Weed Risk Assessment for

Euphorbia terracina L.

False caper

Addendum to a report, Analysis and Assessment of the Invasive risk of *Euphorbia terracina*, submitted by Sarah Reichard and Lizbeth Seebacher, University of Washington, College of Forest Resources, Center for Urban Horticulture.

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Addendum to a report, Analysis and Assessment of the Invasive risk of *Euphorbia terracina*, submitted by Sarah Reichard and Lizbeth Seebacher, University of Washington, College of Forest Resources, Center for Urban Horticulture.

This addendum provides a weed risk assessment that conforms to the USDA, Animal and Plant Health Inspection Service (APHIS) format for weed risk assessment. The information from the report was adapted to this format and risk ratings were assigned by Polly Lehtonen, USDA, APHIS, Plant Protection and Quarantine.

Stage 1: Initiating Weed Risk Assessment Process

Step 1. Document the Initiating Event(s) for the weed risk assessment.

This assessment is part of Plant Protection and Quarantine's continuous effort to identify potential Federal noxious weeds. The attached report was the product of a USDA Invasive Species Coordination initiative, a contract with Dr. Sarah Reichard of the University of Washington. The WRA area is the United States.

Step 2. Identify and Cite Previous Weed Risk Assessments.

This is the first USDA weed risk assessment for this species.

Step 3. Establish Identity of Weed.

Scientific Name: Order, Family, Genus, and species:

Euphorbiales, Euphorbiaceae, *Euphorbia terracina* L.

Synonym(s): *Euphorbia halacsyi* Formánek, *Tithymalus terracinus* (L.) Klotzsch & Garcke

Common name(s): False caper, Geraldton carnation-weed (Huxley, 1992), terracina spurge (Parsons and Cuthbertson, 1992).

Description, general morphology:

False caper is a glabrous erect leafy perennial, which grows to 80 cm tall. The stems are green to red with milky sap. Unbranched at first, they divide into 4 or 5 flower stems immediately above a circle of ovate floral bracts. The bright green leaves are linear-lanceolate, 1-4 cm. long and minutely toothed. The somewhat inconspicuous inflorescence consists of green or yellow green cup-shaped structures, each subtended by a pair of ovate floral bracts. The ovate-rhomboidal .....

bracts each have a short point and are toothed along the edges (Meadly, 1965; Reed, 1977). Each cup contains 8-15 male flowers with single stamens and a solitary female flower with 3 styles; 4 crescent-shaped glands with long slender horns fringe the cup (Parsons and Cuthbertson, 1992).

The fruit is a strongly trilobate capsule, 4 mm in diameter, globose and smooth. The seeds are ovoid, obliquely truncate, 2.5-3 mm long, 2 mm wide, smooth, pale gray, bluish gray or tan, sometimes finely mottled brown or black, with a fleshy white stalked aril (Davis, 1982; Parsons and Cuthbertson, 1992; Reed, 1977).

Pertinent information regarding life history, including growth, development, means of reproduction and dispersal:

In Australia, seeds germinate in late summer and autumn. During winter, the plants produce several stems from the crown. In late winter each stem forms 4 or 5 primary branchlets, which then branch repeatedly to form numerous flowering branchlets. Flowering begins in spring and continues while growth conditions remain suitable. Flowers and mature fruit occur simultaneously on each plant. In autumn, established plants produce from the crown new stems, which continue growth during winter. A plant at this stage is a mixture of last year's fruiting stems and the new season's vegetative growth. Older stems may continue to produce flowers as the new season's stems develop their own inflorescences (Parsons and Cuthbertson, 1992).

Preferred habitat and climatic tolerance:

E. terracina prefers rocky limestone slopes, sandy beaches, dunes, roadsides (Davis, 1982). In the coastal areas of the Mediterranean, it grows on open sandy flats and pathsides at or around sea level (El-Karemy, 1994). In southern Australia, it is most prevalent on the sandy coastal soils but has been recorded more than 100 miles inland (Meadly, 1965). *E. terracina* is common on roadsides, often on shallow soils having high calcium carbonate content (Parsons and Cuthbertson, 1992).

Native distribution:

Africa: Algeria; Egypt; Morocco; Tunisia
Asia-Temperate: Cyprus; Israel; Jordan; Lebanon; Syria; Turkey
Europe: Albania; France (including Corsica); Greece (including Crete); Italy (including Sicily); Portugal; Spain (including Baleares); Yugoslavia

Current world distribution beyond native distribution:

E. terracina has been introduced into Mexico (Radcliffe-Smith, 1984), and Australia, in the

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States of South Australia, New South Wales, Victoria and Western Australia (Auld and Medd, 1992). In the United States, it has been introduced into California.

Stage 2: Assessing pest risk of weed

Step 4. Geographic and Regulatory Information:

Federal noxious weeds are prohibited entry into the United States. *Euphorbia terracina* is of limited distribution in the United States. Hrusa (2001) reports that *E. terracina* is established in Los Angeles County. Sanders (1997) and herbarium records document occurrences in the following areas: UCLA Botanic Garden (collected Oct.1967); El Segundo Dunes, immediately west of LAX airport (May, 1988); Solstice Canyon, Santa Monica National Recreation Area (March, 2001); Monterey Park, Garvey Reservoir, dry slope above dam (June, 2001). The plant is spreading within Los Angeles County, possibly into Ventura County, and currently infests hundreds of acres (Smith, 2001). Further detection and delineation surveys are planned. Some populations may be targeted for eradication.

The California Department of Agriculture lists this species under the "Q" category, which is defined as "Temporary "A", action outside of nurseries at the state-county level pending determination of a permanent rating."

Euphorbia terracina was reported in Pennsylvania in the Bulletin of the Torrey Botanical Club in 1892. An accidental introduction on iron ore at Bethlehem, the population did not persist beyond that year (Block, 2001). No populations occur in Pennsylvania at the present time (Mountain, 2001).

Step 5. Assess Economic and Environmental Importance:Consequences of Introduction.

After each of the four risk elements (A-D) in step 5, we discuss the rationale for the rating and the level of certainty.

A. **Establishment potential or habitat suitability in the protected area**. Estimate the potential range in the United States, considering suitable climate conditions. (See discussion and map in the attached report.)

Assign rating as follows:

Rating	Numerical Score	Explanation: A suitable climate and habitats would permit the weed to survive and establish:

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Rating	Numerical Score	Explanation: A suitable climate and habitats would permit the weed to survive and establish:
High	3	In most or all of the United States (generally, in more than four plant hardiness zones).
Medium	2	Approximately one-third to two thirds of the United States (generally, in three or four plant hardiness zones).
Low T	1 T	Approximately one third or less of the United States (one or two plant hardiness zones).
Negligible	0	No potential to survive and become established in the WRA area.

Rationale for the rating and the level of certainty:

Based on the Climate prediction model using the known distribution of false caper throughout the coastal areas of the Mediterranean, the climatic correlation is high throughout California and in a few locations in eastern Washington. Using current distributions in Australia (Esperance, Fremantle and Geraldton), the high climatic correlation also includes Texas, a small part of Oklahoma, Arizona, and Oregon.

Level of certainty = Uncertain. The prediction is based on climate preference and documented distribution in other parts of the world.

B**. Spread potential after establishment, Dispersal Potential**

Check each of the following that apply:

- Consistent and prolific seed production 3
- Rapid growth to reproductive maturity
- High germination rate under a wide range of conditions
- Ability to suppress the growth of other plants by releasing a chemical inhibitor
- Ability to persist as dormant long-lived propagules or underground parts, such as rhizomes, tubers, turions or stolons
- Seed dormancy
- Stress tolerance, including ability to resist herbicides
- Ability to colonize a wide variety of habitats
- Lack of natural control agents
- Well-developed storage tissue (for example, tap root) T
- Dispersal by wind, waterT, machinery T, animals T, and/or humans T.

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Assign rating as follows:

Rating	Numerical score	Explanation
High T	3 T	Weed has potential for rapid natural spread throughout its potential range in the WRA area (*e.g.*, high reproductive potential ***AND*** highly mobile propagules).
Medium	2	Weed has potential for natural spread throughout a physiographic region of the WRA within a year (*e.g.*, it has either high reproductive potential ***OR*** highly mobile propagules).
Low	1	Weed has potential for natural spread locally in the WRA area within a year (some reproductive potential and/or some mobility of propagules).
Negligible	0	Weed has no potential for natural spread in the WRA area.

Rationale for the rating and the level of certainty:

Spread is by seed. Ripe fruits burst open, spreading seeds over several meters. More distant spread occurs by water movement along channels and streams, and in mud adhering to animals, machinery and other vehicles (Parsons and Cuthbertson, 1992). In California, seed is spreading with earth movement, which is part of the Solstice Creek restoration project. Hand-digging of mature plants resulted in the subsequent emergence of thousands of seedlings (Smith, 2001).

E. terracina has a robust tap root (Parsons and Cuthbertson, 1992).

The combination of prolific seed production, a variety of seed vectors, and a well-developed storage organ earn a high dispersal rating for *E. terracina*.

Level of certainty = reasonably certain

C. **Economic Impact**.

Discuss the potential economic importance of the species in the WRA area. Consider three primary types of damage:

1. Reduced crop yield (*e.g.*, by parasitism, competition, or by harboring other pests). T
2. Lower commodity value (e.g., by increasing costs of production, lowering market price, or a combination); or if not an agricultural weed, by increasing costs of control.T
3. Loss of markets (foreign or domestic) due to presence of a new Federal noxious weed.

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Assign ratings as follows:

Rating	Numerical score	Explanation
High	3	Weed causes all three of the above impacts, or causes any two impacts over a wide range (over 5 types) of economic plants, plant products, or animals.
Medium T	2 T	Weed causes any two of the above impacts, or causes any one impact to a wide range (over 5 types) of economic plants, plant products, or animals.
Low	1	Weed causes any one of the above impacts.
Negligible	0	Weed causes none of the above impacts.

Rationale for the rating and the level of certainty:

E. terracina is an aggressive weed, but it does not persist on frequently cultivated soil. It is a serious competitor with pasture plants and is toxic to stock. Stock losses due to hydrocyanic acid have been attributed to the plant in New South Wales, but stock poisoning is rare because the sap makes the plant unpalatable to animals (Parsons and Cuthbertson, 1992). In Western Australia, E. terracina is a serious weed of grazing land (Hussey et al, 1997).

A medium economic impact rating results from potential reduction of carrying capacity for rangeland, rare stock poisoning and increased costs of control. *Euphorbia terracina* is not listed as a prohibited weed by any of the United States' trading partners.

Level of certainty = reasonably certain

D. **Environmental Impact**

Check each of the following that apply. Consider whether or not the weed, if introduced, could:

- Cause impacts on ecosystem processes (alteration of hydrology, sedimentation rates, a fire regime, nutrient regimes, changes in productivity, growth, yield, vigor, etc.).
- Cause impacts on natural community composition (*e.g.*, reduce biodiversity, affect native populations, affect endangered or threatened species, impact keystone species, impact native fauna, pollinators, or microorganisms, etc.). T
- Cause impacts on community structure (*e.g.*, change density of a layer, cover the canopy, eliminate or create a layer, impact wildlife habitats, etc.).
- Have impacts on human health such as allergies or changes in air or water quality. T
- Have sociological impacts on recreation patterns and aesthetic or property values.

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- Stimulate control programs including toxic chemical pesticides or introduction of a nonindigenous biological control agent. T

Assign ratings as follows:

Rating	Numerical Score	Explanation
High T	3 T	Three or more of the above. (Potential to cause major damage to the environment with significant losses to plant ecosystems and subsequent physical environmental degradation. Population reduction of endangered or threatened species would elevate that one impact to a high rating.)
Medium	2	Two of the above. (Potential to cause moderate impact on the environment with obvious change in the ecological balance, affecting several attributes of the ecosystem, as well as moderate recreation or aesthetic impacts.)
Low	1	One of the above, unless the factor is potential to reduce populations of endangered or threatened species, which rates High. (Limited potential impact on environment.)
Negligible	0	None of the above. (No potential to degrade the environment or otherwise affect ecosystems.)

Rationale for the rating and the level of certainty:

E. terracina forms dense thickets which out compete native species for sun, light and nutrients. With rapid growth and prolific seeding, it has potential to be invasive (Plant Protection Society of Western Australia web site).

In California, *Euphorbia terracina* is threatening the ecological health of the Lower Solstice Creek, one of the few perennial streams in the Santa Monica Mountains. This creek supports high levels of riparian plant diversity, and is targeted for re-introduction of the federally listed endangered Southern steelhead trout. *Euphorbia terracina* is forming monotypic stands in the riparian corridor, replacing native, streamside vegetation. Some populations will be targeted for local eradication efforts using the herbicide Telar (chlorsulfuron). Biological control agents that have been released against leafy spurge (*Euphorbia esula*) will be evaluated for effectiveness against false caper (Smith, 2001).

Many species of the spurge family are known to exert toxicological effects on animals and

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humans. The aerial parts of most of the genus *Euphorbia* excrete a milky fluid that causes a number of physiological effects including skin irritation, tumor promotion, and pro-inflammatory properties. In many cases, these biological responses are due to the presence of specific types of diterpenes, most particularly phorbol derivatives (Marco, 1999). This milky sap can also cause temporary blindness if the sap comes in contact with the eyes (Page and Olds, 1999). Exudates from broken roots of succulent *Euphorbias* can be fatal to fish. The juice of some species is used for arrow poisons and to stupefy fish (Bailey and Bailey, 1976).

When mechanical and cultural methods are inappropriate for control, herbicides likely will be used. In Australia, a mix of amitrole T + atrazine + amine 2,4-D produces good results applied to seedlings. Older plants can be spot-sprayed with a picloram + 2,4-D mixture before seeds mature. Chlorsulfuron controls young plants in Western Australia, while triclopyr is used on older plants (Parsons and Cuthbertson, 1992).

The combination of potential invasiveness in natural areas, potential impacts on an endangered species, toxicological effects, and chemical control impacts earn *E. terracina* a high environmental impact rating. The classification in Australia of this species as a significant environmental weed (National Weeds Strategy Page, 2000; Agriculture Western Australia Weed Science Page, 2000) supports this high rating.

Level of uncertainty: very certain

ECONOMIC and ENVIRONMENTAL IMPORTANCE SUMMARY: Consequences of Introduction: Cumulative Risk Element Score

Add together the numerical estimates for the four risk elements to produce an overall estimate of the Consequences of Introduction Risk Rating for the weed. The overall risk rating is used to assign a Consequences of Introduction Risk Score as follows:

Risk: Consequences of Introduction (Sum Risk Elements #1-4) (1+3+2+3= 9)		
Cumulative Risk Element Score	Risk Rating	Risk Score
0 - 2	Negligible	0
3 - 6	Low	1
7 - 10 T	Medium T	2
11 – 12	High	3

The Consequences of Introduction Risk Rating, an indicator of the potential of the weed to become established and spread, and its potential to cause economic and environmental impacts, is medium for *Euphorbia terracina*.

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Step 6. Assess Likelihood of Introduction.

Discuss entry potential and establishment potential. What is the likelihood that the species will enter the United States, survive the shipment and find a suitable habitat for establishment?

Assign ratings as follows:

Rating	Numerical Score	Explanation: Introduction is
High T	3 T	Very likely or certain
Medium	2	Likely
Low	1	Low, but clearly possible
Negligible	0	Extremely unlikely

Rationale for rating and the level of certainty:

Euphorbia terracina has already been introduced into California, and possibly into Pennsylvania at one time. Possible pathways include as a seed contaminant of agricultural commodities (Wiersema and Leon, 1999) and intentional introduction; the species is listed in at least one seed catalogue on the Internet. In both pathways, no treatment is used and the seed would likely survive the shipment and be introduced into the environment. Without regulation, the likelihood of introduction and spread is high.

Level of certainty = reasonably certain

Step 7. Conclusion: Pest Risk Potential of Weed.

Produce an estimate of the pest risk potential of weed by considering the Consequences of Introduction and the Likelihood of Introduction using the following table as a guide. The pest risk potential of weed will be obtained from the combination of the scores for likelihood of introduction and consequences of introduction, and will be assigned as follows:

Likelihood of Introduction (Rating and Score)	Consequences of Introduction (Rating and Score)	Overall Pest Risk Potential of weed
Negligible (0)	Negligible (0)	Negligible
Negligible (0)	Low (1)	Negligible
Negligible (0)	Medium (2)	Negligible
Negligible (0)	High (3)	Negligible

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Likelihood of Introduction (Rating and Score)	Consequences of Introduction (Rating and Score)	Overall Pest Risk Potential of weed
Low (1)	Negligible (0)	Negligible
Low (1)	Low (1)	Low
Low (1)	Medium (2)	Low
Low (1)	High (3)	Low
Medium (2)	Negligible (0)	Negligible
Medium (2)	Low (1)	Low
Medium (2)	Medium (2)	Medium
Medium (2) T	High (3) T	Medium- High T
High (3)	Negligible (0)	Negligible
High (3)	Low (1)	Low
High (3)	Medium (2)	Medium-High
High (3)	High (3)	High

Summary and Conclusion:

Euphorbia terracina earns a medium-high pest risk potential of weed rating. An aggressive perennial, it forms dense stands that inhibit the growth of native plants. It has potential to compete with crops and pasture plants, is avoided by stock and can be toxic to animals. It is of limited distribution in the United States, and is subject to control efforts in California.

Step 8. References.

Agriculture Western Australia Weed Science Page. 2000. Agriculture Dept. Western Australia. <http://www.agric.wa.gov.au/progserv/plants/weeds/weedlist.htm> 28 October 2000.

Auld, B.A. and R.W. Medd 1992. Weeds, an illustrated botanical guide to the weeds of Australia. Agricultural Research and Veterinary Centre, Orange NSW Agriculture.

Bailey, Liberty Hyde and Ethel Zoe Bailey. 1976. Hortus Third, A Concise Dictionary of Plants Cultivated in the U.S. and Canada. MacMillan Publishing Company, New York, New York.

Block, T. 2001. Personal communication. Director, Pennsylvania Flora Project, Morris Arboretum of the University of Pennsylvania, Philadelphia, PA.

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Davis, P.H. 1982. Flora of Turkey and the East Aegean Islands Volume 7. Edinburgh at the University Press.

El-Karemy, Z. 1994. On the taxonomy of the genus Euphorbia (Euphorbiaceae) in Egypt. Feddes-Repertorium 105:5-6 271-281.

Hrusa, G. F. 2001. Personal communication. Senior Plant Systematist, Herbarium (CDA) Plant Pest Diagnostics Center, California Dept. of Food & Agriculture, Sacramento, CA.

Hussey, H.M.J. et al. 1997. Western Weeds, a guide to the weeds of Western Australia. The Plant Protection Society of Western Australia (Inc.), Victoria Park, Western Australia.

Huxley, A. ed. 1992. The new Royal Horticultural Society dictionary of gardening.

Invaders Database System Page. 2000. USDA Agricultural Research Service. <http://invader.dbs.umt.edu/Noxious_Weeds/> 28 October 2000.

Marco, J. Alberto, Sanz-Cervera, Juan F., Yuste, Alberto and Jakupovic, Jasmin. 1999. Isoterracinolides A and B, Novel Bishomoditerpene Lactones from *Euphorbia terracina.* Journal of Natural Products 62: 110-113.

Meadly, G.R.W. 1965. Weeds of Western Australia. Department of Agriculture, Western Australia.

Mountain, W. 2001. Personal communication. Botanist, Pennsylvania Department of Agriculture, Harrisburg, PA.

National Weeds Strategy Page. 2000. Weeds Australia, Agriculture and Resource Management Council of Australia and New Zealand, Australia and New Zealand Environmental and Conservation Council and Forestry Ministers. <http://www.weeds.org.au/> 280ctober2000.

Page, Susan and Olds, Margaret. 1999. Botanical. Welcome Rain Publisher LLc, New York, New York.

Parsons, W. T. & E. G. Cuthbertson. 1992. Noxious weeds of Australia. Inkata Press, Melbourne, Sydney.

Radcliffe-Smith, A. 1984. A new introduction to the flora of Mexico. Kew-Bulletin of London: Her Ma~estv's StationarY Office v 39:3 466.

Reed, C.F. 1977. Economically important foreign weeds, potential problems in the United States. Agriculture Handbook No. 498, Agriculture Research Service, Animal and Plant Health Inspection Service, USDA. p. 403.

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Sanders, A. C. 1997. Noteworthy Collections. Madroño 44 (3): 203-206.

Smith, R. 2001. Personal communication. Supervisory Agricultural Inspector, Los Angeles County Agricultural Commissioner's Office, Arcadia, CA.

USDA, NRCS. 1999. The PLANTS database <http://plants.usda.gov/plants>. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Wiersema, J. H. & B. León. 1999. World economic plants: a standard reference. CRC Press, Boca Raton, London, New York, Washington, D.C.

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