California Pest Rating Proposal for

Thlaspi arvense L., field pennycress, fanweed, stinkweed, Frenchweed

Family: Brassicaceae

Current Pest Rating: Q, Z

Proposed Pest Rating: C

Comment Period: 04/26/2022 through 06/10/2022

Initiating Event:

Thlaspi arvense has been assigned a rating of Q by the CDFA Botany Laboratory and requires a pest rating analysis to evaluate its risk to the state.

History & Status:

Background: *Thlapsi arvense* is an erect, glabrous, strongly scented, annual or winter annual herb, up to 80 cm in height, with stems simple or branched above the base. The basal leaves are petiolate, with the blade oblanceolate to spoon-shaped, 1-5 cm long, and the margin entire to coarsely dentate. The cauline leaves are sessile and oblong, with an arrowhead-like (sagittate) base. The four-parted flowers are arranged in unbracted racemes, with the petals white and 2-5 mm long. The two-chambered silicle fruits are strongly flattened perpendicular to the narrow partition, obovate to almost orbicular, approximately 1-2 cm long, and broadly winged, with the short (0.1-0.3 mm) style included in a narrow apical notch. The seeds are approximately six to 16 per fruit, purplish- to blackish-brown, approximately 1-2 mm long, with concentric ridges forming a fingerprint-like pattern (Al-Shehbaz, 2010; Clapham, 1964; Best and McIntyre, 1975).

Worldwide Distribution: *Thlaspi arvense* is native to Europe and temperate areas of Asia and portions of the Indian subcontinent (USDA GRIN, 2022). It is a cosmopolitan weedy species, naturalized in Macaronesia (Cape Verde, Canary Islands, and Madeira), temperate areas of Africa (Algeria, Morocco, South Africa), Australia, New Zealand, South America (Brazil, Colombia, Argentina, Chile), and many areas of the United States and Canada. In the U. S., it has been reported from all states except for Hawaii, and it has been found in all provinces of Canada (Al-Shehbaz, 2010; USDA PLANTS database, 2022; Warwick et al., 2002), and has also been reported from Greenland (CABI, 2020). The species is primarily a weed of temperate regions and can reach elevations of 2740 meters in the Rocky Mountains of the United States, and as high as 4200 meters in the Himalayas (CABI, 2020). It is considered a serious weed pest of wheat, barley, and oat grain fields in the northern United States and Canada (DiTomaso and Healy, 2007; CABI, 2020).

Official Control: *Thlaspi arvense* is listed as an invasive plant under Michigan law (Center for Invasive Species and Ecosystem Health, 2022). It is listed as a restricted noxious weed seed in the states of Indiana, Kansas, Michigan, Minnesota, Nebraska, Nevada, Ohio, South Dakota, and Washington (USDA/AMS, 2022), and is a secondary noxious

weed seed in Canada (Weed Seeds Order, 2016). It is listed as a harmful organism in phytosanitary requirements by the countries of India, Indonesia, Thailand, Egypt, Mexico, Ecuador, Panama, Paraguay, and Uruguay (USDA/PCIT database, 2022).

California Distribution: *Thlaspi arvense* has been reported from at least 32 counties along the entire length of California, with the greatest number of known localities found in northern and eastern California in the Modoc Plateau and Cascade and Sierra Nevada mountain regions. In vouchered records from the Consortium of California Herbaria (CCH, 2022) *Thlaspi arvense* has been collected from 25 counties: Humboldt, Modoc, Siskiyou, Lassen, and Shasta counties in far northern California; Plumas, Sierra, Nevada, Placer, Alpine, Mono, Fresno, and Inyo counties in the Sierra Nevada mountain region, Butte, Sonoma, Napa, Marin, Yolo, Sacramento, San Mateo, Monterey, and Stanislaus counties in the coast ranges and Central Valley, and Los Angeles, San Bernardino, and San Diego counties in southern California. Scattered localities from an additional seven counties (El Dorado, Mariposa, Madera, Tuolumne and Tulare counties in the Sierra Nevada region and Lake and Tehama counties in northern California) are shown in the Calflora database (CalFlora, 2022). The earliest collections documented in the Consortium database were made in 1909 in Siskiyou County, in the 1910's in Modoc and Los Angeles counties, and in the 1920's in the Yosemite area.

California Interceptions: Over 100 interceptions of plants or seeds of *Thlaspi arvense* have been submitted for identification to the CDFA Plant Pest Diagnostics Branch from 2003 to 2022, most commonly as a contaminant in truckloads of hay or in oats, wheat, or barley grain shipped into the state and sampled for feed mill certification (CDFA PDR database, 2022).

Consequences of Introduction

1) **Climate/Host Interaction:** Score is **Medium (2)**
Thlaspi arvense is a Eurasian species that is widely naturalized in temperate areas of the world. It is an early successional species of open habitats (Best and McIntyre, 1975). The species can tolerate moist and dry soils, but grows preferentially on fertile sites (CABI, 2020). It is found at elevations below 2000 meters (6562 feet) in California, where it has been collected in open habitats including fields, meadows, gardens, orchards, roadsides, riversides, and floodplains, and in open areas of hillsides and woodlands (CCH, 2022; DiTomaso and Healy, 2007).

Evaluate if the pest would have suitable hosts and climate to establish in California.
- Low (1) Not likely to establish in California; or likely to establish in very limited areas.
- **Medium (2) may be able to establish in a larger but limited part of California.**
- High (3) likely to establish a widespread distribution in California

2) **Known Pest Host Range:** Score is **High (3)**
Thlaspi arvense can occur wherever conditions exist that are conducive to its survival.
- Low (1) has a very limited host range.
- Medium (2) has a moderate host range.
- **High (3) has a wide host range.**

3) **Pest Dispersal Potential:** Score is **Medium (2)**

Thlaspi arvense reproduces only by seed. Seeds are small (approximately 1-2 mm long) and typically ten to sixteen per fruit, but dozens of fruits are produced in each inflorescence, and individual plants have been reported to produce

several thousand seeds under extremely favorable conditions (Best and McIntyre, 1975; Holm et al., 1997). The seeds can be dispersed locally by wind or water or by farm equipment or the feet or fur of animals, and over longer distances as a plant contaminant in shipments of hay and as a seed contaminant in shipments of grain or other crop seeds, as well as on farm equipment and other vehicles (CABI, 2020). The seeds can remain viable in the soil seed bank for up to 20 years when buried below the reach of light, but typically germinate relatively rapidly in the presence of light (Best and McIntyre, 1975).

Evaluate the natural and artificial dispersal potential of the pest.

- Low (1) does not have high reproductive or dispersal potential.
- **Medium (2) has either high reproductive or dispersal potential.**
- High (3) has both high reproduction and dispersal potential.

4) Economic Impact: Score is **High (3)**.

Plants of *Thlaspi arvense* are strongly scented, and give a bad flavor to milk when eaten by cattle. The mustard oils in the plant are gastric irritants, and the allylthiocyanate compounds in the plant can be toxic to cattle, particularly if large amounts of seeds are consumed (Kingsbury, 1964; Warwick et al., 2002), though the species was not specifically noted as a poisonous plant in California by Fuller and McClintock (1986). The presence of seeds of the species as a contaminant in wheat renders the grain undesirable for flour making (Thornton et al., 1974). As noted above under Official Control, the species is listed as a restricted noxious weed seed by nine states in the U.S. and is considered a harmful plant subject to exclusion in phytosanitary permitting by nine countries in Asia, Africa, and the Americas. The seeds of *Thlaspi arvense* are high in oil content and have attracted attention as a possible feedstock for commercial biofuel production (Moser et al., 2009), but such uses would have to be closely controlled because of the weedy behavior of the species.

Evaluate the economic impact of the pest to California using the criteria below.

A. The pest could lower crop yield.
B. The pest could lower crop value (includes increasing crop production costs).
C. The pest could trigger the loss of markets (includes quarantines).
D. The pest could negatively change normal cultural practices.
E. The pest can vector, or is vectored, by another pestiferous organism.
F. The organism is injurious or poisonous to agriculturally important animals.
G. The organism can interfere with the delivery or supply of water for agricultural uses.

Economic Impact:

- Low (1) causes 0 or 1 of these impacts.
- Medium (2) causes 2 of these impacts.
- **High (3) causes 3 or more of these impacts.**

5) Environmental Impact: Score is **Medium (2)**

Thlaspi arvense is a weed of agricultural land and disturbed or open habitats in its native range (Clapham, 1964) and as a naturalized species in North America (Best and McIntyre, 1975; Al-Shehbaz, 2010). It occasionally occurs as a garden or orchard weed in California (CCH, 2022). Manual removal or cultivation before the plant sets seed can be an effective means of control (DiTomaso and Healy, 2007).

Environmental Impact:

A. The pest could have a significant environmental impact such as lowering biodiversity, disrupting natural communities, or changing ecosystem processes.
B. The pest could directly affect threatened or endangered species.
C. The pest could impact threatened or endangered species by disrupting critical habitats.
D. The pest could trigger additional official or private treatment programs.
E. The pest significantly impacts cultural practices, home/urban gardening or ornamental plantings.

Environmental Impact:
- Low (1) causes none of the above to occur.
- Medium (2) causes one of the above to occur.
- High (3) causes two or more of the above to occur.

Consequences of introduction to California for *Thlaspi arvense:* **Medium (12)**

Low = 5-8 points
Medium = 9-12 points
High = 13-15 points

6) Post Entry Distribution and Survey Information: Score is **Medium (2)**

-Not established (0) Pest never detected in California or known only from incursions.
-Low (-1) Pest has a localized distribution in California or is established in one suitable climate/host area (region).
-Medium (-2) Pest is widespread in California but not fully established in the endangered area, or pest established in two contiguous suitable climate/host areas.
-High (-3) Pest has fully established in the endangered area, or pest is reported in more than two contiguous or non-contiguous suitable climate/host areas.

7) Final Score: Medium 10 (12-2=10)

Conclusion and Rating Justification:

Thlaspi arvense has been known from the state of California for over 100 years and continues to be introduced into the state relatively frequently as a contaminant of commercial grain or hay. The species is of scattered distribution in open or disturbed habitats and is an early successional species of limited competitive ability in undisturbed habitats. It is relatively widespread but of sporadic distribution in California, having been reported from at least 32 counties along the length of the state. The species has potential agronomic uses as a source of seed oil for biodiesel, but would have to be grown under controlled conditions to mitigate its spread as a weed. A rating of “C” is recommended.

Uncertainty:

The species is a cosmopolitan weed in temperate areas of the world, and has been present in California for many years, so there is little uncertainty.

References:

Al-Shehbaz, I.A. 2010. *Thlaspi* Linnaeus. Pp. 745-746 in Flora of North America Editorial Committee (eds.). Flora of North America North of Mexico. Volume 7, Magnoliophyta: Salicaceae to Brassicaceae. Oxford University Press, New York and Oxford.

Best, K.F., and McIntyre, G.I. 1975. The biology of Canadian weeds 9. *Thlaspi arvense* L. Canadian Journal of Plant Science 55: 279-292.

CalFlora. 2022. Information on California plants for education, research and conservation with data contributed by public and private institutions and individuals, including the Consortium of California Herbaria. Accessed: April 21, 2022. https://www.calflora.org/

CDFA Pest and Damage Record (PDR) Database. 2022. *Thlaspi arvense*. Plant Health and Pest Prevention Services. CA Department of Food and Agriculture. Accessed April 21, 2022. http://phpps.cdfa.ca.gov/user/frmLogon2.asp

Center for Agriculture and Bioscience, International (CABI). 2020. Invasive Species Compendium, *Thlaspi arvense* (field pennycress). https://www.cabi.org/isc/datasheet/27595 Accessed April 15, 2022.

Center for Invasive Species and Ecosystem Health. 2020. Field pennycress, *Thlaspi arvense*. https://www.invasive.org/browse/subinfo.cfm?sub=6524 Accessed April 16, 2022.

Clapham, A.R. 1964. *Thlaspi* L. Pp. 318-322 in T.G. Tutin et al. (eds.). Flora Europaea. Volume 1, Lycopodiaceae to Platanaceae. Cambridge University Press, Cambridge, United Kingdom.

DiTomaso, J.M., and Healy, E.A. 2007. Weeds of California and Other Western States. University of California Agriculture and Natural Resources Publication 3488.

Fuller, T.C., and McClintock, E. 1986. Poisonous Plants of California. University of California Press, Berkeley.

Holm, L.G., Doll, J., Holm, E., Pancho, J.V., and Herberger, J.P. 1997. World Weeds: Natural Histories and Distribution. John Wiley and Sons, New York.

Kingsbury, J.M. 1964. Poisonous Plants of the United States and Canada. Prentice-Hall, Englewood Cliffs, N.J.

Moser, B.R., Knothe, G., Vaughn, S.F., and Isbell, T.A. 2009. Production and evaluation of biodiesel from field pennycress (*Thlaspi arvense* L.) oil. Energy Fuels 23(8): 4149-4155.

Thornton, B.J., Harrington, H.D., and Zimdahl, R.L. 1974. Weeds of Colorado. Colorado State University Experiment Station Bulletin 514-S, Revised edition.

United States Department of Agriculture (USDA), Agriculture Marketing Service (AMS). 2022. State Noxious-Weed Seed Requirements Recognized in the Administration of the Federal Seed Act. https://www.ams.usda.gov/sites/default/files/media/StateNoxiousWeedsSeedList.pdf Accessed April 21, 2022.

United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), PLANTS Database. https://plants.usda.gov/core/profile?symbol=THAR5 Accessed April 21, 2022.

United States Department of Agriculture (USDA), Agricultural Research Service, National Plant Germplasm System. 2022. Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/gringlobal/taxonomydetail.aspx Accessed April 21, 2022.

United States Department of Agriculture (USDA), Phytosanitary Certificate Issuance and Tracking System (PCIT). 2022. Phytosanitary Export Database. https://pcit.aphis.usda.gov/PExD/faces/ViewHarmfulOrgs.jsp Accessed April 21, 2022.

Warwick, S.I., Francis, A., and Susko, D.J. 2002. The biology of Canadian weeds 9. *Thlaspi arvense* (update). Canadian Journal of Plant Science 82: 803-823. https://cdnsciencepub.com/doi/pdf/10.4141/P01-159 Accessed April 21, 2022.

Weed Seeds Order. Government of Canada. 2016. https://laws-lois.justice.gc.ca/eng/regulations/SOR-2016-93/section-sched838558.html?txthl=arvensis+thlaspi+arvense Accessed April 21, 2022.

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***Comment Period: 04/26/2022 through 06/10/2022**

***NOTE:**

You must be registered and logged in to post a comment. If you have registered and have not received the registration confirmation, please contact us at permits[@]cdfa.ca.gov.

Comment Format:

- Comments should refer to the appropriate California Pest Rating Proposal Form subsection(s) being commented on, as shown below.

  Example Comment:

  Consequences of Introduction: 1. Climate/Host Interaction: [Your comment that relates to "Climate/Host Interaction" here.]

- Posted comments will not be able to be viewed immediately.

- Comments may not be posted if they:

  Contain inappropriate language which is not germane to the pest rating proposal;

  Contains defamatory, false, inaccurate, abusive, obscene, pornographic, sexually oriented, threatening, racially offensive, discriminatory or illegal material;

  Violates agency regulations prohibiting sexual harassment or other forms of discrimination;

Violates agency regulations prohibiting workplace violence, including threats.

- Comments may be edited prior to posting to ensure they are entirely germane.
- Posted comments shall be those which have been approved in content and posted to the website to be viewed, not just submitted.

Proposed Pest Rating: [C]