ABSTRACT  The goldspotted oak borer, *Agrilus auroguttatus* Schaeffer (Coleoptera: Buprestidae), is an invasive wood-borer that was recently introduced into southern California from southern Arizona, and has caused the rapid mortality of thousands of native oaks. Biological control of *A. auroguttatus* is a management strategy of high interest, but is in its early stages, which is due, in part, to a lack of information on the basic biology and life history of this beetle. To address this shortcoming, studies were conducted in quarantine on the realized lifetime fecundity of *A. auroguttatus*, which was determined by comparing oviposition and larval emergence rates of females subjected to different dietary and mating treatments. Longevity and body size were also recorded for male and female adults under these treatments. Mean *A. auroguttatus* lifetime oviposition and larval emergence were similar in females that were continuously paired with either one or two males. Virgin females laid significantly fewer eggs and no larval emergence resulted from unfertilized eggs. The number of mates did not affect mean *A. auroguttatus* adult longevity, but a carbohydrate-enriched diet increased both mean longevity and lifetime oviposition by as much as 46 and 250%, respectively. There was no correlation between adult body size and lifetime oviposition, days to initial oviposition, larval emergence, and adult longevity. However, hind tibia length was marginally correlated with total oviposition period. For mass rearing *A. auroguttatus* eggs in the laboratory, pairing females with one male and providing adults with a continuous diet of 10% honey-water and oak foliage is recommended.

KEY WORDS  *Agrilus auroguttatus*, classical biological control, invasive pest, fecundity, longevity

The goldspotted oak borer, *Agrilus auroguttatus* Schaeffer (Coleoptera: Buprestidae), is a serious invasive pest of native oaks in southern California. Initially detected in San Diego County, CA, in 2004 (Westcott 2005), this wood-boring beetle was likely introduced into the area through the movement of infested oak firewood from its native range in southern Arizona. In Arizona, *A. auroguttatus* preferentially attacks oaks that are in decline (e.g., Emory oak, *Quercus emoryi* Torrey, and silverleaf oak, *Quercus hypoleucoides* A. Camus), and has never been considered a significant forest pest (Coleman et al. 2012). The impact of *A. auroguttatus* in southern California is much more severe than that observed in Arizona, as this insect aggressively attacks and kills healthy coast live oak (*Quercus agrifolia* Nee), California black oak (*Quercus kelloggii* Newberry), and canyon live oak (*Quercus chrysolepis* Liebm) (Coleman and Seybold 2008a). Mortality of these native species is estimated at >22,000 trees within the 212,460-ha infestation zone in San Diego (Coleman et al. 2011) and, more recently (2012), Riverside County (Jones et al. 2013).

Oak woodlands are unique environments in California that are composed of diverse native flora and fauna, and they contain the highest levels of biological diversity of any broad habitat in the state (Allen-Diaz et al. 2007). As foundation species, oaks greatly influence the functioning of these ecosystems because they impact microclimates, affect energy and nutrient inputs, and provide essential habitat and food resources for a variety of native wildlife (Ellison et al. 2005). Oak habitat is also economically important in California because it enhances property values (Diamond et al. 1987), provides more than two-thirds of range land for domestic livestock (Huntsinger et al. 1997), and is of significant esthetic and recreational value (Standiford and Tinnin 1996).

Management strategies for *A. auroguttatus* control are limited to protecting individual, highly valued trees (i.e., systemic and topical insecticides are used); preventing the spread of this insect through the sanitation of infested oak wood (i.e., wood solarization and grinding infested wood); or outreach efforts on the risks of moving infested firewood to reduce inadvertent spread into new areas. At this time, biological control may be the only feasible long-term method for controlling this pest on a forest scale because, compared with pesticide use, host-specific natural enemies are more likely to provide sustainable long-term cost-effective control with fewer nontarget impacts. How-
ever, developing a biological control program requires an understanding of the pest’s fundamental biological and life-history traits, of which nothing is known for *A. auroguttatus*. Before 2008, the only information available for *A. auroguttatus* was collection records from its native range in Arizona (Coleman and Seybold 2008a, 2008b).

Before *A. auroguttatus* was determined to be a significant cause of decline and mortality to native California oak species in 2008, there was no information available on the biology or life history of this insect (Coleman and Seybold 2008a). Since 2008, field studies in southern California suggested that most *A. auroguttatus* larvae complete their development to adulthood in a single year (Haavik et al. 2013). However, some larvae and pupae are present under bark in October, which indicates that some individuals may require >1 yr to complete development (Coleman and Seybold 2008a, Haavik et al. 2013). In the laboratory, *A. auroguttatus* adults feed on oak foliage. However, leaf feeding is minor and has never been observed in the field. After ≈2 wk of feeding under laboratory conditions, females are reproductively mature and begin to lay eggs individually on oak bark or artificial substrates. *A. auroguttatus* eggs have rarely been observed in the field due to their small size (=1 mm in width) and cryptic coloration. However, based on information from other *Agrilus* species (Loerch and Cameron 1984, Liu et al. 2007), it is likely that individual eggs are placed in bark crevices, which coupled with small size further compounds the difficulty of visual detection in the field. Once eggs hatch, larvae burrow through the bark to reach the vascular cambium, where they create feeding galleries. Repeated feeding damage to the phloem/xylem interface by *A. auroguttatus* larvae eventually results in tree death (Coleman and Seybold 2008b). When larval development is complete, larvae tunnel to the outer phloem to create pupal chambers underneath the outer bark. Following pupation, emerging adults chew D-shaped emergence holes to exit the tree.

The lack of information regarding the basic biology and life history of *A. auroguttatus* poses a significant challenge to our understanding and, ultimately, management of this pest. Knowledge of the biology and life history of a pest can aid in the selection of natural enemies for incipient biological control programs, as it may guide foreign exploration for natural enemies which will have the greatest deleterious impact on the pest by targeting the most vulnerable life stages (Shea and Kelly 1998, Buchle et al. 2005). Information about the occurrence and persistence of specific life stages and the effects of adult size on the abundance and viability of offspring can help with the development of laboratory-based mass-rearing programs for *A. auroguttatus*. In addition, quantification of expected lifetime and reproductive capabilities will increase understanding of factors affecting *A. auroguttatus* population dynamics, which could be useful in risk assessment models that rely on estimates of population growth and dispersal (Venette et al. 2010).

Currently, laboratory rearing of *A. auroguttatus* is restricted to the egg and neonate larval stages, and eggs are produced from field-collected adults or late instar larvae that emerge as adults in the laboratory. Methods for rearing *A. auroguttatus* from eggs to the adult stage have been investigated using emerald ash borer (*Agrilus planipennis* Fairmaire) rearing techniques such as an artificial diet (Blossey et al. 2000, Gould et al. 2011), as well as egg (L. S. Bauer, USDA Forest Service, personal communication) and larval insertions (Duan et al. 2011, Duan and Oppel 2012) into cut oak branches. None of these methods used for *A. planipennis* were successful in rearing *A. auroguttatus* from the egg to adult stage in quarantine. However, the ability to rear viable eggs in the laboratory from field-collected adults led to a focused search for egg parasitoids in Arizona, that, if found, could be evaluated as potential biological control agents of *A. auroguttatus* in California. Surveys for egg parasitoids were initiated in 2012 using sentinel egg masses, and resulted in the collection of the first known egg parasitoid of this beetle, a currently undescribed *Trichogramma* species (Lopez and Hoddle 2013). Determining factors that affect rearing of *A. auroguttatus* eggs in the laboratory would help maximize the number of eggs that could be used for research programs on this pest. For example, an abundant and a predictable egg supply would enable the deployment of sentinel eggs in both the native and introduced range of this beetle to survey for unknown species of egg parasitoids that could be considered for use in a classical biological control program. In addition, enhanced egg production techniques using field-collected *A. auroguttatus* in the laboratory would also be advantageous for testing the host specificity of potential biological control agents, and for mass rearing egg parasitoids for use in a classical biological control program against *A. auroguttatus* in California. Further, the degree-day requirements and egg hatching rates for *A. auroguttatus* across multiple temperatures could be quantified to provide a better understanding of how varying temperatures affect the development of this life stage.

An insect’s reproductive success can be affected by its size, nutrition, and access to mates. Body size has been shown to be correlated to fecundity in many insect species (Honek 1993, French and Hammack 2010, Lauzière et al. 2000). Nutritional quality (i.e., diet) and mating frequency have been demonstrated to influence insect longevity and reproduction (Tisdale and Sappington 2001, Keena 2002, Millar et al. 2003, French and Hammack 2011). Therefore, it is likely that the size of adult *A. auroguttatus*, nutritional quality, and mating success could influence the reproductive biology of this beetle both in the laboratory and nature. Consequently, the objectives of the studies reported here were: 1) to determine the effects of diet and mating status on the realized lifetime fecundity of *A. auroguttatus* females by comparing oviposition and larval emergence rates of females subjected to different dietary and mating treatments; and 2) to investigate the relationship between longevity and body size in adult male and female *A. auroguttatus*.
maintained under different diet and mating treatments. This laboratory investigation under quarantine conditions provides the first detailed life-history data for *A. auroguttatus*.

**Materials and Methods**

**Rearing of *A. auroguttatus* Adults.** *A. auroguttatus* adults were reared from infested *Q. agrifolia* and *Q. kelloggii* trees at two locations in southern California. In March–April 2011, infested trees were felled at several locations (exact locality data were not recorded) within the Cleveland National Forest, San Diego County, CA; cut into rounds (≈30 by 60 cm); and placed inside 15–30 emergence tents (1.83- by 1.83-m Lumite screen portable field cages, Bioquip Products, Rancho Dominguez, CA) located at the Camp Ole U.S. Forest Service Fire Station, Mt. Laguna, CA. The following April (2012), infested *Q. agrifolia* and *Q. kelloggii* trees were felled at William Heise County Park, Julian, CA (33°02′N/116°35′W; 1,280 m), and similarly cut into rounds and tented at William Heise County Park. From June to August each year, adults were collected daily from the emergence tents. Immediately after collection, live adults were maintained under different diet and mating treatments. This laboratory investigation under quarantine conditions provides the first detailed life-history data for *A. auroguttatus*.

Immediately after collection, live adults were transported under permit (CDFA Permit No. 2664; USDA-APHIS permit No. F526P-10-00667) to the Insectary and Quarantine Facility at the University of California, Riverside County. In addition, in April 2012, bark containing prepupae and pupae was removed from *A. auroguttatus*-infested *Q. agrifolia* and *Q. kelloggii* trees at William Heise County Park, and transported to the Insectary and Quarantine Facility at the University of California, Riverside, under the same permits. Newly emerged adults were collected daily from infested bark in quarantine from May to June 2012.

Following field cage and quarantine collections, recently emerged *A. auroguttatus* adults (<24-h-old) were randomly selected for placement into treatment combinations that were assembled from a mixture of different mating and diet treatments. For every treatment combination, the emergence date of adults was recorded, and newly emerged adults were introduced into 2.13-liter hand-grip rearing containers (11.7 by 12.1 by 18.1 cm, Candy Concepts Inc., Pewaukee, WI) held under ambient laboratory conditions (photoperiod of 14:10 [L:D] h, 23 ± 2°C, 30 ± 2% relative humidity [RH]) in quarantine, and where they remained until death. Each rearing container had a 2.1-cm-diameter hole in the lid that was used to hold each diet type. A cotton dental wick (3.8 by 1 cm, nonsterile Wrapped Rolls, Richmond Dental and Medical, Charlotte, NC) was placed into the lid hole, which allowed adults to safely access diet liquids. *Q. kelloggii* leaves used in specified diets were placed into condiment containers (holding respective diet liquids) through the lid hole along with a cotton wick. Diets (including condiment containers and dental wicks) were replenished every 3–4 d, a time interval shown in preliminary studies to be adequate.

**Data Collection.** The time (in days) to initial oviposition, realized weekly and lifetime fecundity, and total oviposition period for each female in each treatment were determined by removing the coffee filter paper daily (and replacing with fresh paper) and counting the number of eggs laid. Coffee filter papers were labeled by date and rearing container identification number, and were held in sealed petri dishes (photoperiod of 14:10 [L:D] h, 23 ± 2°C, 30 ± 2% RH) until larval emergence (i.e., eclosion of eggs) was complete. Larval emergence holes from eggs on each paper were counted. Egg counts were used to calculate average weekly and lifetime oviposition for individual *A. auroguttatus* females in each of the four mating treatments. Weekly oviposition of females within each mating treatment was calculated using the average number of eggs oviposited every 7 d following the initial oviposition event of each respective female. Larval emergence counts were used to calculate lifetime and percentage larval emergence for *A. auroguttatus* females in all treatments. Male and female longevity were recorded daily for all treatments.

Body size of males and females from all treatments was estimated by removing the right hind tibia and right elytron of each adult, and slide mounting in a balsam/clove oil mix to measure elytron length and width and tibia length. To slide mount each *A. auroguttatus* adult’s tibia and elytron, a balsam mix was made from ≈50% Canada balsam (CAS #8007-47-7, Spectrum Chemical Manufacturing Corporation, New Brunswick, NJ) and 20% clove (bud) oil (CAS...
Statistical Analyses. Female oviposition (the number of eggs oviposited per lifetime, to initial oviposition, and total oviposition period in days), larval emergence rates, and adult longevity were analyzed using analysis of covariance (ANCOVA) to determine the effects of body size, diet, and mating treatment on reproductive output. Total oviposition period and larval emergence data were not transformed before analysis. However, the time to initial oviposition was analyzed on an inverse scale, and the number of eggs laid per lifetime and adult longevity were log transformed to satisfy normality assumptions. Females fed a water-only diet had zero oviposition during this study and were therefore excluded from all oviposition data analyses. In addition, larval emergence was analyzed using observations with nonzero oviposition data. Tukey-Kramer tests were used to conduct pairwise comparisons for each significant factor in the ANCOVA. Finally, three measures of body size (elytron width, elytron length, and tibia length) were analyzed with ANCOVA to determine if a correlation between female fecundity and adult longevity existed. A t-test was used to compare the mean body sizes of male and female A. auroguttatus used in this study. All statistical analyses were conducted at the 0.05 level of significance and were performed using SAS 9.2 (SAS 2008).

Results

Fecundity. There were no significant differences between 2011 and 2012 for the total number of eggs laid per lifetime of experimental female A. auroguttatus ($F = 0.68; df = 1, 50; P = 0.42$), time to initial oviposition ($F = 0.94; df = 1, 47; P = 0.34$), total oviposition period ($F = 0.80; df = 1, 48; P = 0.38$), larval emergence ($F = 0.01; df = 1, 17; P = 0.94$), or adult longevity ($F = 0.29; df = 1, 161; P = 0.59$); therefore, the data from these 2 yr were pooled together. The average (mean ± SE) lifetime oviposition period (days), days to first oviposition, percentage larval emergence, and male (excluding T1) and female longevity (days) are shown in Table 1. The average (mean ± SE) weekly oviposition rates of females in T2, T3, and T4 fed either a water and Q. kelloggii leaf diet or a 10% honey-water and Q. kelloggii leaf diet are shown in Fig. 1. The mean number of eggs oviposited by A. auroguttatus females paired with zero, one, or...
two males, and fed water and *Q. kelloggii* foliage or a 10% honey-water and *Q. kelloggii* foliage, is shown in Fig. 2. The mean number of larvae that emerged from eggs oviposited by *A. auroguttatus* females paired with zero, one, or two males, and fed water and *Q. kelloggii* foliage, is shown in Fig. 3. Larval emergence did not differ between mating or diet treatments. All females fed a

![Fig. 1. Mean (±SE) weekly number of oviposited eggs following the initial oviposition of females fed a water and *Q. kelloggii* foliage diet (Diet 1), or a 10% honey-water and *Q. kelloggii* foliage diet (Diet 2), and paired with (a) zero males (one ♀ only), (b) one male (one ♀ × one ♂), or (c) two males (one ♀ × two ♂). Females fed a water-only diet (Diet 3) laid zero eggs throughout this study and were excluded from this figure. Different uppercase letters indicate a significant difference between mating treatments, and lowercase letters indicate a significant difference between diet types based on Tukey-Kramer means separation test with α = 0.05 (SAS 2008).](image1)

![Fig. 2. Mean number of eggs oviposited by *A. auroguttatus* females paired with zero (one ♀), one (one ♀ × one ♂), or two males (one ♀ × two ♂), and fed water and *Q. kelloggii* foliage (water and leaves), or a 10% honey-water and *Q. kelloggii* foliage diet (honey-water and leaves). Females fed a water-only diet laid zero eggs throughout this study and were excluded from this figure. Different uppercase letters indicate a significant difference between mating treatments, and lowercase letters indicate a significant difference between diet types based on Tukey-Kramer means separation test with α = 0.05 (SAS 2008).](image2)
water-only diet laid zero eggs (Table 1) and were excluded from Figs. 1–3.

**Body Size.** Adult body size was measured for all males \((n = 87)\) and females \((n = 80)\) used in this study. The average body size for males was 7.03 ± 0.06 mm (elytron length), 1.20 ± 0.03 mm (elytron width), and 1.56 ± 0.01 mm (tibia length). The average body size of females was 7.73 ± 0.07 mm (elytron length), 1.31 ± 0.01 mm (elytron width), and 1.68 ± 0.02 mm (tibia length). Females were significantly larger than males in elytron length \((t = 8.16; df = 163; P \leq 0.0001)\), elytron width \((t = 2.69; df = 163; P = 0.0079)\), and tibia length \((t = 5.82; df = 163; P \leq 0.0001)\).

**Influence of the Number of Mates on Female Fecundity and Adult Longevity.** The number of mates paired with female *A. auroguttatus* had a significant effect on lifetime oviposition \((F = 16.38; df = 2.50; P \leq 0.0001)\) and days to initial oviposition \((F = 9.20; df = 2.47; P \leq 0.0005)\). Total oviposition period \((F = 0.07; df = 2, 48; P = 0.94)\) and larval emergence rates \((F = 0.97; df = 1, 17; P = 0.34)\) were not influenced by the number of mates housed with each female. No larvae emerged from eggs laid by unmated \((T2)\) females. Pairwise comparisons using Tukey-Kramer showed that females with no access to males \((T2)\) laid significantly fewer eggs over their lifetime than females with access to one male \((T3)\) \((t = -6.03; df = 50; P \leq 0.0001)\) or two males \((T4)\) \((t = -4.42; df = 50; P \leq 0.0001)\). In addition, females with no access to males \((T2)\) experienced initial oviposition significantly later \((\approx 5–8 \text{ d})\) than females with access to one \((T3)\) male \((t = -3.42; df = 47; P = 0.004)\).

The number of males paired with females had no significant effect on adult \((male \text{ and } female)\) longevity \((F = 0.41; df = 3, 161; P = 0.75)\) across treatments. However, male and female longevities were significantly different \((F = 7.35; df = 1, 161; P = 0.008)\), with females, on average, living \(\approx 6–9\%\) longer than males (Table 1). The average longevity for *T1* males fed a water-only \((n = 7)\) diet was 12.4 ± 2.1 d. Males in *T1* fed a water and *Q. kelloggii* diet \((n = 8)\) lived, on average, 53.9 ± 6.4 d, and males fed a 10% honey-water and *Q. kelloggii* \((n = 8)\) diet lived, on average, 91.3 ± 17.2 d.

**Influence of Diet on Female Fecundity and Adult Longevity.** Diet type had a significant effect on lifetime oviposition (Fig. 2). Females fed 10% honey-water and *Q. kelloggii* leaves laid more eggs over their lifetime \((F = 15.49; df = 1, 50; P = 0.0003)\) and had a longer oviposition period \((F = 5.74; df = 1, 48; P = 0.02)\) than females fed a water and *Q. kelloggii* diet (Table 1). However, diet type had no significant effect on average larval emergence rates \((F = 1.51; df = 1, 17; P = 0.23)\) (Table 1).

Adult longevity was significantly affected by diet type \((F = 81.17; df = 2, 161; P \leq 0.0001)\). Male and female *A. auroguttatus* adults lived significantly longer when fed a 10% honey-water and *Q. kelloggii* leaf diet than a water and *Q. kelloggii* \((t = 5.10; df = 161; P = 0.0001)\) or water-only diet \((t = 11.80; df = 161; P \leq 0.0001)\) (Table 1).

**Influence of Body Size on Female Fecundity and Adult Longevity.** Adult body size was not significantly correlated with the majority of measured fitness parameters listed in Table 1. Lifetime oviposition, the main parameter used to assess fitness of individual female *A. auroguttatus*, was not correlated with elytron length \((F = 0.05; df = 1, 50; P = 0.82)\), elytron width \((F = 0.34; df = 1, 50; P = 0.56)\), or tibia length \((F = 0.03; df = 1, 50; P = 0.87)\). The period until initial oviposition was not correlated with any *A. auroguttatus* body measurement \((P \geq 0.05)\). Tibia length, however, was significantly, but marginally, correlated with the total oviposition period \((F = 4.43; df = 1, 48; P = 0.04)\) of females. In addition, elytron length, elytron width, and tibia length did not have a significant relationship with larval emergence or adult \((male \text{ and } female)\) longevity \((P \geq 0.05)\).

**Discussion**

**Influence of the Number of Mates on Female Fecundity and Adult Longevity.** *A. auroguttatus* females mate frequently when paired with males (V.M.L., per-
Influence of Diet on Female Fecundity and Adult Longevity. Lifetime oviposition for *A. auroguttatus* was greatest when females were fed a diet of a 10% honey-water solution and *Q. kelloggii* foliage, was reduced to zero when females were fed a water-only diet, and was intermediate when females were fed a water and *Q. kelloggii* leaf diet. Longevity was significantly greater when adults were fed a 10% honey-water and *Q. kelloggii* leaf diet. Sugar-enriched diets are known to increase the fecundity (Benschoter and Leal 1976, Heimpel et al. 1997, Baggen and Gurr 1998, Marchioro and Foerster 2013) and longevity (Benschoter and Leal 1976, Haynes 1985, Fadamiro and Baker 1999, Lauzière et al. 2000, Tisdale and Sappington 2001, Simmons et al. 2012) of many insects, and are therefore a useful and cost-effective addition to mass-rearing programs. *A. auroguttatus* females had an ~140–250% increase in average lifetime egg production, an approximate 44–97% increase in total oviposition period (i.e., 21–42 d longer), and lived, on average, ~23–50 d longer (i.e., 27–69% longer) when given an additional carbohydrate resource in the form of 10% honey-water than females that were fed *Q. kelloggii* leaves and water only. The lack of oviposition from females given only water suggests that adult feeding on oak leaves is a necessary requirement for *A. auroguttatus* egg maturation and oviposition. However, the lack of diet-induced effects on *A. auroguttatus* larval emergence indicates that egg viability was not influenced by the consumption of additional carbohydrates in the 10% honey-water solution in combination with oak leaves.

Influence of Body Size on Female Fecundity and Adult Longevity. Lifetime oviposition, time to initial oviposition, larval emergence, and male and female longevity were not influenced by *A. auroguttatus* adult body size (i.e., elytron length or width, or hind tibia length). However, tibia length was marginally correlated with the total oviposition period of *A. auroguttatus* females. According to Honek (1993), female size is usually a good indicator of potential fecundity, although there are studies where no significant relationships were found (Slansky 1980, Boggs 1986, Johnson 1990, Ohgushi 1996, Klingenberg and Spence 1997).

Large body size can enhance reproductive success in adults through physiological and behavioral advantages such as increased egg load and egg size (O’Neill and Skinner 1990, Ellers et al. 1998), and male competition for mates (Hanks et al. 1996, Forslund 2000). Adult body size and fecundity in female insects are genetically determined and modified by environmental conditions during development, which may influence reproduction and growth (Honek 1993). Body size can also influence longevity, although factors such as temperature, diet, and the overall health of an individual (e.g., effects of sub-lethal chronic microbial infections) may play a greater role (Carroll and Quiring 1993, Nylin and Gotthard 1998, Sokolovska et al. 2000). As *A. auroguttatus* adults were reared from a
number of different oak hosts growing in the Cleveland National Forest, the environmental conditions during larval development (i.e., host quality) are unknown, but may have influenced the fecundity and longevity recorded in these experiments for both smaller and larger A. auroguttatus adults.

We conclude that information on the basic aspects of the reproductive biology of A. auroguttatus is a necessary foundation for developing species-specific management strategies targeting this pest, and for understanding and assessing factors affecting invasion risk into new areas. At this time, classical biological control is seen as the best option for managing A. auroguttatus in a forest environment, as the spread of this pest has become too great to control, contain, and eradicate with pesticides. Surveying for and identifying suitable egg parasitoids of A. auroguttatus from its home range in southern Arizona using sentinel egg masses is currently the major focus in the development of a classical biological control program for this pest (Lopez and Hoddle 2013). Our current inability to rear A. auroguttatus from eggs to adults in quarantine has changed the original focus of the biological control program from larval and pupal parasitoids found during surveys in Arizona (e.g., the parasitoid Calosota elongata Gibson [Hymenoptera: Eupelmidae]) (Gibson 2010, Coleman and Seybold 2011, Coleman et al. 2011) to prospecting for egg parasitoids. In the northeastern United States, release of Oobius agrili Zhang and Huang (Hymenoptera: Eucryphidae), a solitary egg parasitoid of A. planipennis, has contributed up to 48% parasitism in emerald ash borer study sites (Duan et al. 2012). Although almost nothing is known about the parasitoid fauna associated with A. auroguttatus eggs, this life stage is easily obtainable in the laboratory from field-collected adults and can be easily and rapidly deployed at appropriate field sites in Arizona as sentinel egg masses before being returned to quarantine to rear out parasitoids (Lopez and Hoddle 2013). The results of work presented here demonstrate that to maximize the fecundity and longevity of A. auroguttatus females for mass rearing eggs in the laboratory, pairing females with one male and providing adults with a continuous diet of 10% honey-water and oak foliage is recommended. Further investigation into A. auroguttatus biology, such as the fecundity of singly mated females and the influence of different temperatures on adult longevity, egg production, and developmental rates, will help to determine whether continuous mating is necessary and the optimal temperatures to maximize fecundity and subsequent egg hatch.

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