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Field Release of the Parasitoid *Spathius galinae* for the Biological Control of the Emerald Ash Borer (*Agrilus planipennis*) in the Contiguous United States

Environmental Assessment, March 2015

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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), Pest Permitting Branch is proposing to issue permits for release of the insect parasitoid[1] species *Spathius galinae* (*S. galinae*) Belokobylskij & Strazanac (Hymenoptera: Braconidae). This organism would be used by the permit applicant for biological control of the nonindigenous emerald ash borer (EAB) (*Agrilus planipennis*) in the continental United States.

This environmental assessment[2] (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 the parasitoid wasp, *S. galinae*, to control EAB within the continental United States. This EA considers a "no action" alternative and the potential effects of the proposed action.

The applicant's purpose for releasing *S. galinae* is to reduce infestations of EAB in the continental United States. The EAB is an invasive wood-boring beetle from Asia threatening North America's ash trees (*Fraxinus* spp.). It was introduced into the Detroit, Michigan area, probably sometime in the 1990s, and was identified as the cause of ash mortality in the area in 2002 (Haack et al., 2002). EAB larvae feed on ash phloem, cutting off the movement of resources within the tree and killing the tree in 4-5 years (Smith, 2006; Knight, 2013). Unlike other *Agrilus* species that are attracted to and attack mainly stressed trees, EAB is able to attack and kill presumably healthy trees in both natural and urban settings. Today, EAB infestations have been detected in 22 states; Colorado, Connecticut, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin. EAB appears well suited for climatic conditions in North America and destroys entire stands of ash trees. EAB will continue to disperse along continuous corridors of ash now present in natural and urban environments due to the widespread use of ash as a landscape tree.

[1] In this case, small, stingless wasps that during their development, live in the body or egg of a single host individual, eventually killing that individual.

[2] 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.

All of the existing EAB management options (discussed below) are expensive, temporary, ineffective, and/or include non-target impacts. For these reasons, there is a need to identify and release an effective, host-specific biological control organism against EAB in the continental United States.

II. Alternatives

This section will explain the two alternatives available to APHIS–PPQ: no action (no issuance of permits) and issuance of permits for environmental release of *S. galinae* in the continental United States. Although APHIS' alternatives are limited to a decision of whether to issue permits for release of *S. galinae*, other methods are described that are currently used to control EAB in the United States. Use of these control methods is not an APHIS decision, and their use is likely to continue whether or not APHIS-PPQ issued permits for environmental release of *S. galinae*.

APHIS–PPQ considered a third alternative but will not analyze it further. Under this third alternative, APHIS–PPQ would issue permits for the field release of *S. galinae*. The permits, however, would contain special provisions or requirements concerning release procedures or mitigating measures, such as limited releases of *S. galinae* in the United States. There are no issues raised indicating that special provisions or requirements are necessary.

A. No Action

Under the no action alternative, APHIS–PPQ would not issue permits for the field release of *S. galinae* for the control of EAB — the release of this biological control agent would not occur, and current methods to control EAB in the United States will continue. Use of these methods is likely to continue even if APHIS–PPQ issues permits for release of *S. galinae*. Presently, control of EAB in the United States is limited to physical, chemical, and biological control methods.

1. Physical Control

In a forest environment, rapid detection of EAB presence and destruction of affected tree materials is the best method to reduce the chance of other ash trees being attacked in the area. Dead and dying ash trees should be cut down and chipped, burned, or buried on the site.

2. Chemical Control

There are several insecticides that may be applied to ash trees; systemic insecticides and protective cover sprays. Systemic insecticides are applied and translocated throughout the tree. Systemic insecticides including imidacloprid, emamectin benzoate, and Bidrin® may be applied as soil injections or drenches, or may be injected directly into the tree using specialized equipment (Herms et al., 2009). The systemic insecticide dinotefuran can be applied to the bark; it is absorbed through the bark and distributed throughout the tree (Herms et al., 2009). Protective cover sprays using permethrin, bifenthrin, cyfluthrin, or carbaryl, are applied to the bark and foliage to target adult beetles or EAB larvae as they chew through the bark (Herms et al., 2009).

3. Biological Control

Three parasitoids were discovered parasitizing EAB in China and were approved as biological control agents of EAB in the United States (Liu et al., 2003; 2007). These EAB biocontrol agents are: (1) *Oobius agrili*, a solitary egg parasitoid that has two generations per year (Zhang et al., 2005; Bauer and Liu, 2007), (2) *Tetrastichus planipennisi*, a larval endoparasitoid that may complete four generations per year and produces an average of 57 progeny per EAB larva (Liu et al., 2003; 2007; Yang et al., 2006; Ulyshen et al., 2010), and (3) *Spathius agrili*, a larval ectoparasitoid that has two generations per year and produces an average of five progeny per EAB larva (Yang et al., 2010; Gould et al., 2011).

B. Issue Permits for Environmental Release of *S. galinae* (Preferred Alternative)

Under this alternative, APHIS–PPQ would issue permits upon request and after evaluation of each application for the field release of *S. galinae* for the control of EAB in the continental United States. These permits would contain no special provisions or requirements concerning release procedures or mitigating measures.

1. *Spathius galinae* Taxonomic Information

Spathius galinae is an ectoparasitoid attacking 2nd to 4th instar EAB larvae. Oviposition (egg laying) by *S. galinae* on the EAB larva paralyzes it and stops its development beyond the larval stage.

a. Taxonomy: *Spathius galinae* (Hymenoptera: Braconidae). No synonymy or common names.

b. Location of voucher specimens. Specimens of *S. galinae* were deposited in the Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia. Specimens also were deposited in the National Museum of Natural History, Smithsonian Institution, Washington, DC, the American Museum of Natural History, New York (Belokobylskij et al., 2012), and at the USDA-Agricultural Research Service (ARS) Beneficial Insects Introduction Research Unit.

c. Natural geographic range, other areas of introduction, and expected attainable range in North America (also habitat preference and climatic requirements of *S. galinae*). *Spathius galinae* has been collected from Vladivostok and Khaborovsk, Russia and from Daejeon and Yangsuri, South Korea (Belokobylskij et al., 2012; Gould and Duan, 2013). The insects used to initiate colonies in the United States were all collected from EAB populations infesting *Fraxinus pennsylvanica* trees in the Vladivostok area (Duan et al., 2012a). In contrast, the previously introduced agent *S. agrili* was collected primarily from Tianjin, China, and it is rare and difficult to collect in Changchun, China. Tianjin, approximately 1,000 kilometers south of Vladivostok, is the source of the *S. agrili* population released in the United States. The climatic conditions that are most conducive to population growth of *S. galinae* or *S. agrili* are not explicitly known; therefore, climate matching analyses were conducted to determine how similar Vladivostok and Tianjin are with the regions of the United States that are infested with EAB.

The climate matching feature of the climate analysis software CLIMEX (Hearne Scientific Software Pty Ltd, Melbourne, Australia) was used. The software calculated a Climate Match Index (CMI) that is a measure of the degree of similarity between a home location and away locations. The index had values between 0, complete dissimilarity, and 1, exact climate match. Adult *Spathius* are only present in the summer, so the adult model for matching was restricted to June 4 through September 30 and was based on minimum temperature, maximum temperature, total precipitation, precipitation pattern, and relative humidity. Because larvae live under bark, the larval model for matching was based on minimum temperature, maximum temperature, total precipitation, and precipitation pattern for an entire year.

Climate matching analyses comparing Vladivostok and Tianjin to the rest of Asia indicate that *S. agrili* and *S. galinae* come from climatically unique regions of Asia. Species adapted to one of these conditions are more likely to establish and survive well in parts of North America that match these climatic conditions than will other species. The climate of Tianjin (the source area for *S. agrili*) is best matched with the climate in the center of the United States (larval model – green area in Fig. 1) and the southeastern

United States (adult model – green area in Fig. 2). The areas where scientists have released and studied establishment of *S. agrili* to date are in the more northern parts of the United States (Michigan, Ohio, Illinois). At these sites, *S. agrili* does establish, and percentage parasitism after the first winter is sometimes high, but after the first year the insects are found in very low numbers or not at all. Climate incompatibility and possible asynchrony between parasitoid and host could certainly contribute to the observed lack of persistence of *S. agrili* in the northern United States. The climate matching analysis indicates that *S. galinae* may be better adapted than *S. agrili* for establishment in the northern United States (green areas in Figs. 3 and 4).

Figure 1: Climate match between Tianjin, China (source of *S. agrili*) and North America based on minimum temperature, maximum temperature, total precipitation, and precipitation pattern for the entire year (larval model).

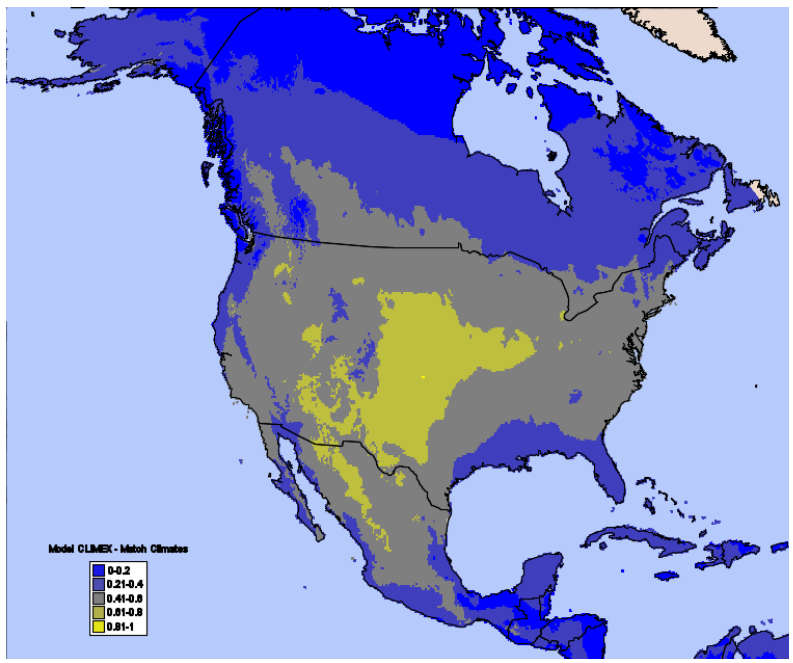


Figure 2: Climate match between Tianjin, China (source of *S. agrili*) and North America based on minimum temperature, maximum temperature, total precipitation, and precipitation pattern, and relative humidity from June 4 – September 30 (adult model).

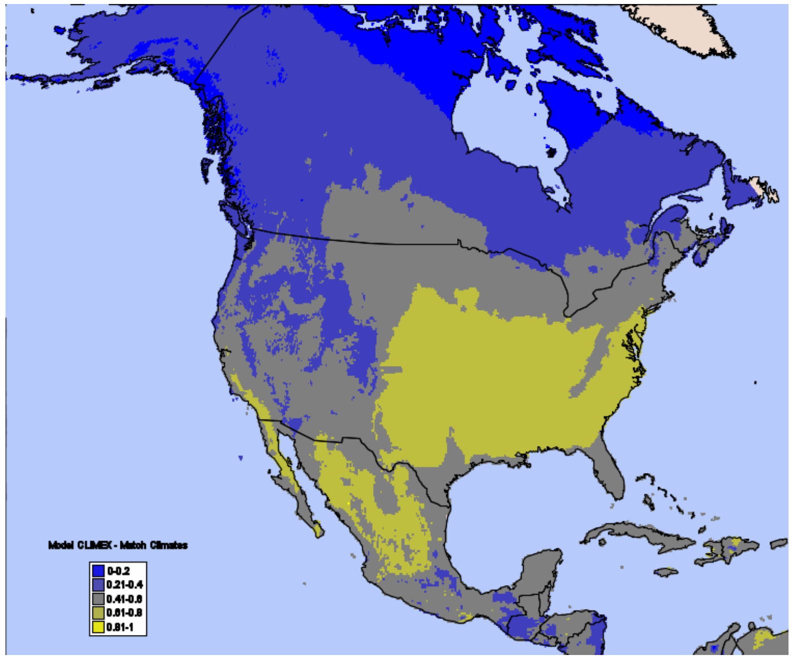


Figure 3: Climate match between Vladivostok, Russia (source of *S. galinae*) and North America based on minimum temperature, maximum temperature, total precipitation, and precipitation pattern for the entire year (larval model).

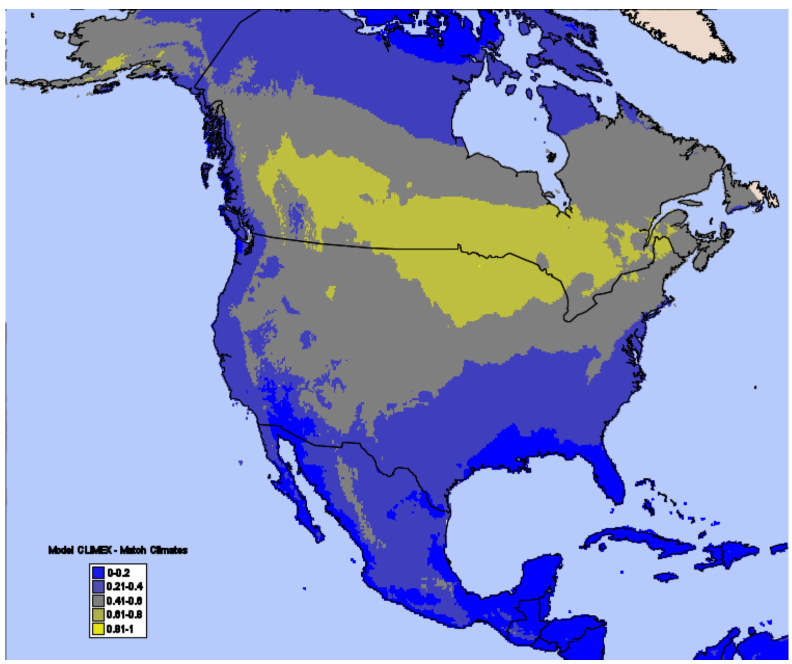
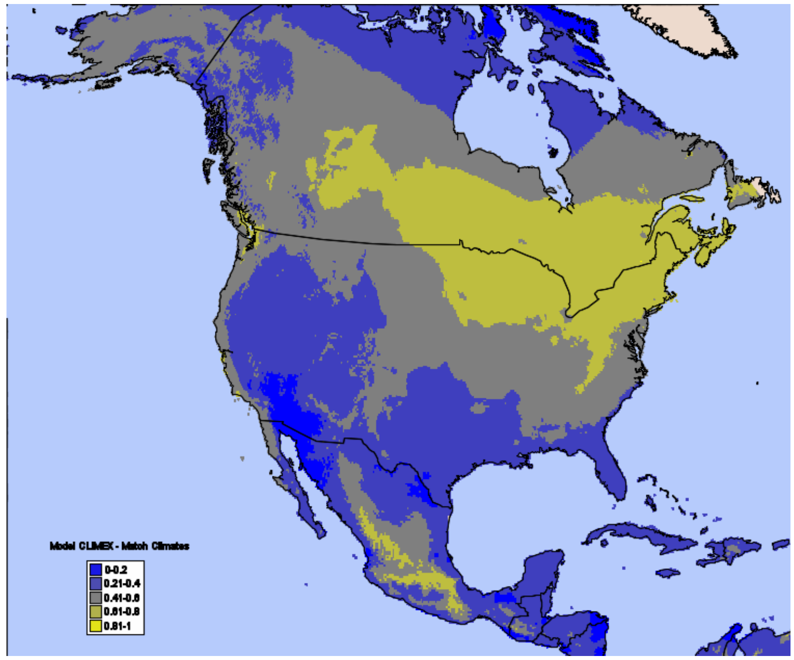


Figure 4: Climate match between Vladivostok, Russia (source of *S. galinae*) and North America based on minimum temperature, maximum temperature, total precipitation, and precipitation pattern, and relative humidity from June 4 – September 30 (adult model).



d. Source of the culture/agent in nature (name of collector, name of identifier). *Spathius galinae* was collected by USDA-ARS and USDA-APHIS scientists in collaboration with personnel from the Russian Far East Research Institute, and the insects were described as a new species by Belokobylskij et al. (2012).

e. Life history (including dispersal capability and damage inflicted on EAB). *Spathius galinae* females search the trunk of ash trees infested with EAB, ovipositing on the larvae through the bark. The EAB is paralyzed and the parasitoid eggs are deposited on the outside of the larva**.** From 6−15 larvae feed externally on the EAB larva and spin cocoons inside the EAB gallery (Duan et al., 2012a), eventually chewing through the bark and emerging as adults. In the laboratory, a female lays an average of 31 eggs during her lifetime, which averages 6.8 weeks. *Spathius galinae* can complete a generation in 3–4 weeks under normal rearing conditions (25–27^{o}C, and 16 hours of light:8 hours of dark photoperiod) and diapause is not obligatory (it does not enter diapause under long day/warm temperature conditions), both of which indicate that this insect completes at least two generations per year. Sample percentage parasitism on green ash at two sites near Vladivostok, Russia averaged approximately 63 percent (Duan et al., 2012a); while at a site near Khabarovsk, EAB were attacked by *T. planipennisi* and *S. galinae* was not present. Because *S. galinae* has at least two generations per year, total attack by parasitoids within a single EAB generation is likely higher. Although data are not available on the dispersal capability of *S. galinae*, they fly strongly and are long lived (10–12 weeks), indicating that dispersal capabilities may be high.

f. History of past use of *S. galinae*. *Spathius galinae* has never been used as a biological control agent.

g. Pathogens, parasites, hyperparasitoids of *S. galinae* and how to eliminate them from a culture of the agent. No pathogens, parasitoids, or hyperparasitoids have been observed attacking *S. galinae*, either in Russia or Korea or in specimens imported to the United States. Only healthy *S. galinae* are used to establish colonies. If any diseased organisms are discovered, they will be sent to insect pathologists for identification, and hyperparasitoids will be eliminated from the colony. Insects that are subsequently reared in the United States will be maintained in pure culture and monitored for disease.

h. Standard Operating Procedures stating how agent will be handled in quarantine. Both the ARS Beneficial Insects Introduction Research Unit and PPQ have well developed quarantine standard operating procedures for handling exotic insects including *S. galinae*. All imported (exotic) insects will be first examined and screened in a well-confined sample processing room; any contaminants will be excluded during the process. *Spathius galinae* will be reared on EAB larvae feeding in small ash logs according to methods described in Duan et al. (2011; 2013b). *Spathius galinae* females readily parasitize EAB larvae in these logs. Colonies will be maintained in bioclimatic chambers set at 25ºC, 65 percent relative humidity, and a day length of 16 hours of light and 8 hours of dark. Under these conditions, *S. galinae* does not enter diapause and colonies can be maintained indefinitely. All material is sterilized before being removed from quarantine.

III. Affected Environment

A. North American *Agrilus* species

The “Nomina insecta Nearctica; a checklist of the insects of North America” (Poole, 1997) lists 164 species of *Agrilus* in North America. Most are not considered pests; however, Solomon (1995) considers 24 *Agrilus* species to cause injury to trees and shrubs under certain circumstances. Most species of *Agrilus* are unable to colonize healthy trees; in fact, EAB is not typically a pest of *Fraxinus* in its native range. *Agrilus* species typically attack trees that are stressed by factors such as drought, damage from other insects, or poor silvicultural practices. In some cases their actions may be considered beneficial since they remove sick or damaged trees from the forest. Species such as *Agrilus anxius* Gory (bronze birch borer) and *Agrilus bilineatus* (Weber) (two-lined chestnut borer) are often considered major pest species in forest and landscape situations, but they are typically acting as secondary pests on already stressed trees or trees not native to the United States. *Agrilus hyperici* (Creutzer) has been released as a biological control agent of the weedy St. John's wort, *Hypericum perforatum* L., in the western United States and is considered to be contributing to weed suppression in Idaho (Campbell and McCaffery, 1991). However, St. John's wort is a perennial herb, not a tree, and grows in meadows, not in forests.

B. Ash Resources of North America

The known hosts of EAB in the United States are ash trees (*Fraxinus* spp.). Twenty-two species of ash grow in the United States, of which sixteen are native (USDA, NRCS, 2006). Ash species native to North American forests and known to be susceptible to EAB include: white ash (*F. americana*), green ash (*F. pennsylvanica*), and black ash (*F. nigra*), which are major components of the forest; and blue ash (*F. quadrangulata*) and pumpkin ash (*F. profunda*), which are less common species. There is increasing evidence that EAB will attack all *Fraxinus* spp., although susceptibility varies by ash species and variety (Liu et al., 2003; Wei et al., 2004; 2007; Rebek et al., 2008; Duan et al., 2012a).

Ash trees are present as ornamentals, street trees, or timber trees in all of the lower 48 states except Idaho. It is estimated that there are more than 7.5 billion ash trees in the United States, and unless climate inhibits population growth in the most southern states, all of those trees are at risk of being destroyed by EAB. Each *Fraxinus* species is adapted to slightly different habitats within forest ecosystems. Several species are tolerant of poorly-drained sites and wet soils, protecting environmentally-sensitive riparian areas; pure stands of black ash grow in bogs and swamps in northern areas where they provide browse, thermal cover, and protection for wildlife such as deer and moose. In agricultural and shelterbelt areas, ash provides vital shelter for livestock; for example, about 25 percent of all trees in North Dakota are *Fraxinus* spp. Bark of young ash trees is a favored food of mammals including beaver, rabbit, and porcupines; older trees provide habitat for cavity-nesting birds such as wood ducks, woodpeckers, chickadees, and nuthatches; seeds are consumed by ducks, song and game birds, small mammals, and insects.

Ash timber is valued for applications requiring strong, hardwood, but with less rigidity than maple. In the eastern United States, a net volume of 114 billion board feet of ash sawtimber is harvested, comprising 7.5 percent of the volume of all hardwood species (FR, 2003). In 2001, ash accounted for over 149 million board feet of timber products produced in the United

States. White ash is the primary commercial hardwood used in production of tool handles, baseball bats, furniture, flooring, containers, railroad cars and ties, canoe paddles, snowshoes, boats, doors, and cabinets; green ash is used for both solid wood applications such as crating, boxes, handles, and for fiber in the manufacture of high grade paper; black ash is typically used for interior furniture, cabinets (FR, 2003), and Northeastern Native Americans require ash for the art of basketry.

Beyond manufacturing, ash trees play an important role in the urban landscape due to their historical resistance to pests and tolerance of adverse growing conditions, such as soil compaction and drought. Many of the ash trees that now serve as street, shade, and landscape trees were planted to replace elm trees destroyed by Dutch elm disease; ash trees now comprise 5–20 percent of all street trees throughout North America. In the United States, urban areas cover about 3.5 percent of the total land area, contain more than 75 percent of the population, and support about 3.8 billion trees. The City of Chicago has approximately 603,000 ash trees that provide 14.4 percent of leaf area (FR, 2003). Trees are considered vital to the health of cities because they sequester gaseous air pollutants and particulate matter, help people conserve energy through the shade they provide, assist in the dispersal of storm water, provide shelter belts for urban fauna, and contribute aesthetic pleasure to the lives of city-dwellers and tourists. Ash is a vital component of the urban forest.

IV. Environmental Consequences

A. No Action Alternative

1. Impact of EAB

EAB is an invasive wood-boring beetle that is spreading rapidly and poses a serious threat to ash trees in the United States if not controlled. Despite state and federal quarantines designed to contain EAB, there is a lack of effective methods to detect and control EAB. Besides natural dispersal, the spread of EAB has been accelerated through human-assisted movement of infested ash firewood, timber, solid-wood packing materials, and nursery stock. As EAB spreads throughout North America, regulatory agencies, land managers, and the public are seeking sustainable management tools to reduce EAB population densities and to slow its spread (Cappaert et al., 2005; GAO, 2006; Poland and McCullough, 2006). Since its discovery, EAB has killed tens of millions of ash trees and has cost municipalities, property owners, nursery operators and forest products industries tens of millions of dollars.

Trees in the genus *Fraxinus* are important components of many forested ecosystems throughout North America and are planted extensively as urban and shelterbelt trees. USDA Forest Service Forest Inventory and Analysis estimates that establishment of EAB throughout the United States could result in loss of approximately 2.6 percent of trees in timberlands or 7.5 billion trees (USDA FS, 2006). White, blue, and Oregon ash grow on fertile uplands and river terraces; green, black, Carolina, and pumpkin ash are wetland species; and velvet and single-leaf ash grow in semi-deserts and canyons. If EAB populations are not managed, ash resources throughout North America will be devastated (MacFarlane and Meyer, 2005). The loss of ash over large geographical areas will adversely affect water, soil, and air, resources. Ash is an important riparian tree and is often found along river banks. Removing ash from stream banks will affect bank soil retention and stream processes.

2. Impact from the Use of Other EAB Control Methods

The continued use of physical, chemical, and biological control at current levels would result if the “no action” alternative is chosen, and may continue even if permits are issued for environmental release of *S. galinae.*

a. Physical Control

Although physical control may slow the spread of EAB to other ash trees in an area, this method is not effective at controlling the EAB population. It is likely that ash trees in the area will eventually become infested.

b. Chemical Control

Insecticide treatment of ash trees for EAB control is inconsistent in effectiveness, especially on larger trees. Results have been mixed in insecticide efficacy studies; in some sites, insecticides are effective but fail in other sites (Herms et al., 2009). In addition, insecticide treatment does not guarantee that the tree will be protected from EAB attack. Trees with greater than 50 percent canopy loss are unlikely to recover even if treated with insecticides (Herms et al., 2009). Foliar and bark treatments can result in pesticide drift that affects non-target organisms in the treatment area, and trunk injections can cause damage to the injected tree. Insecticide treatments can be costly, especially on large trees and must be repeated annually to be effective, although emamectin benzoate is effective for two years or longer (Herms et al., 2009).

Insecticide treatments are useful to protect certain high value trees but are not practical for controlling EAB over a large area or forest situation. Besides being costly, there are label restrictions on the amount of insecticide that can be applied per acre per year.

c. Biological Control

All three parasitoid species that have been previously released against EAB (*Oobius agrili, Tetrastichus planipennisi,* and *Spathius agrili*) have been recovered following release in the United States; however, only *T. planipennisi* and *O. agrili* have been recovered consistently more than one year after release. At two sites in Michigan, parasitism by *O. agrili* increased from 3-4 percent in the year of release to 20–28 percent two years later. *Tetrastichis planipennisi,* a stronger flier than *O. agrili,* has effectively spread and established. At six intensively studied sites in Michigan, 92 percent of the trees at the release site contained at least one brood of *T. planipennisi* four years after release, and parasitism levels increased steadily to an average of over 20 percent (Duan et al., 2013a). Parasitism by *T. planipennisi* at the six control sites (at least 1 kilometer away) also increased yearly to an average level of 13 percent. The story was not the same for *S. agrili*. At a release site near Hawley, Michigan, 18 percent of the EAB were parasitized by *S. agrili* after one year; however, a sample of 40 entire trees the following year revealed not a single parasitoid. At another site, parasitism one year after release was 45 percent, two broods were discovered the following year and two broods were recovered in 2011, but parasitism by *S. agrili* has been very low. At the six intensively sampled study sites, *S. agrili* was recovered in yellow pan traps, but only two EAB larvae parasitized by this species have been recovered after 2–5 years of sampling. One possible explanation is that *S. agrili* was collected from Tianjin, China, which is near the southern limit of the EAB distribution in China, and the climate there is a better match for the central rather than the northern United States. There may be a problem with synchrony between the emergence of adult *S. agrili* and availability of the mature EAB larvae that they attack.

Although *O. agrili* and *T. planipennisi* are establishing and dispersing, both have limitations that affect their ability to successfully control EAB populations. *Oobius agrili* is a very small insect, dispersing much more slowly than *T. planipennisi*. It is also solitary, with only one adult emerging from an EAB egg, although it is important because it prevents damage to the phloem caused by EAB larvae. *Tetrastichus planipennisi* is a gregarious larval parasitoid, producing an average of 57 adults per EAB larva (Liu et al., 2003; 2007; Yang et al., 2006; Ulyshen et al., 2010); however, it is a relatively small insect with a short ovipositor (egg-laying organ) and cannot parasitize EAB larvae under the thick bark of larger trees (Abell et al., 2012). *Tetrastichus planipennisi* cannot oviposit in bark thicker than 3.2 millimeters (mm), which means it is limited to attacking EAB in the top of mature trees or in smaller trees (stems <11.2 centimeters (cm) diameter). It is anticipated that *T. planipennisi* will be most effective in stands of small, early successional ash rather than in mature forests.

B. Biological control alternative (preferred alternative)

1. Environmental and Economic Impacts of the Proposed Release of *S. galinae*

a. Known impact on vertebrates including humans: *Spathius galinae* is an obligate parasitoid of wood boring larvae, specifically EAB. As such, it will rarely come into contact with humans or other vertebrates, and if it does, it is incapable of stinging or biting. Braconid wasps have no known adverse impacts on humans or other vertebrates.

b. Direct impact of *S. galinae* (e.g., intended effects on EAB, direct effects on non-targets). Percentage parasitism by *S. galinae* in Russia can reach 63 percent in stands of green ash (*Fraxinus pennsylvanica*) (Duan et al., 2012a). Because *S. galinae* has at least two generations per year compared with just one (univoltine) or half (semivoltine) for EAB, generational percentage parasitism will be greater than that measured during a single collection. *Spathius galinae* clearly has the potential to cause considerable mortality to EAB populations. In Asia, it is probable that EAB is not typically a pest because of the interaction between host plant resistance and natural enemies. While it is clear that American ash species are not resistant to EAB per se, they can withstand some attack as evidenced by callusing of EAB galleries, and woodpeckers can remove a considerable percentage of overwintering larvae. In Michigan, 32 to 42 percent of EAB larvae were removed by woodpeckers (Duan et al., 2010; 2013a) and a 2012 study at sites in Ulster County in New York found that woodpeckers removed between 40 and 65 percent of mature EAB larvae (Gould and Vandenberg, unpublished). Duan et al. (2010) also found that tree defenses in lightly infested young green ash killed 10 to 12 percent of EAB larvae. *Spathius galinae* will not have to cause 100 percent mortality of EAB to beneficially affect the health of ash stands, because ash can successfully withstand some attack.

To evaluate the effects of *S. galinae* on non-target insect species, no-choice and choice host specificity tests were conducted in the United States to determine the physiological host range of *S. galinae* and possible direct effects on non-target species. Between 2011 and 2013, 15 North American species of wood-boring insects were exposed to *S. galinae* by scientists at the ARS Beneficial Insects Introduction Research Unit and PPQ to assess the parasitoid's host range. *Spathius galinae* finds hosts to parasitize by using cues associated with sounds or vibrations produced by feeding borer larvae. Studies have shown that they do not attack prepupae or molting larvae that are not feeding (Duan et al., 2013c). All test larvae, therefore, had to be feeding inside their natural hosts during testing. To accomplish this, bark flaps were created in 4-8 cm diameter logs and a 3 cm long groove was drilled underneath each flap. The test larvae were placed in these grooves, and the flaps were reassembled and secured with rubber bands. The logs were placed into plastic jars that contained five one-week old *S. galinae* females and one male. The parasitoids were fed honey streaked on the fabric covering the lid of the jars. Every time a test was initiated with one or more non-target hosts, the same number of EAB larvae was tested in ash as a positive control to demonstrate that the wasps used in the tests were physiologically ready to attack suitable hosts. After two weeks, the larvae were checked to determine if they were parasitized. All parasitized larvae were held for at least 4 weeks to determine if *S. galinae* could develop to the adult stage. For the choice tests, gravid females of *S. galinae* were presented simultaneously to both an ash log containing five target host larvae (EAB) and an ash or non-ash log containing five non-target host larvae in a test arena (ventilated-clear polystyrene crisper boxes,each 17.6 × 12.6 × 10 cm, Tri-State Plastics, Latonia, KY). After a period of 2-weeks of exposure, the logs were incubated in normal rearing conditions for two weeks and scored for parasitism by *S. galinae* as previously described for the no-choice test.

The larvae of fifteen wood-boring insects were tested to assess the host specificity of *S. galinae* (Table 1). Emphasis was placed on species closely related to the target pest or those feeding on ash. Thirteen species were wood-boring beetles; one clearwing moth (Lepidoptera: Sesiidae) and one sawfly (Hymenoptera: Cephidae) were also tested. Of the beetles, five were in the genus *Agrilus,* and were thus closely related to the EAB, and another was in the same family (Buprestidae). Three of the tested insects, the longhorned beetle *Neoclytus acuminatus*; the clearwinged moth *Podosesia* spp.; and the eastern ash bark beetle, *Hylesinus fraxini* attack ash as their main host and would be susceptible to parasitism if *S. galinae* accepts any boring insects infesting ash.

Spathius galinae only attacked one species other than the EAB, and that was the gold spotted oak borer, *Agrilus auroguttatus* in red oak. The rate of parasitism was, however, considerably less (41 percent) on the non-target host than on the EAB (71 percent) under test conditions that strongly favored parasitism. *Spathius galinae* did not attack any of the other three species infesting red oak, nor did they attack any of the other *Agrilus* or any of the three non-*Agrilus* species infesting ash.

Table 1. Host specificity testing of *S. galinae* against sixteen species of wood-boring insects. EAB larvae were used in each trial as a positive control (from Gould and Duan, 2013).

Test Species	Order/Family	Choice or no choice	Host Plant	No. of Replicates	# viable hosts	Parasitism Rate	*S. galinae* Progeny Per Host (± SE)
Agrilus anxius	Coleoptera: Buprestidae	none	Birch	5	18	0%	
Agrilus planipennis	Coleoptera: Buprestidae	none	Ash	5	12	67%	8.0 ± 1.4
Agrilus anxius	Coleoptera: Buprestidae	choice	Birch	5	11	0%	
Agrilus planipennis	Coleoptera: Buprestidae	choice	Ash	5	23	91%	6.7 ± 0.3
Agrilus masculinus	Coleoptera: Buprestidae	none	Maple	16	42	0%	
Agrilus planipennis	Coleoptera: Buprestidae	none	Ash	15	52	33%	7.1 ± 0.5
Agrilus sulcicollis	Coleoptera: Buprestidae	none	Red Oak	10	38	0%	
Agrilus bilineatus	Coleoptera: Buprestidae	none	Red Oak	10	45	0%	
Agrilus planipennis	Coleoptera: Buprestidae	none	Ash	10	37	62%	5.6 ± 0.7
Agrilus auroguttatus	Coleoptera: Buprestidae	none	Red Oak	10	44	41%	5.4 ± 1.4
Unknown Cerambycidae	Coleoptera: Cerambycidae	none	Red Oak	10	48	0%	
Agrilus planipennis	Coleoptera: Buprestidae	none	Ash	10	48	71%	5.8 ± 0.7
Chrysobothris spp.	Coleoptera: Buprestidae	none	Maple	4	12	0%	
Agrilus planipennis	Coleoptera: Buprestidae	none	Ash	4	17	65%	5.4 ± 1.3
Anoplophora glabripennis	Coleoptera: Cerambycidae	none	Maple	13	65	0%	
Agrilus planipennis	Coleoptera: Buprestidae	none	Ash	9	44	57%	5.1 ± 0.8

Test Species	Order/Family	Choice or no choice	Host Plant	No. of Replicates	# viable hosts	Parasitism Rate	*S. galinae* Progeny Per Host (± SE)
Anoplophora glabripennis	Coleoptera: Cerambycidae	choice	Maple	9	20	0%	
Agrilus planipennis	Coleoptera: Buprestidae	choice	Ash	9	32	100%	7.0 ± 0.4
Elaphidion mucronatum	Coleoptera: Cerambycidae	none	Maple	10	38	0%	
Agrilus planipennis	Coleoptera: Buprestidae	none	Ash	10	45	29%	4.2 ± 0.9
Neoclytus acuminatus	Coleoptera: Cerambycidae	none	Ash	11	49	0%	
Agrilus planipennis	Coleoptera: Buprestidae	none	Ash	11	36	83%	3.6 ± 0.7
Neoclytus acuminatus	Coleoptera: Cerambycidae	none	Maple	10	41	0%	
Agrilus planipennis	Coleoptera: Buprestidae	none	Ash	10	38	47%	5.7 ± 0.7
Urographus fasciatus	Coleoptera: Cerambycidae	none	Maple	6	25	0%	
Agrilus planipennis	Coleoptera: Buprestidae	none	Ash	9	32	50%	5.6 ± 0.9
Isorhipis obliqua	Coleoptera: Eucnemidae	none	Maple	6	15	0%	
Agrilus planipennis	Coleoptera: Buprestidae	none	Ash	6	10	30%	8.0 ± 1.0
Hylesinus fraxini	Coleoptera: Curculionidae	none	Ash	10	52	0%	
Agrilus planipennis	Coleoptera: Buprestidae	none	Ash	10	42	98%	4.5 ± 0.5
Podosesia spp.	Lepidoptera: Sesiidae	none	Ash	6	24	0%	
Agrilus planipennis	Coleoptera: Buprestidae	none	Ash	6	22	36%	6.3 ± 1.1
Janus abbreviatus	Hymenoptera: Cephidae	none	Willow	10	37	0%	
Agrilus planipennis	Coleoptera: Buprestidae	none	Ash	15	55	78%	5.7 ± 0.8

2. Effects on the Physical Environment and Indirect Effects of the Release of *S. galinae*

a. Effects on physical environment (e.g. water, soil and air resources): Trees in the genus *Fraxinus* are important components of many forested ecosystems throughout North America and are planted extensively as urban and shelterbelt trees. USDA Forest Service Forest Inventory and Analysis estimates that establishment of EAB throughout the United States could result in loss of approximately 2.6 percent of trees in U.S. timberlands or 7.5 billion trees (USDA, FS, 2006). White, blue, and Oregon ash grow on fertile uplands and river terraces; green, black, Carolina, and pumpkin ash are wetland species; and velvet and single-leaf ash grow in semi-deserts and canyons. If EAB populations are not managed, ash resources throughout North America could be devastated (MacFarlane and Meyer, 2005). The loss of ash over large geographical areas will adversely affect water, soil, and air, resources. Ash is an important riparian tree and is often found along river banks. Removing ash from stream banks will affect bank soil retention and stream processes. The successful deployment of EAB biocontrol agents such as *S. galinae* will have a positive impact on the physical environment by moderating EAB population increase, thus limiting tree damage. Conservation of ash trees in North American timberlands and urban forests will result in less flooding and soil erosion and moderate changes in air quality.

b. Indirect effects (e.g. potential impacts on organisms that depend on EAB or non-target species including potential competition with resident biological control agents). Successful management of EAB using biological control agents, including *S. galinae*, will result in positive, indirect effects on U.S. municipalities, land owners, wood industries, Native American basketry, air quality, forest biodiversity, wildlife, riparian areas, wildlife, and organisms dependent on *Fraxinus* spp. (e.g., the cerambycid: red-headed ash borer, *Neoclytus acuminatus;* the sphingid: great ash sphinx, *Sphinx chersis*). Organisms most directly affected by EAB-associated ash demise will be those directly dependent on ash trees, such as ash-specialist plant-feeding arthropods (Gandhi and Herms, 2010), including several Lepidoptera (butterflies, moths, and skippers) species identified at high risk of endangerment (Wagner, 2007). *Fraxinus pennsylvanica* provides food and nesting for songbirds and food and shelter for mammals (USDA, NRCS, 2003). *Fraxinus nigra* seeds are consumed by game birds, songbirds and small mammals and used as browse by white-tailed deer and moose (Wright et al., 1990). Beavers also use ash as a food resource (Henry and Bookhout, 1970).

The indirect effects on a few biological control projects that utilize *Agrilus* species to control weeds must be considered. *Agrilus hyperici* was released against Klamath weed (St. John’s wort) in the western United

States and has shown mixed results. In northern Idaho it is beneficial in assisting two Klamath weed beetles, *Chrysolina* sp., in controlling the target weed (Campbell and McCaffery, 1991), but in California it has been displaced by *Chrysolina quadrigemina* (McCaffrey et al., 1995). *Agrilus hyperici* is a root feeder acting on a rangeland weed and it is not likely to come in contact with populations of *S. galinae*. Another exotic buprestid, *Sphenoptera jugoslavica*, also a root feeder, was released against spotted, diffuse, and squarrose knapweeds. *Spathius galinae* attacks larvae in branches and trunks in forest ecosystems. It is unlikely that *S. galinae* will be attracted to rangeland habitats or to attack larvae in the roots of herbaceous plants. *Spathius galinae* is not known to search for hosts underground and is not likely to attack *A. hyperici* or *S. jugoslavica*.

3. Uncertainties Regarding the Environmental Release of *S. galinae.*

Once a biological control agent such as *S. galinae* is released into the environment and becomes established, there is a slight possibility that it could move from the target insect (EAB) to attack nontarget insects, such as native *Agrilus* species. Based on host specificity testing conducted, *S. galinae* only attacked one species other than the EAB, and that was the gold spotted oak borer, *Agrilus auroguttatus,* in red oak. The rate of parasitism was considerably less (41 percent) on the non-target host than on EAB (71 percent) under test conditions that strongly favored parasitism. Native species that are closely related to the target species are the most likely to be attacked (Louda et al., 2003). If other insect species were to be attacked by *S. galinae*, the resulting effects could be environmental impacts that may not be easily reversed. Biological control agents such as *S. galinae* generally spread without intervention by man. In principle, therefore, release of these parasitoids at even one site should 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. Post-release evaluations of *S. galinae* populations and their effects on EAB and other non-target species will be conducted by the permittee.

In addition, these agents may not be successful in reducing EAB populations in the continental United States. Approximately 12 percent of all parasitoid introductions have led to significant sustained control of the target pests, but the majority of introductions have failed to provide control of the pest (Greathead and Greathead, 1992) either because introduction did not lead to establishment or establishment did not lead to control (Lane et al., 1999). Actual impacts on EAB populations by *S. galinae* will not be known until after release occurs and post-release monitoring has been conducted. For instance, although *Oobius agrili* and

Tetrastichus planipennisi are establishing and dispersing, both have limitations that affect their ability to successfully control EAB populations that were not known until after their release. Parasitism of EAB by *Spathius agrili* has also been much lower than expected.

The environmental consequences discussed under the "no action" alternative may occur even with the implementation of the biological control alternative, depending on the efficacy of *S. galinae*, in combination with the other organisms released for biological control of EAB, to reduce EAB populations in the continental United States.

4. 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).

APHIS has put quarantines in place to prevent the movement of EAB out of EAB-infested areas of the United States (7 CFR Subpart 301.53). This area may expand as new infestations are discovered. Quarantines are put in place to prevent the artificial spread of EAB through movement of infested firewood or other infested wood materials. In addition, APHIS, in cooperation with the appropriate State Departments of Agriculture, conducts survey program to determine new areas of EAB infestation. These methods do not control EAB but slow the spread or provide infestation information to state departments of agriculture for implementation of quarantines.

Homeowners apply insecticides or hire arborists and tree care professionals to make applications to protect high-value ash trees in the landscape. Landowners may conduct a salvage harvest should EAB be detected in their ash trees. Insecticide applications and tree removals provide a temporary local reduction of EAB but do not result in long term control.

Because little can be done to control EAB, research is being conducted at universities and by Federal agencies to understand the beetle's life cycle and find ways to detect new infestations, control EAB adults and larvae, and contain the infestation.

Release of *S. galinae* will have no negative cumulative impacts in the continental United States because of its host specificity to EAB, other than potential impacts on non-target *Agrilus* species such as the gold spotted oak borer, *Agrilus auroguttatus*. However, based on host-specificity testing conducted, impacts to non-target *Agrilus* spp. are expected to be minimal because *S. galinae* clearly preferred EAB. Effective biological control of EAB will have beneficial effects to current EAB management activities, and may result in protection of ash resources and reduction in removals of infested trees.

5. 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 or endangered species or result in the destruction or adverse modification of critical habitat.

Only one wood boring insect is listed as threatened under the ESA, the valley elderberry longhorned beetle (*Desmocerus californicus dimorphus*) and none are listed as endangered. The valley elderberry longhorned beetle mines the interior wood of the host plant, which must be at least 2.5 cm in diameter (Paine et al., 2004), where it would not be accessible to the relatively short ovipositor of *S. galinae*. In addition, the valley elderberry longhorned borer is not closely related to EAB, and elderberry is not closely related to ash. Therefore, release of *S. galinae* will have no effect on the valley elderberry longhorned beetle or its designated critical habitat. *Spathius galinae* must attack its hosts, even EAB, as they are feeding beneath the bark of trees; therefore *S. galinae* will have no effect on any other threatened or endangered insects (or their critical habitat), which are all external feeders.

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. No environmental or human health effects from the proposed action are expected and there will be no 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 are involved in implementing the preferred alternative. Therefore, it is expected that no disproportionate effects on children are anticipated as a consequence of implementing the preferred alternative.

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….” Consistent with EO 13175, in April and May, 2014, APHIS sent letters of notification and requests for comment and consultation on this proposed action to tribes in 32 states, reflecting the very wide national distribution of ash (*Fraxinus* spp.) in the lower 48 states. APHIS received responses from the Quartz Valley Indian Reservation (California), the Sokaogon Chippewa Community (Wisconsin), and the Houlton Band of Maliseets (Maine). In June, 2014, APHIS conducted a phone conversation with the Seneca Nation (New York) who expressed support at the end of the call. Contacts were made informally with other tribes in New York, followed by calls in July and August 1, 2014. On August 1, APHIS officials participated in informal consultation, via telephone, with representatives from the Saint Regis Mohawk Tribe and the Shinnecock Nation, both in New York. The Saint Regis Mohawk Tribe supported the action, while the Shinnecock Nation wished to further examine the documents. The Shinnecock Nation subsequently indicated they had no further questions. Some of these tribes have expressed interest in participating in *S. galinae* releases and monitoring activities. 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

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
Plant Protection and Quarantine
Otis Pest Survey, Detection, and Exclusion Laboratory
Building 1398
Otis ANGB, MA 02542-5008

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Policy and Program Development
Environmental and Risk Analysis Services
4700 River Road, Unit 149
Riverdale, MD 20737–1238

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Appendix 1. Response to comments.

The draft EA was made available to the public in the Federal Register (docket APHIS-2014-0094) from February 12, 2015 to March 16, 2015. Ten comments were received on the draft EA. Five were in support of the proposed release of *S. galinae.* One comment was unrelated to the proposed release and was a general complaint against APHIS' Wildlife Services.

Four commenters had questions or concerns about the release. These comments are addressed below.

1. Three commenters were concerned about non-target impacts of *S. galinae*. What is the effect of parasitism on the gold spotted oak borer? If the gold spotted oak borer experiences a decrease in population numbers, could this result in an 'outbreak' in population numbers of other species to fill the void in the food web or might species that predate on the gold spotted oak borer experience a decline if the gold spotted oak borer is not available to its native predator(s)? Will the effects on gold spotted oak borer, and its natural predator(s), be monitored by APHIS or another agency or academic institution?

No biological control agent has ever completely eliminated its host. Therefore, it is expected that the emerald ash borer will always be available for *S. galinae.* As discussed on pages 14 and 18 of this EA, based on host specificity testing conducted, *S. galinae* only attacked one species other than the emerald ash borer, and that was the gold spotted oak borer, *Agrilus auroguttatus,* in red oak. Parasitism attack rates on *A. auroguttatus* were approximately half the levels seen for *A. planipennis*. It is possible that *S. galinae* will occasionally attack a few non-target *Agrilus* species, but host specificity testing predicts minimal impact. Even under no choice test conditions, *S. galinae* rejected four other *Agrilus* species, and these are the species they are more likely to encounter in the eastern United States where the majority of the ash resource occurs. In host specificity testing, *S. galinae* was even more host specific than the previous biological control organisms released for emerald ash borer control.

Researchers intend to monitor the impacts of *S. galinae* on non-target species. They have been collecting data on impacts of previously introduced emerald ash borer parasitoids on ash phloem feeding insects (clear wing moths and redheaded ash borer) and *Agrilus* species (*A. anxius* and *A. bilineatus*) in both Michigan and Maryland, and have observed limited parasitism of these non-target insects by previously introduced parasitoids (one bronze birch borer was parasitized by *Spathius agrili;* this was not unexpected based on the host-specificity testing that was conducted for that agent). The researchers plan to do the same with *S. galinae* when it is released.

The possibility of risk of the potential *S. galinae* introduction to some non-target *Agrilus* species in North America needs to be balanced against the potential benefit that could result from successful biological control of the emerald ash borer. Emerald ash borer has now spread to 25 U.S. states and two Canadian provinces and killed tens of millions of North American ash trees along with the spread. It has been estimated that eight billion ash trees in U.S. forests and woodlands are vulnerable to the emerald ash borer. Uncontrolled spread of emerald ash borer in the United States will have adverse impacts on many non-target species and there are no methods available to control it at this time. The loss of ash over large geographical areas will adversely affect water, soil, and air resources.

2. One commenter questioned the sting/venom/allergic potential of *S. galinae.*

As stated on page 13 of this EA, *S. galinae* is an obligate parasitoid of wood boring larvae, specifically emerald ash borer. As such, it will rarely come into contact with humans or other vertebrates, and if it does, it is incapable of stinging or biting. Braconid wasps have no known adverse impacts on humans or other vertebrates.

3. One commenter asked whether *S. galinae* requires a very warm climate.

As described on pages 4 to 7 of this EA, *S. galinae* does not require a very warm climate.

4. One commenter asked what the sensitivities are to various insecticides present in the emerald ash borer infested region.

Although it was unclear as to what insecticide sensitivity the commenter was referring to, it was interpreted as human sensitivity. As described on page 3 of this EA, several systemic and protective cover insecticides are used against emerald ash borers. A portion of the human population is sensitive to insecticides, although the percentage of sensitivities to the insecticides used against emerald ash borer in the infested area of the United States is not known. Regardless of whether the commenter was referring to human sensitivity to insecticides or the sensitivity of other organisms to insecticides, the release of *S. galinae* is expected to reduce the need for the use of insecticides against the emerald ash borer, thus having a beneficial effect to any organisms with insecticide sensitivity.

5. Was the use of native woodpeckers considered as a control method in combination with other options? A third alternative, which evaluates a

multi-factorial approach combining control methods, such as native woodpeckers, along with selective chemical control, would help illustrate why the preferred method was selected. This discussion should include relative costs and risks in greater detail than is currently provided.

The use of woodpeckers as a control method is beyond the scope of this EA, and does not meet the purpose and need for the proposed action, although woodpeckers are a significant source of mortality of emerald ash borer (Cappaert et al., 2005). The proposed action is the permitting of *S. galinae*, not a general control program for the emerald ash borer. Although other methods of control are discussed in the EA for informational purposes, these are beyond the purview of the APHIS-PPB Permit Unit. The Plant Protection Act of 2000 provides the PPB Permit Unit with the authority to issue permits for release of biological control agents as requested by permit applicants. The preferred alternative was selected because of the host specificity of *S. galinae* and its potential as a stand-alone method for control of emerald ash borer, regardless of any other methods of control that are being used. The only decision available to the PPB Permit Unit is whether or not to issue the permit to release *S. galinae.*

The alternatives could be potentially infinite if the PPB Permit Unit analyzed all of the possible emerald ash borer control tools and their combinations. If the PPB Permit Unit were analyzing a proposed control program for the emerald ash borer, these alternatives (or a selected suite of them) would be appropriate, but not for the decision to issue a permit for the environmental release of a biological control organism.

6. What is the plan of control in the event that *S. galinae* moves from the target (emerald ash borer) to other non-target *Agrilus* species? If establishment occurs, but does not lead to control, what species will *S. galinae* be preying upon, what are the potential negative impacts of those relationships, and how will the *S. galinae* population be controlled? What are the costs associated with that control?

As stated in the response to comment 1, *S. galinae* is expected to only occasionally attack some non-target *Agrilus* species. Even under no choice test conditions, *S. galinae* rejected four *Agrilus* species, and these are species that *S. galinae* is likely to encounter in the eastern United States where the majority of the ash resource occurs. In host specificity testing, *S. galinae* was even more host specific than the previous biological control organisms released for emerald ash borer control. Emerald ash borers are abundant in the environment, while native *Agrilus* species are less abundant and difficult for *S. galinae* to locate. If *S. galinae* establishes but does not control the emerald ash borer, it would still continue to parasitize it as its preferred host. There would be no negative impacts expected from this other than the emerald ash borer would continue to spread unabated.

However, if extensive non-target effects are observed, APHIS would not issue any more permits for releases or interstate movement of *S. galinae*, although the organism would continue to spread naturally if it became established. There would not likely be a control program implemented against *S. galinae* even if extensive non-target impacts were observed.

7. Specific details concerning costs of other control measures would be helpful to evaluate various control options and how they could possibly be used in combination with other methods. Additionally, a discussion of potential costs associated with the unbridled increase of *S. galinae* should be discussed.

The cost of other control measures for emerald ash borer is beyond the scope of this EA. However, APHIS alone has spent $300 million to combat the emerald ash borer since 2002 when it was first detected here. This does not include spending by other Federal agencies or the costs to states, towns, or homeowners for emerald ash borer control, tree removal, and replanting. Kovacs et al. (2010) used simulations of emerald ash borer spread and infestation for 2009-2019 to estimate the cost of ash treatment, removal, and replacement on developed land in a 25-state study area. They estimated that 38 million ash trees occur on this land base and predict that it would require treatment, removal, and replacement of more than 17 million ash trees with a mean discounted cost of $10.7 billion (Kovacs et al., 2010). In contrast, to collect, test, and rear *S. galinae*, the cost to the permit applicant was approximately $500,000. If *S. galinae* establishes and spreads, it becomes self-perpetuating and there is no additional cost besides monitoring costs.

8. EPA recommends adding any correspondence between APHIS and U.S. Fish and Wildlife Service (USFWS) regarding this issue as an appendix to the EA. In particular, we recommend that APHIS obtain and document concurrence from USFWS on APHIS' preliminary determination of no effect on the valley elderberry longhorned beetle.

APHIS made a no effect determination for the valley elderberry longhorned beetle, and justified that determination based on the unrelatedness of the longhorned beetle to the emerald ash borer and the inability of *S. galinae* to oviposit in valley elderberry longhorned beetle larvae because the ovipositor is too short. Therefore, APHIS is not required to consult with or receive concurrence from the USFWS.

9. EPA recommends USDA analyze the potential for the anticipated loss of ash trees, 2.6 percent as estimated by the U.S. Forest Service, to contribute to climate change. Alternatively, analysis of the average anticipated loss of ash at a more localized geographical level may be more

informative.

It has been estimated that eight billion ash trees in U.S. forests and woodlands are vulnerable to the emerald ash borer. Although the impact of the loss of ash trees on climate change is an important issue, it is beyond the scope of this EA. However, the release and establishment of *S. galinae* is expected to reduce the loss of ash trees and thus, will help to reduce the effects of tree loss on climate change.

10. EPA recommends APHIS discuss whether the ash flower gall could interfere with the efficacy of *S. galinae*.

The ash flower gall would have no effect on *S. galinae. Spathius galinae* does not use ash flowers. There is no plausible reason to believe that ash flower gall would interfere with *S. galinae.*

11. EPA recommends USDA advise states and communities impacted by EAB to replant using a variety of tree species native to the respective ecoregion of the country, thereby diversifying urban tree plantings.

APHIS works with State cooperators to detect, control and prevent the human-assisted spread of the pest in order to safeguard America's ash trees. Strategies to manage the pest focus on biological control, survey, and regulatory activities, combined with public outreach and education initiatives to promote program support and compliance. APHIS continues work to identify effective tools to manage and control EAB populations.

WWW.emeraldashborer.info is the national website developed by the Cooperative EAB Program and funded by the U.S. Forest Service as a resource and link to federal and state information. It contains current program information including: Quarantine information, maps, emerald ash borer signs and symptoms, ash tree identification, treatment options, tree replacement options, community preparedness plans, and on-going research.

References:

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Decision and Finding of No Significant Impact
for
Field Release of the Parasitoid *Spathius galinae* for the for the Biological Control of the Emerald Ash Borer (*Agrilus planipennis*) in the Contiguous United States
March 2015

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ) Pest Permitting Branch (PPB), is proposing to issue permits for release of an insect, *Spathius galinae* (Hymenoptera: Braconidae), in the contiguous United States. The agent would be used by the applicant for the biological control of emerald ash borer (EAB), *Agrilus planipennis* (Coleoptera: Buprestidae). Before permits are issued for release of *S. galinae*, APHIS must analyze the potential impacts of the release of this organism into the continental United States in accordance with USDA APHIS National Environmental Policy Act implementing regulations (7 Code of Federal Regulations Part 372). 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

or

http://www.aphis.usda.gov/planthealth/ea
(select the link entitled, "Emerald Ash Borer Programs").

The EA analyzed the following two alternatives in response to a request for permits authorizing environmental release of *S. galinae*: (1) no action, and (2) issue permits for the release of *S. galinae* for biological control of EAB. 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 physical, chemical, and biological control methods of EAB. These control methods described are not alternatives for decisions to be made by the PPB, but are presently being used to control EAB in the contiguous United States and may continue regardless of permit issuance for field release of *S. galinae.* Legal notice of the EA was made available in the Federal Register (docket APHIS-2014-0094) from February 12, 2015 to March 16, 2015. Ten comments were received on the draft EA. Comments were addressed in appendix 1 of the final EA.

I have decided to authorize the PPB to issue permits for the environmental release of *S. galinae*. The reasons for my decision are:

- This biological control agent is sufficiently host specific and poses little, if any, threat to the biological resources, including non-target insect species of the United States.

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

- *Spathius galinae* poses no threat to the health of humans.

- No negative cumulative impacts are expected from release of *S. galinae.*

- 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 *S. galinae* into the environment will be reversible, there is no evidence that this organism will cause any adverse environmental effects.

I have determined that there would be no significant impact to the human environment from the implementation of the preferred alternative (issuance of permits for the release of *S. galinae*) and, therefore, no Environmental Impact Statement needs to be prepared.

Emily Pullins [signature] ________________ April 20, 2015 ________________

Emily Pullins
Director
Regulations, Permits, and Manuals
Plant Health Programs
Plant Protection and Quarantine
Animal and Plant Health Inspection Service
U.S. Department of Agriculture

Date