Introduction
The jumping gall wasp, *Neuroterus saltatorius* (Edwards) is a small gall-forming wasp that produces 1.0–1.5 mm round galls (Fig. 1) on the lower surface of leaves of Garry oak, *Quercus garryana* Douglas. The common name of this wasp is derived from the jumping behavior of the galls after they drop to the ground. The jumping gall wasp is native to the western United States and is thought to have been recently introduced to British Columbia. Since its initial discovery in British Columbia near Victoria in 1986 the area infested by the jumping gall wasp has steadily increased and now includes all of southeast Vancouver Island and Saltspring Island (Fig. 2). The jumping gall wasp causes severe and chronic mid-summer scorching (premature browning of foliage) of Garry oak throughout the Capital Regional District and the lower Cowichan Valley threatening both the longterm health and stability of remaining oak woodlands.

Hosts
In British Columbia, Garry oak is the only tree species on which the jumping gall wasp can complete its life cycle. The jumping gall wasp also lays eggs on a number of ornamental oak species — English oak.
**Quercus robur** L.; red oak, **Quercus rubra** L.; scarlet oak, **Quercus coccinea** Muenchn.; and pin oak, **Quercus palustris** Muenchh. — but fails to complete its development on these trees. In the western United States, numerous species of native white oaks are suitable hosts including: valley oak, **Quercus lobata** Nee; blue oak, **Quercus douglasii** Hook & Aym; California scrub oak, **Quercus dumosa** Nutt.; Arizona white oak, **Quercus arizonica** Sarg.; live oak, **Quercus virginiana** Mill.; and post oak, **Quercus stellata** Wangenh..

**Distribution**

Although the jumping gall wasp occurs from Texas and California north to the state of Washington, it was unknown in British Columbia prior to its initial discovery near Victoria (View Royal, Thetis Lake) in 1986. Since then, the area infested by the gall wasp has gradually expanded, and by 1996, included all of the Capital Regional District, Salt Spring Island and the lower Cowichan Valley. Light non-damaging populations also occur north to Nanoose Bay. The gall wasp is not yet known to occur north of Nanoose Bay, on the outer Gulf Islands or at two isolated Garry oak stands in the Fraser Valley (Sumas Mountain, Yale).

The available evidence suggests the jumping gall wasp was inadvertently introduced here since no British Columbia record or specimen is known to exist prior to the initial discovery in 1986, despite extensive longterm surveys of insects occurring on Garry oak in British Columbia.

**Description**

**Egg:** Small, white oval, 0.2 mm long.

**Larva:** Cream coloured with dark mandibles, curled in a C-shape inside the gall; a full-grown larva is 1.5 mm long.

**Pupa:** Cream coloured, 1.5 mm long, similar in appearance to adult wasp.

**Life history and habits**

The jumping gall wasp completes two generations annually. The first generation is gamic, consisting of both males and females, while the second generation is agamic, consisting of females only. The agamic, adult female gall wasp overwinters within a gall buried in the soil or duff (Fig. 3). During the latter half of March, agamic females chew through the gall (Fig. 4), fly into the canopy of nearby oaks and oviposit in swelling oak buds (Fig. 5). Each female lays up to 150 eggs in groups on small leaves within a swelling bud (Fig. 6). By mid-April yellow/pink masses of 3 to 40 galls are visible from both the upper and lower surfaces of the leaves (Fig. 7). Adults of this first, gamic generation emerge from early to mid May. Each individual gall mass produces either males or females but not both (Fig. 8).
After mating, a gamic female lays up to 70 eggs singly on the lower surface of the leaf, preferring the most recently formed unhardened leaves at the end of the branches. In early June minute papillate galls begin to form on the lower surface of the leaf (Fig. 9). By mid-June many of these galls have matured into spherical 1.0–1.5 mm yellow galls resembling mustard seeds (Fig. 1). Although most galls mature and drop to the ground between late June and mid July, (Fig. 10) some galls develop at a slower rate and drop to the ground in August or September. Gall development from oviposition to gall drop is very rapid with most galls completing their development in 6–8 weeks (Fig. 11). Once on the ground the galls jump sporadically, sometimes up to 2.5 cm high. This “jumping” action is produced when a tightly curled larva (Fig. 12) moves within its gall. This in turn flexes the wall of the gall and causes it to jump. The jumping movement can persist for up to eight weeks and eventually causes the gall...
to work its way into the soil. The larva transforms into a pupa in September and becomes an adult in October. The adult remains in the gall over the winter months.

**Damage**

Little damage is caused by the gamic (first) generation with only an occasional early flushing oak sustaining noticeable damage (foliar scorch).

Damage caused by the agamic (second) generation, however, is more apparent and varies from chlorotic spotting of leaves on lightly infested trees to complete scorching and partial premature defoliation on the most severely infested trees (Fig. 13). Damage first becomes apparent in mid-June as chlorotic spotting at the point of attachment of each gall. By mid-July marginal and interveinal necrosis develops and gives the leaves a scorched appearance (Fig. 14). During August some premature defoliation occurs on severely scorched trees followed by partial refoliation as the tree attempts to restore photosynthetic capacity.

Chronic mid-summer foliar scorching and partial defoliation followed by weak refoliation drains the tree’s energy reserves resulting in a gradual weakening of affected trees. Weakened trees may exhibit additional symptoms such as dying back of twigs and branches and increased vulnerability to disease and secondary insects.
Although virtually all foliar scorch occurring on Garry oak in British Columbia is caused by the jumping gall wasp, foliar scorch similar in appearance may also be caused by the oak leaf phylloxera\(^1\) or oak anthracnose, *Discula umbrinella* (Berk. & Broome) Sutton (Fig. 15) a fungal disease that occurs on an occasional Garry oak in years with wetter than average spring weather.

The jumping gall wasp readily lays its eggs on numerous species of ornamental oaks but fails to complete its development on these off-host species. Damage on these species is usually restricted to light chlorotic spotting on the foliage.

**Damage Impact**

Garry oak is the most prominent feature of the unique and distinctive oak woodland ecosystem that once dominated much of the Capital Regional District and the only native oak in British Columbia. This rare ecosystem, unique in Canada, has gradually been reduced to a small fraction of its former area due to urban expansion and is now further threatened by chronic insect damage.

The aesthetic impact of gall wasp damage is also considerable since Garry oak is the major arboral tree cover in urban Victoria. Chronic mid-summer scorching is highly visible and has caused considerable and widespread public concern over the longterm health and survival of the Garry oak.

**Management options**

**Biological control**

Eight species of parasitoids attack the jumping gall wasp in British Columbia. Female parasitoids oviposit in galls before they drop to the ground. Penetrating the gall with their ovipositor (Fig. 16), female adult parasitoids sting the gall wasp larva within and immobilize it before laying

---

1 See Forest Pest Leaflet 81 in this series.
a single egg on the larva. After hatching, the parasitoid larva feeds on the gall wasp larva and eventually kills it (Fig. 17). Although the level of parasitism in the agamic generation was initially very low at less than three percent (1986–92), it has gradually increased to over fifteen percent (1996) in the Capital Regional District. Parasitism in the gamic generation has remained consistently low, averaging less than three percent throughout this period (1986–96). Two factors that appear to limit the effectiveness of the parasitoids are the strong preference of searching female parasitoids for galls still adhering to leaves over those on the ground and the early dehiscence of most galls prior to peak flight of the parasitoids. As a result, parasitism of galls dropping from late June to early July is much lower (<10%) than in galls dropping from mid-July to mid-September (>40%).

Two predators have been observed feeding on galls. The European earwig, *Forficula auricularia* L., feeds on both immature and mature galls on foliage (Fig. 18) and a ground beetle, *Pterostichus melanarius* (Illiger), feeds

### Parasitoids of Jumping gall wasp in British Columbia

- *Amphidocius schickae* Heydon & Boucek
- *Amphidocius* n. sp.
- *Aprostocetus pattersonae* (Fullaway)
- *Aprostocetus verrucarii* Balduf
- *Aprostocetus* n. sp.
- *Mesopolobus longicaudae* Doganlar
- *Brasema* sp.
- *Ormyrus distinctus* Fullaway

Fig. 16. Parasitoid, *Amphidocius schickae*, ovipositing in jumping gall wasp gall.

Fig. 17. Parasitoid larva, *Amphidocius schickae*, feeding on jumping gall wasp larva.

Fig. 18. European earwig predation on jumping gall wasp.
Host resistance

Although trees that are totally immune to the jumping gall wasp have not been found, high levels of gall failure have been observed on some Garry oak. The mechanism causing failed gall development is not known, but it is possible that high tannin levels or oviposition in hardened mature foliage prevents successful gall development. The gall wasp is also attracted to and oviposits in a number of unrelated ornamental oak species but is unable to complete its development on these hosts.

Chemical control

In nursery culture, the jumping gall wasp can be controlled by spraying the foliage with a systemic insecticide in mid-May. Chemical control on large mature trees in either an urban or natural setting is not practical and would cause public concern.

Literature cited


Additional information

Additional copies of this and other leaflets in this Forest Pest Leaflets series, as well as additional scientific details and information about identification services, are available by writing to:

Natural Resources Canada
Canadian Forest Service
Pacific Forestry Centre
506 West Burnside Road
Victoria, B.C. V8Z 1M5
Phone (250) 363-0600

Website: www.pfc.forestry.ca

© Her Majesty the Queen
in Right of Canada, July 1997

PDF version created November 2000