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Field Release of *Jaapiella ivannikovi* (Diptera: Cecidomyiidae), an Insect for Biological Control of Russian Knapweed (*Acroptilon repens*), in the Continental United States

Environmental Assessment, April 2009

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I. Purpose and Need for the Proposed Action

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ) Permit Unit is proposing to issue permits for release of a gall midge, *Jaapiella ivannikovi* Fedotova (Diptera: Cecidomyiidae). The agent would be used by the applicant for the biological control of Russian knapweed, *Acroptilon repens* (L.) DC (=*Centaurea repens* L.), in the continental United States. Before permits are issued for release of *J. ivannikovi*, APHIS must analyze the potential impacts of the release of this agent into the continental United States.

This environmental assessment[1] (EA) has been prepared, consistent with USDA, APHIS' National Environmental Policy Act (NEPA) implementing procedures (Title 7 of the Code of Federal Regulations (CFR), part 372). It examines the potential effects on the quality of the human environment that may be associated with the release of *J. ivannikovi* to control infestations of Russian knapweed within the continental United States. This EA considers the potential effects of the proposed action and a no action alternative.

The applicant's purpose for releasing *J. ivannikovi* is to reduce the severity of infestations of Russian knapweed in the United States. Russian knapweed, *Acroptilon repens*, is native to Eurasia and is common in Armenia, Turkestan, Mongolia, Asia Minor, and Iran (Watson, 1980). The weed was first introduced into North America in 1898 and by 1998 had spread to 313 counties in 45 of the 48 contiguous states in the United States (Zimmerman and Kazmer, 1999). It did not become a serious weed in Canada until 1928, and its spread is linked to the distribution of knapweed-infested hay (Maddox et al., 1985). The introduction of Russian knapweed into the United States is thought to be the result of impure Turkestan alfalfa seed, and possibly sugarbeet seed (Maddox et al., 1985).

Estimated Russian knapweed acreage for the western United States and Canada in the year 2000 totaled over 1,561 million acres with 80 percent of the acreage located in the states of Washington, Idaho, Colorado, and Wyoming (Zouhar, 2001).

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[1] Regulations implementing the National Environmental Policy Act of 1969 (42 United States Code 4321 *et seq.*) provide that an environmental assessment "[shall include brief discussions of the need for the proposal, of alternatives as required by section 102(2)(E), of the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted." 40 CFR § 1508.9.

Russian knapweed is a long lived perennial in the plant family Asteraceae or sunflower family. The weed thrives in a variety of habitats and is found in both irrigated and arid environments, and in cropland, pastures, rangeland, and wasteland. Russian knapweed is a strong competitor and produces allelopathic[2] compounds that exclude other plant species, and as a result, dense (100−300 plants/square meter) infestations may develop (Ivanova, 1966). This species reproduces primarily vegetatively from a primary vertical root having numerous horizontal lateral roots with deep, vertical extensions. Reproduction by seed is apparently not extensive, although a single plant may produce over 1,200 seeds that may remain viable for up to 5 years (Anderson, 1968). Seeds may aid in the long range spread of the weed through infested hay and other means.

Russian knapweed has many negative qualities. It is generally not utilized for forage because of its bitter taste, and may cause neurological disorders in horses if consumed (Young et al., 1970). It reduces wildlife habitat, suppresses other plants, and has no known beneficial qualities.

Existing Russian knapweed management options are ineffective, expensive, temporary, and have nontarget impacts. For these reasons, there is a need to identify an effective, host-specific biological control organism and release it into the environment for the control of Russian knapweed.

Public involvement

Notice of this EA was made available in the Federal Register on March 12, 2009 for a 30-day public comment period. One comment was received on the EA from the Tribal Historic Preservation Officer of the Bois Forte Band of Ojibwe in Minnesota. The commenter indicated a general disagreement with biological control but did not raise any specific issues regarding the release of the organism.

II. Alternatives

This section will explain the two alternatives available to the APHIS PPQ Permit Unit; no action and to issue permits for environmental release of *J. ivannikovi*. Although the APHIS PPQ Permit Unit's alternatives are limited to a decision on whether to issue permits for release of *J. ivannikovi*, other methods available for control of Russian knapweed are also described. These control methods are not decisions to be made by the APHIS PPQ Permit Unit and are likely to continue whether or not permits

[2] Allelopathy is the inhibition of growth of one plant species by another due to the release of chemical substances.

are issued for environmental release of *J. ivannikovi*. These are methods presently being used to control Russian knapweed by public and private concerns.

A third alternative was considered, but will not be analyzed further. Under this third alternative, the APHIS PPQ Permit Unit would have issued permits for the field release of *J. ivannikovi* but the permits would contain special provisions or requirements concerning release procedures or mitigating measures. No issues have been raised that would indicate that special provisions or requirements are necessary.

A. No action

Under the no action alternative, the APHIS PPQ Permit Unit would not issue permits for the field release of *J. ivannikovi* for the control of Russian knapweed. The release of this biological control agent would not take place. The following methods are presently being used to control Russian knapweed and these methods will continue under the "No Action" alternative and will likely continue even if permits are issued for release of *J. ivannikovi*.

1. Chemical control

Russian knapweed may be controlled using the herbicides 2,4-D (although Russian knapweed has some tolerance of 2,4-D), picloram, dicamba, clopyralid, clopyralid plus 2,4-D, and most recently, aminopyralid.

2. Cultural control

Cultural controls include mowing and deep plowing. Systematic cutting of the roots to a depth of 30 centimeters (cm) over a three year period may destroy the root system in the top meter of soil (Mordovets et al., 1972) and root fragments up to 40 cm long may be killed by burial below 30 cm (Agadzhanyan and Agadzhanyan, 1967).

3. Biological control

Two biological control agents have been released on Russian knapweed in North America. One is the nematode *Mesoanguina picridis*, which was introduced from central Asia. The nematodes attack the shoots as they grow up through the soil and cause galls[3] to form on the stems and leaves. The galls look like tiny tennis balls, causing stunting and some mortality of Russian knapweed plants. A second agent, a stem-galling wasp,

[3] A gall is an abnormal growth of plant tissues caused by the stimulus of an animal or another plant.

Aulacidea acroptilonica, was approved for release in 2008.

Research and surveys by Ivanova (1966), Tyurebaev (1972), Kovalev et al. (1975), Ivannikov et al. (1976), Ivannikov and Tyurebaev (1977), Rosenthal et al. (1994), Krivokhatsky and Ovtshinnikova (1995), Sobhian (1994, 1996a,b,c), Fornasari (1996), and Schaffner et al. (2000) have identified at least 13 organisms attacking the plant, although several of these are not being considered for release in the United States. The insects closely associated with Russian knapweed are as follows: a flower gall mite (*Aceria acroptiloni*), a vagrant mite (*Aceria sobhiani*), three flower/bud-gall flies (*Jaapiella ivannikovi, Urophora xanthippe, and U. kasachstanica*), a leaf-gall weevil and midge (*Pseudorchestes* (*Rhynchaenus*) *distans* and *Loewiola acroptilonica*), a stem galling cynipid wasp released in the United States in 2008 (*Aulacidea acroptilonica*), stem boring beetle and a moth (*Agapanthia leucaspis* and *Depressaria squamosa*), a defoliating beetle (*Galeruca interrupta armenica*), and a leaf and stem rust (*Puccinia picridis*). Root feeders associated with Russian knapweed are not well known. Three species have been reported to infest roots, but only *Cochylimorpha nomadana* has potential as a biological control agent.

B. Issue permits for environmental release of *J. ivannikovi*

Under this alternative, the APHIS PPQ Permit Unit would issue permits for the field release of *J. ivannikovi* for the control of Russian knapweed. These permits would contain no special provisions or requirements concerning release procedures or mitigating measures.

1. Biological control agent information

a. Description

Male *J. ivannikovi* are 1.6 millimeters (mm)−1.8 mm long with large eyes. Wings are relatively large and the legs are long. Female *J. ivannikovi* are 2.2−2.5 mm long and similar to the male. The ovipositor (egg-laying organ) is long and capable of being extended from the tip of the abdomen.

J. ivannikovi has three larval instars (immature stages). The larvae are milky whitish/rosy with a curved, legless body and a small whitish head capsule. Pupae (non-feeding, immature insect stage) are approximately 2 mm long and pale.

b. Life history

Females mate soon after adult emergence. Eggs are deposited on the surface of the buds situated on the tips of the main and side shoots of Russian knapweed. Larval feeding causes stunted growth of the shoot and a growing together and fusion of leaves, resulting in a so-called ‘rosette gall’ (Ananthakrishnan, 1984).

Larvae develop in silky webs between the growing leaves of the rosette gall. Dissection of field-collected galls revealed up to 14 larvae feeding inside galls induced by *J. ivannikovi*.

In Uzbekistan, fully developed larvae of the first generation were first found in late April. Pupation occurs inside the rosette gall. Four to five partially overlapping generations, each about one month long, have been observed. The gall midge hibernates in the pupal stage inside galls.

c. Native range

J. ivannikovi has been recorded from southern Russia, Kazakhstan, Uzbekistan, Iran, Pakistan, and China. It can be found on Russian knapweed growing in a wide range of habitats: along roadsides, and in fields, orchards, vineyards, wastelands, and undisturbed semi-deserts. Surveys in Uzbekistan indicate that *J. ivannikovi* can build up large populations in habitats that experience disturbance by animal grazing or soil cultivation, or that are irrigated. Disturbance and irrigation during the summer months causes Russian knapweed to produce new shoots throughout the season; young shoots are the preferred stage for egg-laying by *J. ivannikovi*.

d. Impact on Russian knapweed

In field tests conducted by Collier et al. (2007) from 2003 to 2005, attack of Russian knapweed shoots by *J. ivannikovi* caused a significant reduction in Russian knapweed shoot length (10−20 percent) and shoot biomass (20−25 percent). In 2004 and 2005, *J. ivannikovi* galls also significantly reduced seed number. Plants infested by *J. ivannikovi* did not produce any viable seeds in 2004 and 2005. The goal of the release of *J. ivannikovi* is to slow the rate of spread of Russian knapweed by reducing seed production and to reduce Russian knapweed biomass in existing infestations. It is not expected that *J. ivannikovi* alone will control Russian knapweed but will work along with other control methods to reduce Russian knapweed infestations.

III. Affected Environment

Russian knapweed is a long-lived perennial. This species reproduces primarily vegetatively from a primary vertical root having numerous horizontal lateral roots with vertical extensions. The extensive root system that gives rise to new shoots allows for rapid colonization and survival value. Root depth may reach 5−7 meters, although this is uncommon. Shoots emerge early in the spring shortly after soil temperatures remain above freezing. After emergence, the plants form rosettes and bolt[4] in late May to mid-June. Flowering occurs from early July and will continue through the first hard freeze of the fall, given adequate moisture (Watson, 1980; Littlefield, unpub. data).

Russian knapweed does not appear to reproduce extensively by seed within a clone, but a single plant may produce over 1,200 seeds. Seeds may be viable for up to 5 years (Anderson, 1968). In addition, seeds may be spread through the feces of cattle that have ingested mature flower heads. Seeds of Russian knapweed germinate over a wide temperature range of 0.5^{o}−35^{o} C, with optimum germination occurring from 20^{o} to 30^{o} C (Brown and Porter, 1942; Ivanova, 1966; Muminov, 1967). Lateral spread of Russian knapweed clones is somewhat limited, approximately 35 cm per year for clones observed in Montana (Littlefield, unpubl. data) and up to 1 meter in Wyoming.

A. Areas affected by Russian knapweed

1. Native range

Russian knapweed is native to central Asia. The weed extends more or less in a band between 40^{o} and 45^{o} longitude from central Turkey and Crimea into western Mongolia and Siberia in the east, and is common in Armenia, Turkmenistan, Uzbekistan, Kazakhstan, and parts of Turkey and Iran. Russian knapweed has spread within and to adjacent areas via trade routes.

2. Present distribution in North America

Based on a 1998 survey (Zimmerman and Kazmer, 1999), Russian knapweed currently infests 313 counties in 45 of the 48 contiguous states in the United States. The most severe infestations of Russian knapweed occur in the more arid areas of the western United States. Estimated Russian knapweed acreage for the western United States and Canada in the year 2000 totaled over 1,561 million acres, with 80 percent of the acreage located in the states of Washington, Idaho, Colorado, and Wyoming (Zouhar, 2001). The northern distribution of Russian knapweed appears to be southern Canada, approximately 54^{o} N latitude.

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[4] The rapid growth of a stem prior to flowering.

3. Potential distribution

Based on a 1982 and a 1998 survey, there was a 28.3 percent increase in number of infested counties in just 16 years (Maddox et al., 1985; Zimmerman and Kazmer, 1999). The potential distribution in North America is not known, but it appears that the more arid regions of the West are more susceptible to infestations.

The mode of spread has not been investigated, although long range spread of the weed is thought to occur by the transport of seeds in infested hay or crop seeds (Rogers, 1928; Renney, 1959). In addition, the ingestion of flower heads by cattle and the ability of the seeds to survive through the digestive system may also serve to disperse this weed with the movement of cattle.

4. Habitat

Russian knapweed thrives in a variety of habitats and is found in both irrigated and arid environments, and in cropland, pastures, rangeland, shrublands, and wasteland (Rogers, 1928; Zouhar, 2001). Habitat associations for the western United States may be found in Zouhar (2001). Russian knapweed is found in a variety of soil types and is not associated with a particular soil. Russian knapweed is an adaptable plant and is capable of establishing itself in sandy deserts, compacted soils, and roadsides. Resistant to drought, salt, and compacted soils (Ivannikov et al., 1976), Russian knapweed can become established in areas of disturbed land or where the upper layer of soil is removed.

B. Plants related to Russian knapweed and their distribution

1. Taxonomically related plants

The tribe Cardueae (Russian knapweed belongs to this tribe) is comprised of approximately 83 genera and 2,500 species (Bremer, 1994). This tribe is the more primitive of Asteraceae (sunflower, aster, or daisy family) tribes. Species are primarily Palearctic (European, the northwest coast of Africa, and Asia north of the Himalaya Mountains) and north African, although a few species are found in North and South America, Australia, and tropical Africa. The tribe Cardueae is comprised of two large subtribes - the Centaureinae and Carduinae, and two smaller subtribes – the Carlininae and Echinopsidinae. Although there are native North American species contained within the Cardueae, this tribe is comprised primarily of exotic species of economic importance either as weeds or as ornamentals and commercial crops.

In the subtribe Centaureinae, the genus *Acroptilon* consists of a single species, *A. repens* (Russian knapweed). The closely related genus *Centaurea* is comprised of approximately 32 species in the United States, mostly exotic species that are weedy or some that are used as ornamentals. There are two native knapweed species, *C. americana* and *C. rothrockii,* (some botanists have classified these under a different genus - *Plectocephalus*) of concern. Both species are annuals and are native to the southwest, although the range of *C. americana* extends up through the central United States. Both species are commercially available and may be grown as ornamentals. Safflower, *Carthamus tinctorius,* is also placed in this subtribe and is of concern due to its economic importance. The other subtribe Carduinae contains native species within the genera *Cirsium* and *Saussurea*. Six federally listed threatened or endangered *Cirsium* species are present in the United States. Artichoke, *Cynara scolymus,* is also placed in this subtribe and is of economic concern. Milk thistle, *Silybum marianum,* although considered a noxious weed in many areas is also used as an economic plant species in some locations. The subtribes Carlininae and Echinopsidinae have few representative species in North America, of which all are introduced weeds or ornamentals (i.e., globe thistle).

Besides *Cirsium,* a number of genera within the family Asteraceae have federally threatened and endangered species in the continental United States. These genera are: *Ambrosia, Baccharis, Blennosperma, Boltonia, Chrysopsis, Deinandra, Echinacea, Enceliopsis, Erigeron, Eriophyllum, Grindelia, Helenium, Helianthus, Holocarpha, Hymenoxys, Lasthenia, Layia, Lessingia, Liatris, Malacothrix, Marshallia, Monolopia, Pentachaeta, Pityopsis, Pseudobahia, Senecio, Solidago, Stephanomeria, Taraxacum, Thymophylla, Townsendia, Verbesina,* and *Yermo*. These genera are more distantly related to *Acroptilon* and therefore would be at lower risk of being utilized by Russian knapweed biological control agents.

IV. Environmental Consequences

A. No action

1. Impact of spread of Russian knapweed

a. Beneficial uses:

Russian knapweed has no known beneficial qualities. At one time, it was recommended for soil erosion control in Nevada and that allowed the weed to become more widespread (University of Nevada Cooperative

Extension, 2004).

b. Social and recreational use:

Russian knapweed does not have any known social or recreational use. The monocultural stands of this weed are considered aesthetically unpleasant in comparison to healthy ecosystems. Russian knapweed can form relatively dense stands along river beds which can inhibit recreational activities.

c. Economic losses:

Economic losses due to Russian knapweed infestations have not been studied in detail. Hirsch and Leitch (1996) addressed direct and secondary economic impacts associated with several knapweed species in Montana. Although this study was limited by various assumptions, it does indicate that potential and severe economic impacts could result should these weeds continue to spread.

Russian knapweed imparts a bitter taste to bread when its seeds are threshed together with wheat (Ivannikov et al., 1976). The quality of flour or other grain products that have been contaminated by Russian knapweed seed at a rate of only 0.01 percent by weight is reduced due to the bitter taste. At a density of 25−50 Russian knapweed plants per square meter, wheat yields were decreased by 50-90 percent (Streibig et al., 1989). Shoot densities of 19, 32, and 65 per square meter have reduced the fresh weight yield of corn by 64, 73, and 88 percent, respectively (Berezovskii and Raskin, 1971). Russian knapweed is aggressive and difficult to control in alfalfa, clover, other forage crops, and pastures. It is generally avoided by grazing animals as it imparts a bitter quinine-like taste. The presence of Russian knapweed in hay decreases the feeding value and market value.

d. Health issues:

Russian knapweed has been known to cause the neurological disorder nigropallidal encephalomalacia in horses (Young et al., 1970). No known human ailments have been associated with Russian knapweed, although the plant produces repin and acroptilin, allergenic sesquiterpene lactones which may cause dermal allergies with prolonged or repeated contact.

e. Effects on wildlife populations:

Kurz et al. (1996) reported on the ecological implications of Russian knapweed infestations on small mammals and habitat associations. Field sites in Wyoming and Colorado were chosen for the study of diversity comparisons at infested and non-infested sites. Vegetation measurements indicated distinct differences in composition and structure between knapweed infested and non-infested plots. Diversity comparisons showed a large shift in species composition in Russian knapweed infested areas for both small mammal and plant communities, indicating a displacement of native species.

Certain species of wildlife may, in certain cases, utilize Russian knapweed infested habitats more. A recent study in Colorado and Wyoming indicates that three times as many small mammals frequented Russian knapweed infested rangeland compared to adjacent non-infested sites. Adaptation to Russian knapweed infested sites sometimes occurs, as evidenced by one small mammal - a harvester mouse, which utilizes seeds, and may serve to spread the weed as they cache seeds. In contrast, Russian knapweed infested areas had severely reduced populations of kangaroo rats and ground squirrels in Wyoming (Johnson et al., 1994).

Hirsch and Leitch (1996) estimate that knapweed monoculture could reduce wildlife habitat values as much as 80 percent. Russian knapweed infestations have also been reported to impact big horn sheep forage in British Columbia (Zouhar, 2001).

2. Impact from use of other control methods

The continued use of chemical herbicides, mechanical controls, and previously released biological control agents at current levels would be a result if the “no action” alternative is chosen.

a. Chemical control

Although herbicide treatments are temporarily effective, they are short term solutions that must be repeated (Jones and Evans, 1973; Gruzdev and Popov, 1974; Krumzdorov, 1976; Alley and Humberg, 1979, Benz et al., 1996). In addition, a one-time application of herbicide is usually insufficient in managing Russian knapweed.

Large scale chemical control is potentially ecologically harmful and often not economical on western rangeland, which is of relatively low productive value (DiTomaso, 2000). In Fremont County, Wyoming alone, very conservative estimates to apply one herbicide treatment on Russian knapweed (approximately $15/acre), would exceed $950,000 (Baker et al., 1999). This estimate is considered conservative because it does not factor in the additional cost of treating remote infestations. The majority of infested acres in Fremont County are considered remote grazing land (Baker et al., 1999).

b. Mechanical control

The control of this perennial weed by deep plowing or by mowing may have a limited affect on its extensive root system while disturbing or destroying nontarget plants. Mowing appears to stimulate regrowth in the aerial portion of the plant and may induce dormancy in the roots (Tarshish, 1967). Russian knapweed clones are able to compensate for artificial destruction of individual members of the clone by regrowth from root buds (Schaffner et al., 2001). Cultural control of Russian knapweed is typically not economical on low-productive value rangeland.

c. Biological control

The first biological control agent released on Russian knapweed in North America has been the nematode species *Mesoanguina picridis,* which was introduced from central Asia and released in the United States in 1984. Laboratory experiments suggested extensive damage on the seed development and plant growth from this agent. Due to the low mobility of the nematode and varying moisture conditions, the results of field releases were less than expected. *Mesoanguina picridis* would need to be propagated and redistributed on a large scale, which would not be cost effective. In addition, a second agent, a stem-galling wasp, *Aulacidea acroptilonica*, was approved for release in 2008, although it is not expected to control Russian knapweed alone. For these reasons other organisms are being considered for biological control.

These environmental consequences may occur even with the implementation of the biological control alternative, depending on the efficacy of *J. ivannikovi* to reduce Russian knapweed in the continental United States. It is not expected that *J. ivannikovi* alone will completely control Russian knapweed. The release of *J. ivannikovi* is expected to slow the rate of spread of Russian knapweed by reducing seed production and to reduce Russian knapweed biomass in existing infestations.

B. Issue permits for environmental release of *J. ivannikovi*

1. Impact of *J. ivannikovi* on nontarget plants

Host specificity to Russian knapweed has been demonstrated through scientific literature, field observations, and host specificity testing.

a. Scientific literature

In the literature, *J. ivannikovi* is reported only from Russian knapweed (Fedotova, 1985).

b. Field observations

During field surveys in Turkey, several hundred *Centaurea cyanus* plants were inspected for galls in habitats where *J. ivannikovi* occurs naturally. None of these plants were attacked by the gall midge (Collier et al., 2007).

c. Host specificity testing

Site of quarantine and field studies
All laboratory tests were conducted at the CABI Bioscience Centre in Delémont, Switzerland (Collier et al., 2007). The open-field experiments were carried out in Uzbekistan in collaboration with local scientists.

Test plant list
The list of plants tested consisted of the target plant collected in the native range (Uzbekistan), a population of the target collected in North America (Wyoming), and 50 non-target test plant species or varieties. The test plant list was constructed with the aim of including at least one representative of the major tribes of the family Asteraceae, and the genera within the same tribe as Russian knapweed. The test plant list also included the two native North American species in the genus *Centaurea* (*C. americana* and *C. rothrockii*) and Eurasian species from the genus *Centaurea* that are grown as ornamentals in North America (*C. cyanus*, *C. montana*). Members of the genus *Centaurea* are considered to be the closest North American relatives of *Acroptilon*.

In developing the test list, emphasis was also placed on including as many native North American representatives of the various taxa as possible. Of the three subfamilies of the Asteraceae, the Cichorioideae and the Asteroideae contain species native to North America but the Barnedesioideae do not (Bremer, 1994). Because Russian knapweed resides within the Cichorioideae, this subfamily was more extensively tested than the Asteroideae. In addition, a greater number of genera and species within the tribe Cardueae and subtribe Carduinae were tested than those in other tribes and subtribes (except the Centaurinae). This is because plants in the subfamily Cichorideae, tribe Cardueae and subtribe Carduinae are more closely related to the genus *Acroptilon*, and would be more likely to be potential host plants for *J. ivannikovi*. The Cardueae and Carduinae also contain a number of plants that are either native to North America, federally-listed threatened or endangered species, or important crop plants (e.g. artichoke and safflower).

During the host specificity testing, seed material of some rare and endangered test plant species could not be obtained or proved to have very low germination rates (e.g. *Cirsium pitcheri*, *Cirsium turneri*, *Cirsium wrightii*, *Taraxacum californicum*). Therefore, these species were replaced with other North American *Cirsium* and *Taraxacum* species that were more easily grown.

Laboratory tests

Laboratory host specificity tests followed a no-choice design. Potted non-target test plants and Russian knapweed plants were covered with plastic cylinders and topped with a gauze lid. A moistened filter paper was placed around the base of the plant on the soil surface. Several male and females *J. ivannikovi* gall midges were placed into each of the plastic cylinders. Cylinders remained in place until all female midges had died (maximum of 7 days exposure). After exposure, the test and control plants were inspected for gall formation.

Table 1 shows the results from the no-choice laboratory tests. In these tests, galls occurred only on the target weed Russian knapweed (*Acroptilon repens*) and on the Eurasian knapweed (*Centaurea cyanus*). No galls were produced on any other test plant species.

Table 1. Results of the no-choice oviposition and gall formation test with *Jaapiella ivannikovi* from eastern Uzbekistan (data from 2002-06) (Collier et al., 2007).

Plant Species	Reps	No. of Galls
SUBFAMILY CICHORIOIDEAE		
Tribe Cardueae		
Subtribe Centaureinae		
Acroptilon repens	**41**	**70**
Centaurea americana	22	0
C. cyanus	**11**	**15**
C. montana	24	0
C. rothrockii	22	0
Carduncellus mitissimus	14	0
Carthamus tinctorius		
Cal-West 4440	11	0
Cal-West 1221	13	0
Cal-West 88-OL	11	0
Montola 2001	6	0
Montola 2000	16	0
Serratula tinctoria	14	0
Subtribe Carduinae		
Cirsium arvense	20	0
C. discolor	10	0
C. tuberosum	3	0
C. undulatum	3	0

Table 1, cont.

Plant Species	Reps	No. of Galls
Subtribe Carduinae (cont.)		
C. vulgare	4	0
Cynara scolymus		
Cardon	8	0
Viletto	6	0
Silybum marianum	9	0
Subtribe Echinopsinae		
Echinops ritro	17	0
Tribe Lactuceae		
Subtribe Crepidinae		
Taraxacum officinale	10	0
Subtribe Lactucinae		
Lactuca sativa	24	0
Cichorium intybus	10	0
Tribe Vernonieae		
Subtribe Stephanomeriinae		
Stephanomeria virgata	9	0
Subtribe Vernoninae		
Vernonia fasciculata	15	0
V. missourica	17	0
SUBFAMILY ASTEROIDEAE		
Tribe Astereae		
Aster laevis	18	0
A. umbellata	10	0
Solidago nemoralis	16	0
Erigeron compositus	5	0
E. pinnatisectus	3	0
Tribe Anthemidae		
Artemisia ludoviciana	13	0
Tribe Calenduleae		
Calendula officinalis	15	0
Tribe Eupatorieae		
Eupatorium maculatum	15	0
E. perfoliatum	18	0
Tribe Gnaphalieae		
Gnaphalium obtusifolium	16	0
Tribe Helenieae		
Helenium autumnale	11	0
H. flexuosum	10	0
Gaillardia pinnatifida	12	0

Table 1, cont.

Plant Species	Reps	No. of Galls
Tribe Helinatheae		
Helianthus annuus		
Cargill SF 187	16	0
Cargill SF 270	14	0
Echinacaea pallida	15	0
E. purpurea	6	0
Liatris pycnostachya	4	0
Tribe Senecioneae		
Senecio cineraria	10	0
Cacalia atriplicifolia	17	0

<u>Field tests - multiple-choice oviposition and gall formation</u>

In addition to the laboratory no-choice tests, multiple-choice oviposition and gall formation tests were conducted under open-field conditions in Uzbekistan. Test plant species were either grown from seed or collected in the local area and transplanted to the experimental sites. Test plant species were arranged with Russian knapweed in a randomized design in an experimental garden at the Institute of Zoology, Tashkent, Uzbekistan. *J. ivannikovi* galls were collected locally. Field experiments were carried out each year from 2002–2004.

Results of the open-field experiments are reported in Table 2. Gall formation was recorded in large numbers on Russian knapweed (*Acroptilon repens*) but from no other test plant species. In contrast to the no-choice laboratory experiment, no gall formation was observed on *Centaurea cyanus*.

Table 2. Results of the open-field oviposition and gall formation tests carried out in Uzbekistan (2002-2004). - = missing data (not determined). (Collier et al., 2007).

Plant species	No. of plants	No. of shoots	% shoots attacked	Total No of galls
2002				
Acroptilon repens	10	124	80.6	501
Centaurea americana	10	16	0	0
C. rothrockii	10	3	0	0
Onopordum illyricum	10	11	0	0
Carthamus tinctorius	10	10	0	0
Cirsium arvense	10	28	0	0
C. discolor	6	33	0	0
C. oleraceum	10	12	0	0
C. palustre	10	3	0	0
Taraxacum officinale	10	4	0	0
2003				
Acroptilon repens	10	-	-	105
Centaurea americana	10	10	0	0
C. rothrockii	8	8	0	0
C. cyanus	8	≈ 10	0	0
C. montana	10	10	0	0
Onopordum illyricum	10	10	0	0
Cirsium arvense	10	≈ 30	0	0
C. oleraceum	10	-	0	0
C. palustre	10	-	0	0
2004				
Acroptilon repens	15	-	-	80
Centaurea americana	10	10	0	0

Table 2, cont.

Plant species	No. of plants	No. of shoots	% shoots attacked	Total No of galls
2004 (cont.)				
C. rothrockii	10	10	0	0
C. cyanus	10	≈ 20	0	0
C. montana	10	8	0	0

Discussion

The results from the laboratory and open-field tests indicate that *J. ivannikovi* has a very narrow host range. Under no-choice conditions, none of the non-target test plant species except *Centaurea cyanus* showed signs of gall formation. In North America, *C. cyanus* is not native and is grown as an ornamental, but is considered an invasive weed by the Southeast Exotic Pest Plant Council, the Southern Weed Science Society, and the Western Society for Weed Science. In the open-field choice tests, no gall formation was observed on *C. cyanus* nor on any of the other test plant species.

2. Uncertainties regarding the environmental release of *J. ivannikovi*

Once a biological control agent such as *J. ivannikovi* is released into the environment and becomes established, there is a slight possibility that it could move from the target plant (Russian knapweed) to attack nontarget plants, such as the native plant *Centaurea americana.* Host shifts by introduced weed biological control agents to unrelated plants are rare (Pemberton, 2000). Native species that are closely related to the target species are the most likely to be attacked (Louda et al., 2003). If other plant species were to be attacked by *J. ivannikovi*, the resulting effects could be environmental impacts that may not be easily reversed. Biological control agents such as *J. ivannikovi* generally spread without intervention by man. In principle, therefore, release of this biological control agent at even one site must be considered equivalent to release over the entire area in which potential hosts occur and in which the climate is suitable for reproduction and survival.

In addition, these agents may not be successful in reducing Russian knapweed populations in the continental United States. Worldwide, biological weed control programs have had an overall success rate of 33 percent; success rates have been considerably higher for programs in individual countries (Culliney, 2005). Actual impacts on Russian knapweed by *J. ivannikovi* will not be known until after release occurs and post-release monitoring has been conducted. It is not expected that *J. ivannikovi* alone will control populations of Russian knapweed, but will act in combination with other control methods or biological control agents.

3. Cumulative impacts

"Cumulative impacts are defined as the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agencies or person undertakes such other actions" (40 CFR 1508.7).

Many states and counties, particularly in the western United States, conduct weed control programs to manage Russian knapweed as well as other invasive weeds. Chemical, mechanical, and biological controls, as described previously in this document are used in a wide range of habitats.

Release of *J. ivannikovi* is not expected to have any negative cumulative impacts in the continental United States because of its host specificity to Russian knapweed. Effective biological control of Russian knapweed will have beneficial effects for weed management programs, and may result in a long-term, non-damaging method to assist in the control of Russian knapweed, and prevent its spread into other areas potentially at risk from invasion.

4. Endangered Species Act

Section 7 of the Endangered Species Act (ESA) and ESA's implementing regulations require Federal agencies to ensure that their actions are not likely to jeopardize the continued existence of federally listed threatened endangered species or result in the destruction or adverse modification of critical habitat.

Sixty-six species of Asteraceae are federally-listed as threatened or endangered in the continental United States. These represent species found within both subfamilies of Asteraceae and the majority of the Asteraceae tribes, including Cardueae.

APHIS has determined that based on the host specificity of *J. ivannikovi,* there will be no effect on any listed plant or designated critical habitat in the continental United States based on literature, field observations, and host specificity testing. In host specificity testing, the biological control agents caused gall formation only in Russian knapweed. The only exception was some galls formed on the closely related *Centaurea cyanus* in no-choice tests but not in choice tests. No listed species occur in the genus *Centaurea.*

V. Other Issues

Consistent with Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations," APHIS considered the potential for disproportionately high and adverse human health or environmental effects on any minority populations and low-income populations. There are no adverse environmental or human health effects from the field release of *J. ivannikovi* and will not have disproportionate adverse effects to any minority or low-income populations.

Consistent with EO 13045, "Protection of Children From Environmental Health Risks and Safety Risks," APHIS considered the potential for disproportionately high and adverse environmental health and safety risks to children. No circumstances that would trigger the need for special environmental reviews is involved in implementing the preferred alternative. Therefore, it is expected that no disproportionate effects on children are anticipated as a consequence of the field release of *J. ivannikovi*.

EO 13175, "Consultation and Coordination with Indian Tribal Governments," was issued to ensure that there would be "meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications…." In November 2008, APHIS sent out letters to potentially affected tribal leaders and organizations to give notification of the proposed environmental release of *J. ivannikovi* and to request input from tribes. APHIS will continue to consult and collaborate with Indian tribal officials to ensure that they are well-informed and represented in policy and program decisions that may impact their agricultural interests, in accordance with EO 13175.

VI. Agencies, Organizations, and Individuals Consulted

The Technical Advisory Group for the Biological Control Agents of Weeds (TAG) recommended the release of *J. ivannikovi* on September 19, 2008. TAG members that reviewed the release petition (Collier et al. 2007) included representatives from the U.S. Fish and Wildlife Service, Bureau of Indian Affairs, Weed Science Society of America, Cooperative State Research, Education, and Extension Service, U.S. Geological Survey, Environmental Protection Agency, U.S. Army Corps of Engineers, Bureau of Reclamation, and Agriculture and Agri-Food Canada, Health Canada.

This EA was prepared and reviewed by APHIS. The addresses of participating APHIS units, cooperators, and consultants (as applicable) follow.

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Policy and Program Development
Environmental Services
4700 River Road, Unit 149
Riverdale, MD 20737

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
Permits, Registrations, Imports, and Manuals
4700 River Road, Unit 133
Riverdale, MD 20737

University of Wyoming
Department of Renewable Resources
P.O. Box 3354
Laramie, WY 82071
CABI Bioscience Switzerland Centre
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Delémont, Switzerland.

Montana State University
Department of Land Resources and Environmental Sciences
P.O. Box 173120
Bozeman, MT 59717-3020

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Decision and Finding of No Significant Impact
for
Field Release of *Jaapiella ivannikovi* (Diptera: Cecidomyiidae), an Insect for Biological Control of Russian Knapweed (*Acroptilon repens*), in the Continental United States
April 2009

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ) Permit Unit, is proposing to issue permits for release of a gall midge, *Jaapiella ivannikovi* Fedotova (Diptera: Cecidomyiidae), in the continental United States. This agent would be used for the biological control of Russian knapweed *Acroptilon repens* (L.) DC (=*Centaurea repens* L.). Before permits are issued for release of *J. ivannikovi*, APHIS must analyze the potential impacts of the release of this organism into the continental United States. APHIS has prepared an environmental assessment (EA) that analyzes the potential environmental consequences of this action. The EA is available from:

U.S. Department of Agriculture
Animal and Plant Health inspection Service
Plant Protection and Quarantine
Registrations, Identification, Permits, and Plant Safeguarding
4700 River Road, Unit 133
Riverdale, MD 20737
http://www.aphis.usda.gov/plant_health/ea/biocontrol_weeds.shtml

The EA analyzed the following two alternatives in response to a request for permits authorizing environmental release of *J. ivannikovi*: (1) no action, and (2) issue permits for the release of *J. ivannikovi* for biological control of Russian knapweed. A third alternative, to issue permits with special provisions or requirements concerning release procedures or mitigating measures, was considered. However, this alternative was dismissed because no issues were raised that indicated that special provisions or requirements were necessary. The No Action alternative, as described in the EA, would likely result in the continued use at the current level of chemical, cultural, and biological control methods for the management of Russian knapweed. These control methods described are not alternatives for decisions to be made by APHIS, but are presently being used to control Russian knapweed in the United States and may continue regardless of permit issuance for field release of *J. ivannikovi*. Notice of this EA was made available in the Federal Register on March 12, 2009 for a 30-day public comment period. One comment was received on the EA from the Tribal Historic Preservation Officer of the Bois Forte Band of Ojibwe in Minnesota. The commenter indicated a general disagreement with biological control but did not raise any specific issues regarding the release of the organism.

I have decided to authorize the APHIS PPQ Permit Unit to issue permits for the environmental release of *J. ivannikovi*. The reasons for my decision are:

- This biological control agent is sufficiently host specific and poses little, if any, threat to the biological resources of the continental United States.

- The release will have no effect on federally listed threatened and endangered species or their habitats in the continental United States.

- *J. ivannikovi* poses no threat to the health of humans or wild or domestic animals.

- No negative cumulative impacts are expected from release of *J. ivannikovi.*

- There are no disproportionate adverse effects to minorities, low-income populations, or children in accordance with Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations" and Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks."

- While there is not total assurance that the release of *J. ivannikovi* into the environment will be reversible, there is no evidence that this organism will cause any adverse environmental effects.

An environmental impact statement (EIS) must be prepared if implementation of the proposed action may significantly affect the quality of the human environment. I have determined that there would be no significant impact to the human environment from the implementation of any of the action alternatives and, therefore, no EIS needs to be prepared.

M. J. Firko 4/27/09

Dr. Michael J. Firko Date
Director
Registrations, Identification, Permits, and Plant Safeguarding
APHIS Plant Health Programs
Plant Protection and Quarantine