). No mention of a special adaptation for water dispersal was found in the literature, though it is possible that the tubular pappus may aid in flotation.
ES-17c (Bird dispersal)	n - mod		Fruits are not fleshy, and seem unlikely to be attractive to birds. This question was answered “no” in a weed risk assessment for Brazil (I3N Brazil, 2014). No additional information found.
ES-17d (Animal external dispersal)	y - mod		The species grow in pastures (Astor and Silveria, 2006; Rios, 2006), and in Uruguay, it is becoming prevalent in dairy farms (Rios, 2006). Movement of animals is a minor means of spread (Astor and Silveria, 2006). Preventing entrance of animals into areas where *C. myconis* is flowering is considered a measure for preventing its spread (Rios, 2006). The seeds do not have a special adaptation for attachment to animals, but are apparently dispersed by them, possibly in mud on their feet or hooves.
ES-17e (Animal internal dispersal)	y - low		Seeds have germinated from pig dung (Walther, 2012).

Question ID	Answer - Uncertainty	Score	Notes (and references)
ES-18 (Evidence that a persistent (>1yr) propagule bank (seed bank) is formed)	y - low	1	*Coleostephus myconis* can survive in the soil for several years (Rios, 2006). A Russian landscaping website also states that seeds can remain viable for two to three years (Ozelenenierterras, 2012). *Coleostephus myconis* seeds germinated from the soil seed bank in a study of *Eucalyptus globulus* plantations, but it is unknown how old the seeds were (Carneiro et al., 2013).
ES-19 (Tolerates/benefits from mutilation, cultivation or fire)	? - max	0	One source states that *C. myconis* has a moderate sprouting capacity (I3N Brazil, 2014), but it is not clear what this means and under what conditions it is expressed (e.g., total removal of above ground portions). Because we did not find any other evidence to answer this question, we answered unknown.
ES-20 (Is resistant to some herbicides or has the potential to become resistant)	y - mod	1	Biotypes of *C. myconis* that are resistant to the herbicide simazine have been identified in Spain (Fraga et al., 1999). *Coleostephus myconis* is not listed in Heap (2016).
ES-21 (Number of cold hardiness zones suitable for its survival)	4	0	
ES-22 (Number of climate types suitable for its survival)	4	2	
ES-23 (Number of precipitation bands suitable for its survival)	7	0	
IMPACT POTENTIAL			
General Impacts			
Imp-G1 (Allelopathic)	n - low	0	We found no evidence of allelopathy (e.g., Inderjit and Keating, 1999; Qasem and Foy, 2001). Because this species is fairly well known, we used low uncertainty.
Imp-G2 (Parasitic)	n - negl	0	No evidence was found to suggest that *Coleostephus myconis* is parasitic. It does not belong to a family known to contain parasitic plants (e.g., Walker, 2016).
Impacts to Natural Systems			
Imp-N1 (Change ecosystem processes and parameters that affect other species)	n - low	0	We found no direct evidence that this species has this kind of impact. Furthermore, it does not have traits that tend to modify ecosystem processes or increase frequency or intensity of fires (I3N Brazil, 2014). A weed risk assessment from Brazil also indicated that the species did not change ecosystem processes (Instituto Hórus, 2014).
Imp-N2 (Change community structure)	n - mod	0	Although *Coleostephus myconis* can form large, dense colonies (Marzocca, 1976) that might alter structural diversity in disturbed areas, this species is not typically invasive in natural areas (Tutin et al., 1976) and is therefore unlikely to change habitat structure.
Imp-N3 (Change community composition)	n - low	0	We found no evidence and this species is fairly well known. Because we found no evidence that it invades natural areas, we used low uncertainty for this question and the others that follow.
Imp-N4 (Is it likely to affect federal Threatened and Endangered species)	n - low	0	We found no evidence that it invades natural areas and therefore believe it is unlikely to directly affect threatened and endangered species.
Imp-N5 (Is it likely to affect any globally outstanding ecoregions)	n - low	0	We found no evidence to support this impact.

Question ID	Answer - Uncertainty	Score	Notes (and references)
Imp-N6 (Weed status in natural systems)	a - low	0	*Coleostephus myconis* is not a weed of conservation/natural areas and no evidence of control in these areas was found. Alternate answers for the uncertainty simulation were both "b."
Impact to Anthropogenic Systems (cities, suburbs, roadways)			
Imp-A1 (Impacts human property, processes, civilization, or safety)	n - mod	0	*Coleostephus myconis* is intentionally cultivated in gardens for its ornamental value (Cullen et al., 2011) and is also frequently found along roadsides, railways, and in disturbed habitats (Arévalo et al., 2005; Biondi and Pedrosa-Macedo, 2008; Hanf, 1983; Rios, 2006). However, we found no evidence of these types of impacts and there answered no with moderate uncertainty.
Imp-A2 (Changes or limits recreational use of an area)	n - low	0	We found no evidence. Because it seems unlikely that a terrestrial herbaceous annual would limit access we answered no.
Imp-A3 (Outcompetes, replaces, or otherwise affects desirable plants and vegetation)	n - high	0	In a study of the potential usefulness of 26 herbaceous species in low-maintenance landscapes, *C. myconis* developed rapidly, produced high biomass, and competed with other, slower-growing native species (Bretzel et al., 2009). However, this study took place in its native range and these results were not perceived as negative impacts. Because it may behave similarly elsewhere, we used high uncertainty.
Imp-A4 (Weed status in anthropogenic systems)	c - low	0.4	*Coleostephus myconis* is considered a weed of disturbed areas and is being controlled along roadsides in Uruguay as part of efforts to prevent further spread (MGAP Servicios Agrícolas, 2015). A weed of urban areas in Curitiba, Brazil (Biondi and Pedrosa-Macedo, 2008). Alternate answers for the uncertainty simulation were both "b."
Impact to Production Systems (agriculture, nurseries, forest plantations, orchards, etc.)			
Imp-P1 (Reduces crop/product yield)	y - low	0.4	*Coleostephus myconis* is one of the most important weeds of carrots in Portugal (Rocha, 2002). In Uruguay, it grows mainly in dairy farms where it can cause problems in establishing pastures; it also causes significant losses to annual crops (Astor and Silveria, 2006; Rios, 2006). It is a common weed of wheat in Portugal (Calado et al., 2013; Calado et al., 2011; Rios, 2006). A study of wheat yield reductions in Portugal found that weed infestations, which included *C. myconis*, reduced wheat yield (Calado et al. 2013).
Imp-P2 (Lowers commodity value)	y - low	0.2	This species is specifically targeted for control using herbicides in Uruguay (Rios, 2006), and can therefore increase costs of production. Because this species is a national agricultural pest in Chile, and farmers are urged to look for and purchase clean seed (Rios, 2006), agricultural and vegetable seed lots that are contaminated by *C. myconis* may not sell as much as clean seed.

Question ID	Answer - Uncertainty	Score	Notes (and references)
Imp-P3 (Is it likely to impact trade)	y - mod	0.2	*Coleostephus myconis* has been found as a contaminant of seed (Rios, 2006), and is therefore a potential quality pest. Seed and grain are potential pathways of this species to other parts of the world. This species has been declared a national agricultural pest in Uruguay (FAOLEX, 2014). The declaration specifies obligations for domestic control. We answered yes but with moderate uncertainty because the regulation in Uruguay may not directly lead to phytosanitary restrictions, unless the contamination rate is high.
Imp-P4 (Reduces the quality or availability of irrigation, or strongly competes with plants for water)	n - mod	0	We found no direct evidence of this impact in production systems.
Imp-P5 (Toxic to animals, including livestock/range animals and poultry)	n - low	0	We found no evidence that this species is toxic to livestock (e.g., Bruneton, 1999; Burrows and Tyrl, 2013; TOXNET, 2016). *Coleostephus myconis* was consumed by pigs in a study by Walther (2012), and there was no mention of toxicity.
Imp-P6 (Weed status in production systems)	c - negl	0.6	*Coleostephus myconis* is described as an aggressive weed of crops and pastures (Astor and Silveria, 2006; Rios, 2006; WSSA, n.d.), including rice in Chile (Matthei, 1995). Significant efforts have been made to survey and control this species in Uruguay (Rios, 2006), where it has been declared a national agricultural pest. It is a prevalent weed in cereal crop-natural pasture rotations in Portugal (Calado et al., 2011). This author studied the effect of soil tillage systems and herbicide treatment on weed plant density. The study focused on multiple species, including *Coleostephus myconis* (Calado et al., 2013). Alternate answers for the uncertainty simulation were both "b."
GEOGRAPHIC POTENTIAL			Unless otherwise indicated, the following evidence represents geographically referenced points obtained from the Global Biodiversity Information Facility (GBIF, 2014).
Plant cold hardiness zones			
Geo-Z1 (Zone 1)	n - negl	N/A	We found no evidence that it occurs in this hardiness zone.
Geo-Z2 (Zone 2)	n - negl	N/A	We found no evidence that it occurs in this hardiness zone.
Geo-Z3 (Zone 3)	n - negl	N/A	We found no evidence that it occurs in this hardiness zone.
Geo-Z4 (Zone 4)	n - negl	N/A	We found no evidence that it occurs in this hardiness zone.
Geo-Z5 (Zone 5)	n - negl	N/A	We found no evidence that it occurs in this hardiness zone.
Geo-Z6 (Zone 6)	n - high	N/A	One point in Norway, but this is likely erroneous as there are no other points for this zone (GBIF, 2014). It is also reported as adventive (but not established) in Czech Republic (NGRP, 2016), which is predominantly Zone 6.

Question ID	Answer - Uncertainty	Score	Notes (and references)
Geo-Z7 (Zone 7)	n - high	N/A	We found no evidence that it has established in this zone. It is reported as adventive in Poland (NGRP, 2016), which is predominantly Zone 7. However, we answered no with high uncertainty because this species may be escaping continuously from repeated introductions.
Geo-Z8 (Zone 8)	y - negl	N/A	France and Spain; one point in the Netherlands.
Geo-Z9 (Zone 9)	y - negl	N/A	Morocco, Portugal, and Spain.
Geo-Z10 (Zone 10)	y - negl	N/A	Chile, Greece, Israel, and Portugal.
Geo-Z11 (Zone 11)	y - low	N/A	Israel and Portugal.
Geo-Z12 (Zone 12)	n - mod	N/A	We found no evidence that it occurs in this hardiness zone.
Geo-Z13 (Zone 13)	n - mod	N/A	We found no evidence that it occurs in this hardiness zone.
Köppen -Geiger climate classes			
Geo-C1 (Tropical rainforest)	n - low	N/A	We found no evidence that it occurs in this climate class.
Geo-C2 (Tropical savanna)	n - mod	N/A	We found no evidence that it occurs in this climate class.
Geo-C3 (Steppe)	y - negl	N/A	Lots of points in Spain.
Geo-C4 (Desert)	n - high	N/A	Two points in the Canary Islands, but our spatial data may not be very accurate for small islands. We answered no because there is no evidence this species occurs in desert regions in northern Africa.
Geo-C5 (Mediterranean)	y - negl	N/A	Chile, Israel, Italy, Portugal, and Spain.
Geo-C6 (Humid subtropical)	y - low	N/A	Occurrence data: Caxias do Sol, Brazil (GBIF, 2014) and southern Uruguay (MGAP Servicios Agrícolas, 2015).
Geo-C7 (Marine west coast)	y - negl	N/A	France, Portugal, and Spain.
Geo-C8 (Humid cont. warm sum.)	n - mod	N/A	We found no evidence that it occurs in this climate class.
Geo-C9 (Humid cont. cool sum.)	n - high	N/A	Reported as adventive in Poland and Czech Republic (NGRP, 2016), both of which consist mostly of this climate class. However, we answered no for the same reasons as in Geo-Z7. A few points in Sweden, and one in Norway, but these also seem doubtful as there is no other evidence of establishment in this climate type.
Geo-C10 (Subarctic)	n - negl	N/A	We found no evidence that it occurs in this climate class.
Geo-C11 (Tundra)	n - low	N/A	One point in Austria, but this seems very doubtful given the species' global distribution.
Geo-C12 (Icecap)	n - negl	N/A	We found no evidence that it occurs in this climate class.
10-inch precipitation bands			
Geo-R1 (0-10 inches; 0-25 cm)	n - high	N/A	A few points in Spain, but these may be in protected or modified habitats. Based on the species’ overall distribution, we do not think it is well adapted for this amount of precipitation.
Geo-R2 (10-20 inches; 25-51 cm)	y - negl	N/A	Israel and Spain.
Geo-R3 (20-30 inches; 51-76 cm)	y - negl	N/A	Israel, Portugal, and Spain.
Geo-R4 (30-40 inches; 76-102 cm)	y - negl	N/A	Lots of points in Spain.

Question ID	Answer - Uncertainty	Score	Notes (and references)
Geo-R5 (40-50 inches; 102-127 cm)	y - negl	N/A	Chile, Portugal, and Spain. Occurrence in southern Uruguay (MGAP Servicios Agrícolas, 2015).
Geo-R6 (50-60 inches; 127-152 cm)	y - negl	N/A	Portugal.
Geo-R7 (60-70 inches; 152-178 cm)	y - negl	N/A	Portugal.
Geo-R8 (70-80 inches; 178-203 cm)	y - high	N/A	Reported to occur in Caxias do Sol, Brazil (GBIF, 2014), which receives this amount of precipitation.
Geo-R9 (80-90 inches; 203-229 cm)	n - high	N/A	We found no evidence that it occurs in this precipitation band, but we used high uncertainty because this precipitation band occurs near Caxias do Sol, Brazil (See Geo-R8).
Geo-R10 (90-100 inches; 229-254 cm)	n - high	N/A	We found no evidence that it occurs in this precipitation band, but we used high uncertainty because this precipitation band occurs near Caxias do Sol, Brazil (See Geo-R8).
Geo-R11 (100+ inches; 254+ cm))	n - high	N/A	We found no evidence that it occurs in this precipitation band, but we used high uncertainty because this precipitation band occurs near Caxias do Sol, Brazil (See Geo-R8).
ENTRY POTENTIAL			
Ent-1 (Plant already here)	n - low	0	*Coleostephus myconis* is not native or known to be naturalized in Canada or the United States (EDDMapS, 2016; Kartesz, 2016; NGRP, 2016; NRCS, 2016). Although we found evidence it is sold by one seed company in the United States (Anonymous, 2016), we set this answer to no and evaluated this risk element to evaluate its entry potential.
Ent-2 (Plant proposed for entry, or entry is imminent)	n - low	0	We found no evidence.
Ent-3 (Human value & cultivation/trade status)	d - negl	0.5	*Coleostephus myconis* is cultivated as an ornamental plant (Cullen et al., 2011; Zomlefer, 1994). Seeds are available for sale online (e.g., B&T World Seeds, 2016).
Ent-4 (Entry as a contaminant)			
Ent-4a (Plant present in Canada, Mexico, Central America, the Caribbean or China)	n - mod		*Coleostephus myconis* is not native or known to be naturalized in any of these countries/regions (Cullen et al., 2011; Holm et al., 1991; NGRP, 2016; WSSA, n.d.). Although it is sold by one seed company in the United States (Anonymous, 2016), we answered no because we found no evidence it is reasonably abundant in the region.
Ent-4b (Contaminant of plant propagative material (except seeds))	n - mod	0	We found no evidence.
Ent-4c (Contaminant of seeds for planting)	y - negl	0.04	It was found to be a contaminant of serradella (*Ornithopus sativus*) in a study by Silva (1962), who was investigating the occurrence of weed seeds in certified seed lots for export from Portugal. It spreads through contaminated forage seed in South America (Contarin, 2005; Rios, 2006).
Ent-4d (Contaminant of ballast water)	n - low	0	We found no evidence. Because this is not an aquatic plant, we used low uncertainty.

Question ID	Answer - Uncertainty	Score	Notes (and references)
Ent-4e (Contaminant of aquarium plants or other aquarium products)	n - low	0	We found no evidence. Because this seems unlikely, we used low uncertainty.
Ent-4f (Contaminant of landscape products)	? - max		*Coleostephus myconis* is a contaminant of hay and straw (Rios, 2006), which may be used for covering bare soil. However, without specific or more direct evidence that spread has occurred via this pathway, we answered unknown.
Ent-4g (Contaminant of containers, packing materials, trade goods, equipment or conveyances)	y - low	0.02	Machinery is considered a potential vector (Astor and Silveria, 2006; I3N Brazil, 2014).
Ent-4h (Contaminants of fruit, vegetables, or other products for consumption or processing)	? - max		Because it is a contaminant of oat seed for planting (Rios, 2006), it may also be a contaminant of oat grain for consumption. However, without more specific evidence, we answered unknown.
Ent-4i (Contaminant of some other pathway)	e - low	0.04	Hay or straw for animal consumption may be a pathway as baled plants may contain attached seeds (Rios, 2006).
Ent-5 (Likely to enter through natural dispersal)	n - negl	0	*Coleostephus myconis* is not known to be established in any countries or areas immediately outside of Canada or the United States; consequently, this pathway is unlikely.