Oak trees have a lot of gall

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Ian Pearse examines valley oak galls.

Those valley oak trees (Quercus lobata) in California's Central Valley have a lot of gall.

Scientists Ian Pearse, Maxwell Joseph and Melanie Gentles of the UC Davis Department of Entomology knew that going into their research, but in a survey of 1,234 oak apple galls, what they found has led to a better understanding of the gall-making wasps and the organisms that prey upon them or live with them.

"Oak apple galls are themselves a complex ecosystem, with over 20 species of insects, that are in many people's backyards," said Pearse, who is studying for his doctoral degree in entomology with major professor

Rick Karban. "The galls and their wasps are not a major problem for oaks but are themselves food for other organisms such as birds and other insects."

The wasp (Andricus quercuscalifornicus), a member of the Cynipidae family, lays her eggs on the leaves or twigs of a valley oak, which then forms a gall or a structure that resembles an apple hanging from the tree.

"The gall is actually very beneficial, and necessary, for the insect," Pearse said. In reality, the insect "'coerces' the plant to make it a great home."

"This community of insects has been poorly described for most cynipid-induced galls on oaks in North America, despite the diversity of these galls," Pearse said. Cynipids are small solitary wasps that produce galls on oaks and other plants.

Their research, published in a recent edition of the international journal Biodiversity and Conservation, shed light on the natural history of the common oak apple gall and its parasitoid and inquilines community. They found that the composition of the insect community varies with galls of different size, phenology and location. Their collection sites included Davis (around Putah Creek) and Woodland, both in Yolo County, and Vacaville, Solano County.

The researchers discovered that the gall maker "most often reached maturity in larger galls that developed later in the season. "The parasitoid Torymus californicus (family Torymidae) was associated with smaller galls, and galls that developed late in the summer," they wrote. "The most common parasitoid, Baryscapus gigas (family Eulophidae), was more abundant in galls that developed late in the summer, though the percentage of galls attacked remained constant throughout the season."

"Parasitoids and inquilines, in general, had a longer emergence period and diapauses within the gall than the gall-inducer," they wrote. "The association of different parasite species with galls of different size and phenology suggests that different parasite species utilize galls with slight differences in traits."

Insects associated with plant galls have long been a key model system for understanding host-parasite interactions, food relationships, host specificity and other aspects of community ecology.

"Gall inducers manipulate their host plant to produce structures of varying complexity in which the gall inducer develops," they related. "The most complex and species rich group of gall-inducing organisms are the cynipad gall wasps of the tribe Cynipini, which produce complex galls on various tissues of oaks.

Noting the complex ecosystem, Pearse said that each species of wasp usually produces a morphologically distinct gall and has a highly specific relationship with its host oak species. Parasitoids feed on the gall wasps, and inquilines feed on the gall itself, an act that may harm the gall inducer. Another level of insects, the hyperparasitoids, may attack the parasitoids or the inquilines.

Galls provide their inducer with a consistent food source, a predictable abiotic environment, and a refuge from potential enemies, Pearse said.

Galls, which hang on the valley oaks like apples, are especially visible this time of year.

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