BIOLOGY AND MANAGEMENT OF THE HORNED OAK GALL WASP ON PIN OAK

by Eileen A. Eliason[1] and Daniel A. Potter[2]

Abstract. The horned oak gall wasp *(Callirhytis cornigera)* induces large, woody galls on twigs of oak; these galls can disfigure trees and result in extensive branch dieback. This paper reviews our recent research on the pest's biology and management on cultivated pin oaks *(Quercus palustris)* in Lexington, Kentucky, U.S., especially aspects that are of greatest relevance to tree care professionals. The gall wasp has alternating agamic (all female) and sexual generations that develop, respectively, in multi-chambered twig galls and single-chambered leaf galls along veins. Wasp development required about 33 months in twig galls and about 3 months in leaf galls. The number of gall wasps developing within twig galls ranged from 1 to 160, and was dependent on gall size. Numerous other insects, including parasitoids and inquilines, were found within the galls. Natural enemies accounted for high mortality of *C. cornigera*, especially in the leaf-galling generation where 70% to 80% of the larvae were parasitized. The dogwood borer *(Synanthedon scitula)* infested about 15% of the succulent 2- to 3-year-old twig galls. Adult *S. scitula* moths had a similar, bimodal emergence period regardless of whether they originated from dogwoods or horned oak galls. Insecticidal controls targeting the leaf galling stage of *C. cornigera* killed the pest, but also its parasitoids. Therefore, no reduction in the number of twig stem galls was achieved. Difficulties in managing this pest in outbreak situations are discussed.

Key Words. Gall wasp; Cynipidae; *Callirhytis cornigera*; pin oak; *Quercus palustris*; pest management.

Although gall-inducing insects usually are not considered important pests in urban landscapes, the horned oak gall wasp, *Callirhytis cornigera* (Osten Sacken), is a notable exception. This native species sometimes reaches outbreak densities on pin *(Quercus palustris)* and willow *(Q. phellos)* oaks in the eastern United States. As is common in gall wasps (family Cynipidae), *C. cornigera* has a complicated life cycle, with alternating agamic (all female) and sexual (male and female) generations that develop in the large, communal woody galls and in tiny, individual blisterlike leaf galls, respectively. The leaf-galling stage is inconspicuous, but the golf-ball-sized stem galls are noticeable and unsightly, especially after leaf fall (Figures 1 and 2B). Heavily infested oaks may have multiple stem galls on 80% or more of their branches, disfiguring the tree and causing crown dieback (Whyte and Ford 1980; Johnson and Lyon 1988; Eliason 1999).

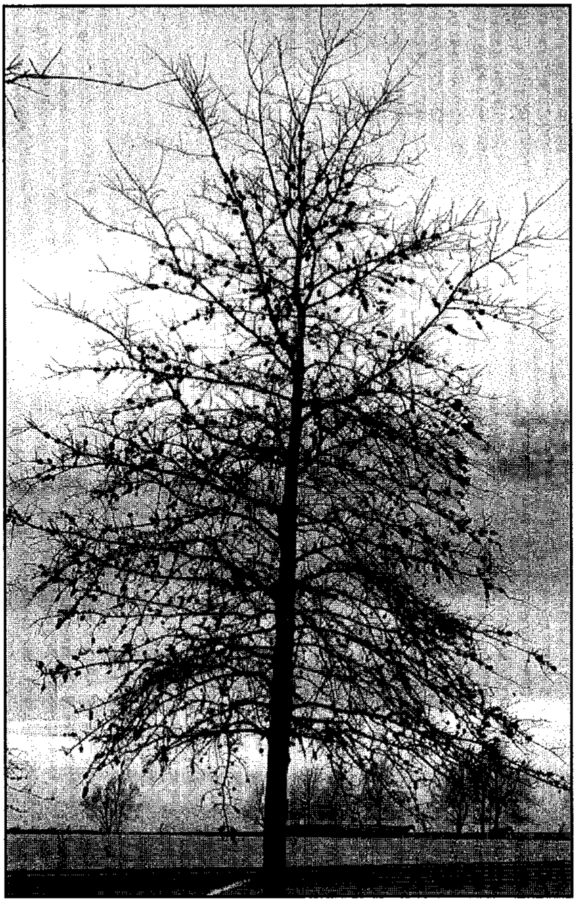

Figure 1. Pin oak tree that is heavily infested with twig galls induced by *Callirhytis cornigera* in Lexington, Kentucky.

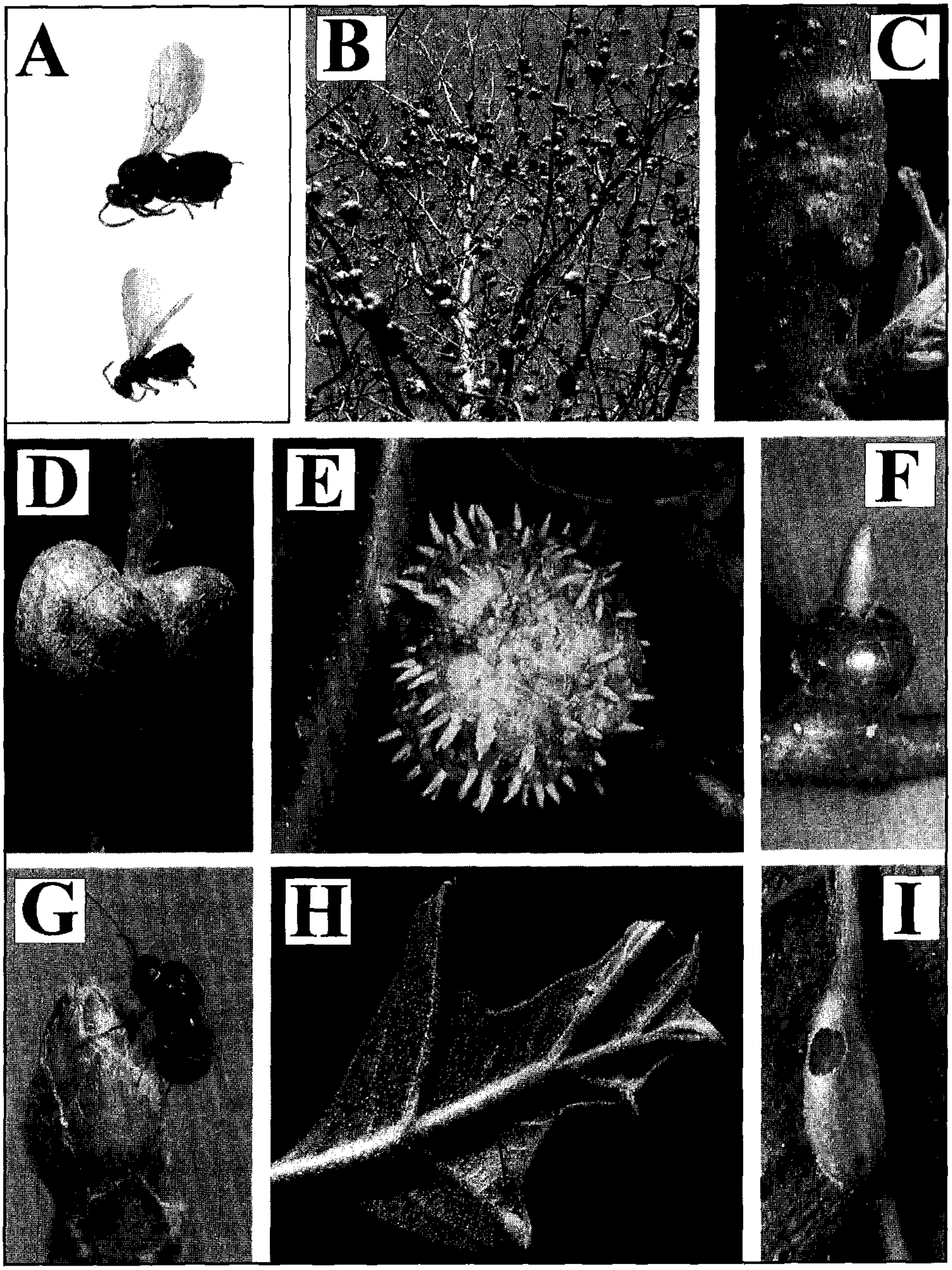

Figure 2. Aspects of the association of *C. cornigera* with pin oak. (A) Agamis (top) and sexual (bottom) female wasps. (B) View from below a heavily galled pin oak tree. (C) Young (10 months old) stem gall. (D) Stem gall (22 months old) just before horn eruption. (E) Large stem gall (27 months old) with horns projecting up from larval *C. cornigera* chambers. (F) Stem gall (27 months old) with only one *C. cornigera* inside. (G) Agamic female ovipositing into swelling bud. (H) Gall developing on a primary lateral vein on the abaxial side of an expanding, juvenile leaf. (I) Mature leaf gall with wasp emergence hole. Reprinted with permission from Eliason and Potter (2000c).

Little was known about the biology and management of *C. cornigera* until recently. Taft and Bissing (1988) described the morphology of the woody stem galls. Johnson and Lyon (1988) suggested a tentative life cycle based upon general field observations, but no careful field studies had been done. A few years ago, we began receiving inquiries from consulting arborists about severe outbreaks of *C. cornigera* they were encountering on pin oaks planted on horse farms or as street trees in central Kentucky. Similar requests for information were also received from Maryland, New York, and other eastern states. Therefore, we conducted several studies on an established population of *C. cornigera* and its galls on a privately owned horse farm in Lexington, Kentucky, from 1996–1999. We sought to clarify the pest's biology and life cycle, and to evaluate possible management tactics, including compatibility with natural enemies that normally help to keep gall wasp populations in check. We also studied the association between *C. cornigera* and another pest, the dogwood borer, *Synanthedon scitula* (Harris), that frequently inhabits the woody stem galls.

This paper is a synopsis of our research that was published in entomological journals (Eliason and Potter 2000a,b,c,d; 2001). Readers interested in details of our methodology are referred to those articles. Our intent here is to summarize those findings that are of greatest relevance to tree care professionals concerned with understanding and managing this important pest.

LIFE CYCLE OF *CALLIRHYTIS CORNIGERA*

Agamic (Stem-Galling) Generation

This generation begins when a tiny female wasp from the sexual generation (Figure 2A) emerges from a leaf gall, mates, and then lays tiny eggs into the periderm tissue of a small-diameter (0.2 to 0.7 cm [about 1/8 to 1/4 in.]) current shoot, or 1- or 2-year-old branch, often near a node (Eliason and Potter 2000c). Eggs are laid in a tight spiral, apparently singly, often completely around the branch. Although egg-laying occurs in June, the new twig galls first become visible as slight swellings the following April, about 9 to 10 months later (Figure 2C). As gall development continues, the plant tissue surrounding the gall wasp larvae coalesces to form an irregular, multi-chambered gall (Figure 2D). Twig galls enlarge over time, achieving maximum size when they are about 24 months old. Their final size varies, depending in part upon the number of *C. cornigera* larvae developing within the gall (Figures 2E and 2F). Mature galls range in diameter from 0.4 to 5.3 cm [3/16 to just over 2 in.] and may contain as few as one, or as many as 160 developing *C. cornigera*.

The woody stem galls are called horned oak galls because of the external projections of the larval *C. cornigera* chambers, which push out of the gall tissue after about 22 months. Horns are like shafts within the galls, and they have two chambers: The empty top one is separated by a thin tissue layer from the bottom larval chamber. Length and width of the entire horn ranges from 2.3 to 15.5 mm and 2 to 3 mm, respectively. The external portion ranges in length from 0.1 to 6.1 mm. The adult wasp chews a round hole in the horn to exit the gall. Galls remain succulent and green at least until the wasps mature and exit, but they begin to harden and dry out soon afterwards. The horns usually break off after the wasps have emerged.

The stem-galling generation of *C. cornigera* thus requires about 33 months from the time that the eggs are laid until the wasps emerge (Figure 3). The larvae overwinter twice, pupate in September, and spend the last winter as pupae or adults within the woody galls. The agamic adult wasps begin to emerge when swelling or green-tip buds are present on pin oak trees. In Lexington, Kentucky, they are active on trees from late March to mid-April, peaking around 7–10 April (Eliason and Potter 2000c,d). First observed activity on pin oaks, averaged over 3 years, corresponded with accumulation of 239 Fahrenheit degree-days (DDF) calculated from 1 January using a base temperature of 45 degrees (= 133 Centigrade degree days (DDC), base 7.2 degrees).

The wasps, all females, walk along branches and twigs, and lay their eggs into primordial leaf tissue within swelling buds (Eliason and Potter 2000c,d). They rarely fly, and can hold onto branches even in heavy winds. Each female carries an average of 230 eggs. In the laboratory, the wasps live about 3 days without food or water, about 5 days with only water, and 7 days with a 10% honey solution. We have observed them feeding in the field on honeydew produced by soft scales (e.g., oak lecanium scale, *Parthenolecanium quercifex*), which could extend their adult life span.

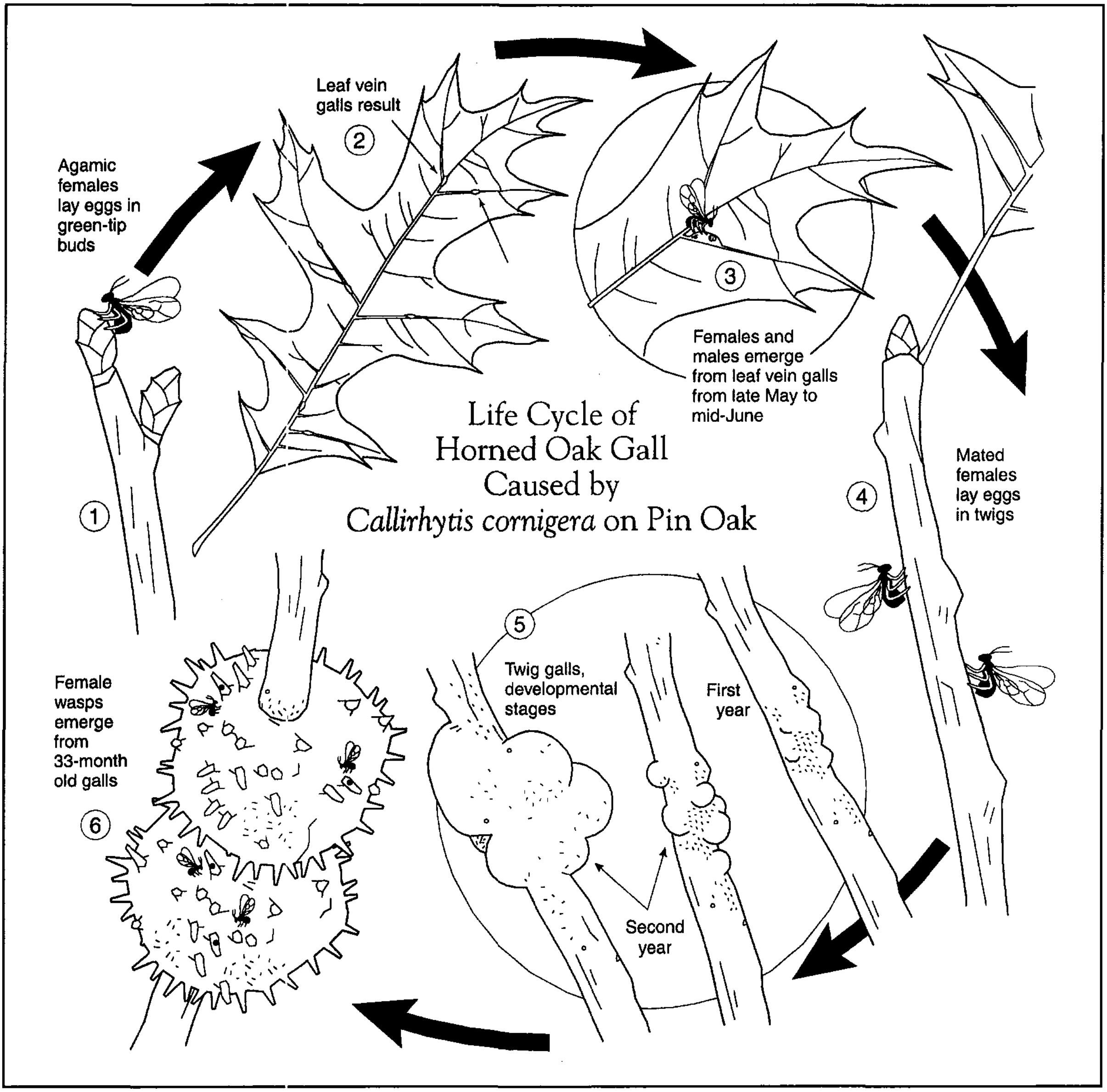

Figure 3. Life history of the horned oak gall wasp, *C. cornigera,* on pin oak as determined from research conducted in Lexington, Kentucky, 1996–1999. Illustration by Dennis Duross (Agricultural Communications Services, University of Kentucky).

Sexual (Leaf-Galling) Generation

This generation begins when a female wasp from the agamic generation lays tiny eggs into swelling buds on oak trees (Figure 2G). The subsequent galls form on the underside of leaves, usually along the midvein or large lateral veins (Eliason and Potter 2001). Although leaf tissue completely encloses each larva within 48 hours after egg hatch, the tiny leaf galls don't become visible on expanding leaves until 7 to 14 days after oviposition (Figure 2H). One larva develops within each leaf gall, but occasionally, two or more galls grow near each other. Galls reach their maximum length (about 2 mm) by late May. Each larva completely consumes the moist nutritive tissue within its gall, leaving only a thin gall layer around the mature larva. If a gall wasp larva dies prematurely, gall development stops and the gall eventually molds and turns yellowish-brown. Larvae pupate, and adults emerge about 2 weeks later. Gall density averaged about five galls per leaf (range, 0 to 18 galls per leaf) on heavily infested trees at our study site.

This sexual generation develops for up to 3 months in leaf galls (Figure 3), but the date of first emergence of the adults may vary by several weeks. In general, emergence of the tiny male and female wasps begins in late May or early June, coinciding with accumulation of 1,298 DDF, base 45 (720 DDC, base 7.2), and continues for up to 2 weeks (Eliason and Potter 2000c,d). Adults chew a round exit hole through the thin gall tissue (Figure 2H), emerge, and clean their bodies. We did not observe mating, egg-laying, or any foraging behavior of these adults in the field, probably because of their small size. We know from laboratory observations that the adult life span is short (1 or 2 days), and that each female carries an average of about 100 eggs. After mating, the females lay eggs into shoots or branches to initiate twig galls, as described above.

Other Gall Inhabitants

By dissecting and keeping galls in containers in the laboratory, we found numerous other arthropods that also live in the stem and leaf galls (Eliason and Potter 2000b,c; 2001). Some of these are incidental invaders that feed on stem gall tissue or use galls as nesting sites but don't usually adversely affect *C. cornigera*. These include the dogwood borer, gall midges (*Lasioptera* sp. and *Lestodiplosis* sp.), a braconid wasp (*Allorhogas* sp.), several beetles (e.g., weevils; adults of both a flat-headed and a round-headed borer), ants (*Camponotus nearcticus* Emery, *Lasius alienus* Foerster), mites (Oribatida, Phytoseiidae, Acaridae), springtails (Entomobryidae), and barklice (Psocoptera). The mites and springtails live on the gall surface, using holes and crevices for shelter. Deutonymphs of the mite species, *Histiogaster robustus* Woodring (Acaridae), are phoretic (i.e., "hitchhike") on cynipid wasps, including *C. cornigera*, and may completely cover the adult wasps when they disperse.

Several species of true inquilines (i.e., arthropods that are closely associated with galls and feed on gall tissue but cannot induce their own galls) also were found inhabiting horned oak galls. *Synergus* sp. near *lignicola*, a tiny yellow and brown wasp, was the most abundant inquiline. Adults of *Synergus* emerge twice each year, from late April to mid-May and again from mid-August to early September. They feed on pollen from pin oak catkins in the spring. After mating, the female lays eggs into 1- to 3-year-old twig galls of *C. cornigera*, sometimes back into the same gall from which she emerged. Another inquiline wasp, *Ceroptres* sp., is unique in that it exploits both the stem and leaf galls formed by *C. cornigera*. Twig galls from which *Ceroptres* adults emerge typically are less than 2 years old, have not yet formed horns, and average 2.5 cm in diameter. The black wasps emerge from such twig galls in May, oviposit into leaf galls, and then even smaller adults emerge from those leaf galls from late June to July. When leaf galls of *C. cornigera* are exploited by *Ceroptres* sp., the larva of the gall-inducer does not survive.

DOGWOOD BORER INFESTATION OF HORNED OAK GALLS

The dogwood borer (*Synanthedon scitula*) is an important, native pest that attacks flowering dogwood, pecan, apple, and other tree species in landscapes and nurseries (Potter and Timmons 1983; Eichlin and Duckworth 1988). The adults are delicate, day-flying clearwing moths (family Sesiidae) that emerge from host trees in spring and summer, mate, and lay eggs in bark crevices. Dogwood borer larvae feed under the bark in the phloem and cambium, which can partially girdle or kill branches or whole trees. Dogwood borers also have been reported to infest various insect-induced galls, including horned oak galls (Engelhardt

1946), but details of its association with such galls had not been studied.

Earlier studies using pheromone traps showed that dogwood borer moths have a prolonged, bimodal seasonal flight pattern with peaks in late spring (May to June) and again from late July to September (Potter and Timmons 1983; Rogers and Grant 1991; Pfeiffer and Killian 1999). Potter and Timmons (1983) suggested that the earlier flight pulse consists mainly of adults emerging from dogwood, and that the second, typically larger pulse consists mainly of moths emerging from branch cankers or burr knots on apple (*Malus* spp.), or possibly from other hosts. Understanding which host plants give rise to each pulse of adults, and into which hosts those females lay their eggs, is potentially important in managing this pest. If each flight pulse represents a different host association, then timing of preventive sprays or other control tactics would need to take this into account. Therefore, we sought to determine if horned oak galls are a significant reservoir for dogwood borer populations. We also studied whether emergence from galls and dogwoods is synchronous, or if emergence from galls contributes disproportionately to the later flight pulse (Eliason and Potter 2000b).

Pheromone traps baited with synthetic sex attractant (Z,Z-3,13-octadecadien-1-ol-acetate) were hung near plantings of dogwoods at six different sites in suburban landscapes, and at five other sites dominated by stands of pin oaks with heavy infestations of horned oak gall. Emergence from dogwoods was monitored by weekly inspection of 23 naturally infested *Cornus florida* for presence of pupal exuviae (cast skins) that are left protruding from the bark when the moths emerge (Potter and Timmons 1983). The pattern of emergence from horned oak galls was monitored by collecting groups of woody stem galls from pin oaks before each flight pulse (1,626 and 1,411 galls on 15 April and 17 July, respectively) and then holding the galls in outdoor rearing cages to recover the moths as they emerged.

Flight activity of *S. scitula* began on 5 May and ended on 13 October 1999, with peaks in late May, and from late July to early August. The flight pattern was similar regardless of whether the traps were hung in landscapes with abundant dogwoods, or at sites dominated by galled pin oaks. The pattern of emergence of adults from dogwood trees and horned oak galls also was similar, with moths emerging from both hosts during both flight periods (Eliason and Potter 2000b). Therefore, we reject the hypothesis that the early-season and late-season flight pulses represent separate populations originating from dogwoods or horned oak galls, respectively.

Horned oak galls may be a nutrient-rich, stable resource for opportunistic borers. In 1999, dogwood borers were found in about 15% of the 2- to 3-year-old, succulent twig galls that we sampled and dissected (n = 270 galls). Evidence of previous infestation (e.g., frass, pupal exuviae) was found in about 13% of the 408 older galls that were examined, but no living borer larvae were found in galls more than 3 years old. Galls less than 2 years old were apparently uninfested. Infested galls averaged 3.6 ± 0.1 cm in diameter (mean ± SE; range, 1.9 to 5.3 cm), and weighed an average of 16.8 ± 4.1 g (range, 1.7 to 44.4 g). As many as four borer larvae developed simultaneously in some larger stem galls, but most galls contained only one larva. Although the borers expelled frass from holes in galls, frass still remained within their tunnels and was woven into the silk of their pupal cases. Larvae pupated below a thin layer of gall tissue, and exuviae protruded from galls when the adult moths emerged (Eliason and Potter 2000b).

Given that heavily galled pin oaks may have hundreds of susceptible 2- to 3-year-old galls, and that 15% or more of these galls may contain *S. scitula* larvae, such trees may harbor large reservoir populations of borers that potentially may emerge to infest nearby dogwoods, apples, or other hosts. The borer's relatively broad host range and flight capability, and its synchronous emergence from dogwoods and horned oak galls, seemingly would facilitate cross infestations. Thus, dogwood trees growing in landscapes with galled pin oaks may be at relatively higher risk from borers.

NATURAL ENEMIES

Several species of parasitoids (i.e., parasitic insects) and predators attack larvae of *C. cornigera* within the woody stem galls (Eliason and Potter 2000a,c; 2001). In general, as stem gall diameter increases, fewer *C. cornigera* larvae are parasitized, whereas very small stem galls are almost always parasitized. Rates of parasitism ranged from less than 20% to 100% for large and small galls, respectively. The most abundant parasitoids in stem galls are *Ormyrus labotus* Walker and *Sycophila* spp., which are tiny wasps in the family Eurytomidae. Adults of both of these species emerge from 2- to 3-year-old twig galls from April to May, but a second generation of *Sycophila* spp. emerge from late July to early September. When *C. cornigera* larvae are parasitized, their larval chambers tend to remain soft and seldom protrude past the gall surface.

The leaf-galling generation is heavily attacked by a complex of tiny parasitic wasps that includes *Aprostocetus* spp. and *Pentastichus* spp. (Eulophidae), *Sycophila* spp. and *Eurytoma* sp. (Eurytomidae), *O. labotus*, and *Brasema* sp. (Eupelmidae). Most of the parasitoids exit from the leaf galls just before *C. cornigera* adults emerge in June. Detailed biological information of each parasitoid species has not been determined, and several may be undescribed species. Together, parasitoids and inquilines often account for 70% to 80% mortality of the leaf-galling stage of *C. cornigera* (Eliason and Potter 2000a,c; 2001).

Predators living in stem galls included the clerid beetles *Phyllobaenus verticalis* (Say), *Phyllobaenus unifasciatus* (Say), *Placopterus thoracicus* (Olivier), and *Cymatodera undulata* (Say). In addition, several spiders (Araneidae, Linyphiidae, Philodromidae, Salticidae, Theridiidae) lived in old, hard, dry stem galls and were observed feeding on agamic *C. cornigera* adults in early spring (Eliason and Potter 2000c).

MANAGEMENT OF HORNED OAK GALL OUTBREAKS

Little is known about how to manage outbreaks of destructive galling insects such as *C. cornigera* on cultivated trees (Frankie et al. 1992). Pruning to remove succulent stem galls helps reduce further infestation, especially when only small numbers of galls are present, but it is impractical on a large scale. The pest's prolonged life cycle with alternating stem- and leaf-galling generations complicates timing of insecticide applications, and the fact that the dead stem galls persist in trees for several years makes it difficult to evaluate whether controls were effective. Before our work, there had been no research to determine optimal treatment timing, appropriate life stages to target, or potential impact of insecticides on natural enemies of *C. cornigera*.

For our tests, we chose not to target existing stem galls because systemic insecticides tend to translocate and penetrate less readily into woody gall tissue than into leaf tissue (Morgan and Frankie 1982). Likewise, we did not try to control the sexual adult wasps after they had emerged from leaf galls because spray penetration would be difficult once the trees were fully leafed out. Also, the sexual adult activity period is brief and hard to predict.

Instead, we targeted the seemingly more vulnerable leaf-galling generation, both at its initiation and after the eggs had hatched and larvae were developing within the leaves. By disrupting the life cycle at this "weak link," we hoped to reduce the population of sexual wasps emerging from leaf galls and the subsequent number of new stem galls that they would induce. Several different approaches and treatment timings were tested (Eliason and Potter 2000a). We also evaluated the impact of the treatments on beneficial parasitoids and whether the number of new stem galls was reduced.

The first strategy we tested was to control the agamic wasps as soon as they emerged from woody stem galls, before they could oviposit into swollen or green-tip buds. Treatments were applied on 29 March 1998, 2 days after the first wasps were observed. At that time, most of the trees had swollen buds but no expanding leaves. Tree canopies were sprayed with chlorpyrifos (Dursban Pro, Dow AgroSciences, Indianapolis, IN) or bifenthrin (Talstar Lawn and Tree Flowable, FMC, Philadelphia, PA) at label rates (1.20 or 0.19 g a.i. per L, respectively), or left unsprayed. Sprays were applied by a certified professional arborist using a high-pressure sprayer, and treatments were tank-mixed with the surfactant Break-Thru (Goldschmidt Chemical, Hopewell, VA). Each treatment had five replicates (trees).

The second approach was to inject concentrated solutions of abamectin, imidacloprid, or bidrin (Abacide, Imicide, or Injecticide-B, respectively; J. J. Mauget, Los Angeles, CA) from pressurized containers into tree sapwood to systemically control young larvae developing in leaf galls. Capsules for injections were placed about 15 cm apart around tree flares near ground level, according to manufacturer instructions. Trees were injected on 10 April, just after peak emergence of asexual wasps from the stem galls. Control trees were not injected. Each treatment had five replicates (trees).

Finally, we attempted to control young larvae within the leaf galls with translaminar systemic insecticides including dimethoate (Cygon 2E; Cyanamid, Parsippany, NJ), acephate (Orthene Turf, Tree & Ornamental Spray; Valent, Worthington, OH), abamectin (Avid 0.15 EC; Novartis, Greensboro, NC), or imidacloprid (Merit 75 WP, Bayer, Kansas City, MO) at label rates. Eight heavily galled trees were used; treatments were blocked within trees. Two spray timings were tested, either 2 May (early leaf expansion; most leaves less than 2.5 cm long), or 17 May (most leaves 30% to 60% expanded). On each date, separate sets of shoots were sprayed to runoff with handheld, pump-type sprayers. Control shoots were not sprayed.

Efficacy was evaluated in each test by harvesting shoots, counting galls, and also dissecting or rearing hundreds of leaf galls to determine the fate of the gall wasps and parasitoids. In the case of the whole canopy sprays and injections, we also later counted the number of new stem galls initiated on 30 woody shoots per tree.

Canopy sprays applied at bud burst, coinciding with emergence of the asexual wasps from twig galls, had the intended effect, reducing leaf gall density by 66% to 91%. Similarly, trunk injections of bidrin or abamectin, or foliar sprays with translaminar systemic insecticides during early leaf expansion, resulted in high mortality of gall wasp larvae within the leaf galls. Each of these approaches, however, also had severe impact on the beneficial parasitoids, which by themselves accounted for about 70% mortality of the leaf-galling generation of *C. cornigera* on untreated trees. This evidently negated whatever benefit the insecticides provided, because none of the treatments reduced the numbers of new stem galls that subsequently formed (Eliason and Potter 2000a).

Our studies help to explain why, even if treatments are precisely timed, it is difficult to manage horned oak gall infestations on landscape and street trees. The pest has a complex life cycle, with both a leaf- and stem-galling generation produced each growing season. Larval development within the woody stem galls takes nearly 3 years, so a tree typically has galls varying in age and size. Therefore, it is unlikely that infestations will be eliminated by a single treatment, regardless of application method. Although successful control would be reflected in a reduction in succulent stem galls on younger twigs after 1 to 2 years, unsightly old or dead stem galls typically persist on trees for several more years. Poorly timed insecticide applications might even be counterproductive by upsetting the balance between *C. cornigera* and its parasitoids, which normally exert significant natural control. Nevertheless, given their impact on the leaf-galling generation, the aforementioned control tactics might eventually suppress gall wasp infestations if applied for two or more consecutive years. Critical evaluation of such multi-year management regimes is therefore warranted.

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Résumé. Le phytopte à galle du chêne *(Callirhytis cornigera)* produit de grosses galles ligneuses sur les ramilles de chênes qui peuvent défigurer les arbres et provoquer un dépérissement étendu des branches. Cet article fait une revue de nos recherches récentes sur la biologie de ce parasite et sur sa gestion par rapport au chêne des marais *(Quercus palustris)* à Lexington au Kentucky, et plus particulièrement en regard des aspects qui sont d'une grande importance pour les professionnels en entretien des arbres. Ce phytopte a des générations asexuées (toutes femelles) et sexuées alternantes qui se développent respectivement dans des galles multi-chambres sur les ramilles et dans des galles à chambre unique le long des nervures des feuilles. Le développement du phytopte requiert environ 33 mois dans les galles sur les ramilles et environ 3 mois pour celles sur les feuilles. Le nombre de phytoptes qui se développent à l'intérieur des galles sur les ramilles se situe entre 1 et 160, et ce dépendant de la dimension de la galle. De nombreux autres insectes, incluant des parasitoïdes et d'autres espèces vivant en commensalisme, ont été découverts à l'intérieur des galles. Les ennemis naturels sont responsables d'un fort taux de mortalité chez *C. cornigera*, particulièrement au stade de la génération de la galle foliaire où 70 à 80% des larves sont parasitées. Le perceur du cornouiller *(Synanthedon scitula)* infeste environ 15% des ramilles succulentes comportant des galles de 2 à 3 ans. La larve adulte de *S. scitula* a une période d'émergence bimodale similaire, peu importe si elle origine de cornouillers ou de chênes comportant des galles. Le contrôle ciblé au moyen d'un insecticide de *C. cornigera* au stade de galle foliaire permet de tuer le parasite, mais aussi ses parasitoïdes. De ce fait, aucune réduction dans le nombre de galles au niveau des ramilles n'a pu être obtenu. Les difficultés de gérer ce parasite lors de situations hors contrôle sont discutées.

Zusammenfassung. Die gehörnte Eichengallwespe *(Callirhytis cornigera)* verursacht große hölzerne Gallen an den Zweigen von Eichen, die einen Baum völlig entstellen und zu extensivem Aststerben führen können. Diese Studie gibt einen Überblick über unsere gegenwärtige Erforschung der Biologie dieses Schadinsekts und der Bekämpfungsmöglichkeiten insbesondere im Hinblick auf die für professionelle Baumpfleger relevanten Daten bei gepflegten *Quercus palustris*-Bäumen in Lexington, KY. Die Gallwespe hat alternierende ungeschlechtliche Formen (alle weiblich) und sexuelle Generationen, die sich in mehrkammerigen Astgallen und einzelkammerigen Blattgallen entlang der Blattadern entwickeln. Die Wespenentwicklung erfordert etwa 33 Monate in Astgallen und etwa 3 Monate in Blattgallen. Die Anzahl der Gallwespen, die sich innerhalb einer Astgalle entwickeln, rangiert zwischen einer und 160 und ist von der Größe abhängig. Zahlreiche andere Insekten, einschließlich Parasiten und andere wurden in den Gallen gefunden. Die natürlichen Feinde sorgen für eine hohe Mortalität bei der *C. cornigera*, besonders in der Blattgallengeneration werden 70-80% parasitiert. Der Hartriegelbohrer Synanthedon scitula besetzt etwa 15 % der sukkulenten 2-3jährigen Astgallen. Die erwachsene *S. scitula*-Motte hat einen ähnlichen Schlüpfzeitraum, egal ob sie auf Hartriegel oder Sumpfeiche lebt. Die eingesetzten Insektizide zur Kontrolle der Blattgallenwespen kontrollieren und töten die Wespe ebenso wie deren Parasit. Daher konnte keine Reduktion der Astgallen erreicht werden. Die Schwierigkeiten im Umgang mit einem Massenauftreten von Gallwespen wurde hier diskutiert.

Resumen. La avispa de agalla del encino (*Callirhytis cornigera)* induce grandes y leñosas agallas en las ramitas de los encinos que pueden desfigurar a los árboles y resultar en una extensa muerte descendente de las ramas. Este trabajo revisa nuestra reciente investigación sobre la biología de la plaga y el manejo de encinos cultivados *(Quercus palustris)* en Lexington, KY, especialmente los aspectos de mayor relevancia para los profesionales del cuidado de los árboles. La avispa tiene generaciones alternantes que desarrollan multicámaras en las ramitas, y agallas solitarias en las hojas a lo largo de las venas. El desarrollo de la avispa requirió cerca de 33 meses en las ramitas y 3 meses en las hojas. El número de avispas en las ramitas variaron de una a 160, y dependió del tamaño de la agalla. Otros numerosos insectos, incluyendo parasitoides e inquilinos, se encontraron dentro de las agallas. Los enemigos naturales responsables de la más alta mortalidad de *C. Cornigera*, especialmente en la generación de formación de agallas en las hojas, fueron 70 a 80% de larvas parasitadas. El barrenador *(Synanthedon scitula)* infestó cerca del 15% de los tallos suculentos de 2 a 3 a años. Los adultos de *S. scitula* tuvieron un período similar bimodal de emergencia sin importar si se originaron del barrenador o de las agallas del encino. El control insecticida para las agallas de la hoja mató la plaga, pero también a los parasitoides. Por otro lado, no se logró reducción en el número de agallas de las ramitas. Se discuten las dificultades en el manejo de esta plaga en situaciones de emergencia.