Glassy winged sharpshooter – a nursery industry biosecurity threat

Background

Glassy winged sharpshooter (*Homalodisca vitripennis* (GWSS)) is a relatively large xylem feeding leafhopper (Fig. 1) which has not been recorded in Australia. Damage incurred by the insect itself rarely occurs, although large numbers in hot weather may cause wilting [4]. Insect excrement may cover leaves and fruit and, when dry, gives a white-washed undesirable appearance (Fig. 2). Since GWSS can consume about 10 times its body weight in plant fluids, large infestations in shade trees above cars and gardens causing staining. Sitting under such trees can also be unpleasantly wet [4]. However, the reason GWSS is a serious economic pest is its capacity to efficiently vector the bacterial pathogen, *Xylella fastidiosa*, to a large number of plant species. Disease caused by this pathogen have different common names depending upon the host plant which has been infected, e.g. Pierce's disease in grapes, almond leaf scorch, alfalfa dwarf disease, oleander leaf scorch, two previously unrecognised diseases producing scorchlike symptoms in olive trees and liquidamber, citrus variegated chlorosis, phony peach disease, coffee leaf scorch, pear leaf scorch, plum leaf scald and others [20, 22]. The severity of the disease ranges from lack of any symptoms to death of plants within 2-5 years.

Fig. 1. Adult GWSS have red colouration on wing veins, yellow and cream spots on its head and white colouration on abdomen and sometimes on wings.

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GWSS is native to southeastern United States and has spread to western United States (mainly California), French Polynesia (Tahiti), Hawaii, Easter Island, Cook Islands and Brazil [22, 24]. GWSS has over 175 feeding and reproductive host plant species, of which all but one are present in Australia [19]. GWSS is known to reproduce on box wood, crape myrtle, philodendron, Chinese elm, ash, macadamia, birch, eucalyptus, hibiscus, citrus, avocado, grape, agapanthus, agonis, *Acacia* spp., chrysanthemum, *Cycas* spp., eugenia, gardenia, lettuce, pittosporum and many others [4, 19]. Citrus is considered to be a very good host for GWSS and serves as a preferred overwintering host. There are 126 known hosts of *X. fastidiosa*, 93 of these are found in Australia [19] with symptoms ranging from death to non-symptomatic hosts [17]. It also seems likely that other hosts not previously exposed to *X. fastidiosa* and GWSS would serve as hosts if it were to become established in Australia [24].

Fig. 2. Excretion from GWSS dries onto leaves and fruit and gives a white-washed appearance. Photo by Regents of the University of California.

Fig. 3. GWSS egg batch laid into the epidermis of a leaf (above) and nymphs on a stem (right). Photos by Regents of University of California.

General biology

Adult GWSS are about 12 mm in length, with smoky-brown wings and red veins (Fig. 1). From above, their heads are brown with white spots; from below their heads are yellow. Their abdomen has distinctive white areas, particularly on their sides and underneath. Nymphs are greyish-brown and have prominent eyes which are sometimes, red, yellow or greyish in appearance (Fig. 3). Adults can live anywhere between 20 and 170 days, depending on gender, whether they have mated and the temperature (season) [18]. Females may lay anywhere

between 100 and 1000 eggs over their lifetime, depending upon season and host plant [7, 16, 18]; females on sunflower laid about 1000 eggs, whereas only about 200 were laid on black-eyed peas. Likewise development from egg to adult differs on different host plants but generally ranges between about 35 and 60 days (at 25°C) [17]. GWSS does not enter diapause but develops continuously as climatic conditions and host plants allow [12]. In fact, the number of eggs laid by individual GWSS in winter was greater than that in summer, although they were laid over a greater length of time, nymphs develop more slowly and adults live longer [18]. Adults are able to feed at a minimum temperature of about 13°C but higher rates of feeding are recorded as temperature increases with highest rates at about 31°C; at about 37°C GWSS stops feeding and mortality is high [15]. Eggs are laid in batches of 5-20 eggs beneath the epidermis of plants on the underside of leaves (Fig. 3) [24].

Fig. 4. Typical symptoms of Pierce's disease in grapes caused by *Xylella fastidiosa*. Photos by Elaine Backus, USDA.

GWSS is very mobile. Adults are able to fly about 100 m within minutes across open fields [8] but will often only travel short distances within an orchard of good host plants, e.g. citrus [3]. Research indicates that GWSS is more likely to disperse further from release points in patches of low quality host plants than high quality hosts and will remain in patches of high quality hosts longer than poor quality hosts [21]. However, even in patches of high quality host plants, adults would often move to a new host within 2-4 days. In California, GWSS are more likely to fly in summer than other seasons [5]. Nymphs can jump up to 70-80 cm, with 50 cm jumps being common, and may disperse 10-20 metres over three days [25]. Adults are more likely to be found in trees above about 1m from the ground [8].

In California, there are 2 distinct generations with most eggs being laid in late winter to spring and again in summer [1]. However, in warmer climates 6-8 overlapping generations may be possible as is indicated by GWSS in Tahiti [11]. Therefore in warmer regions of Australia it seems likely that GWSS will have more than 2 generations.

GWSS and *Xylella*

Xylella fastidiosa is a xylem inhabiting bacteria which is believed to lead to xylem blockage, producing water stress-like symptoms. It is transmitted by many xylem feeding leafhoppers, including GWSS, and can be transmitted through grafting [14]. Different species of insect vectors appear to transmit *X. fastidiosa* more efficiently to some plant species than others, e.g. GWSS transmits *X. fastidiosa* more efficiently from grape to grape than almond to almond [14]. Both nymphs and adults can transmit the disease and do so about 30% of the time on grapes [9]. Nymphs lose their ability to transmit the disease after each moult but adults are able to infect new plants for the remainder of their life after acquiring the bacteria. The rate of transmission increases

as the number of infected insects feeding on a plant increases [9]. Since GWSS moves between plants frequently and populations can reach very large populations, disease it transmission is quick, despite being a relatively inefficient vector compared to other leafhopper species [9].

Fig. 5. Side view of an adult GWSS.

Once a plant is infected, symptoms may take a number of years to develop as it is a very slow developing disease. First symptoms typically include slight chlorosis or bronzing along leaf edges and or tips that increases over time and may become water-soaked before browning and drying. Such symptoms commonly occur on a few branches at first and later occur on almost all foliage [14]. Early defoliation of new malformed leaves may also occur. Symptoms also include abnormally shaped fruit and stems, may show internal and external discolouration, dieback and unusual growth [14]. Some host plants may die after some years, whereas others continue to live with described symptoms.

While *X. fastidiosa* has a very wide host range, various strains (which are probably sub-species) are being described which are more host specific. For example, the grape strain mainly infects grapes, alfalfa and almond, whereas the peach-plum strain infects peach, plum, citrus and coffee; the host range of others remains unclear [13]. Refer to the nursery factsheet on Pierce's disease for more information on *X. fastidiosa*.

Management of GWSS overseas

In the United States nursery stock is highly regulated to limit the spread of GWSS as it is a high-risk commodity. This involves inspection of nursery stock in infested areas prior to shipping to non-infested areas, treatment of nursery stock to keep levels of GWSS below a certain level, certification of shipments, inspection of stock at receiving nurseries prior to sale and trapping in and around nurseries shipping to infested areas [6]. Shipments violating the above actions can be restricted from shipping certain plant species for a period of time, suspended from shipping all plants out of an infested area until the risk is mitigated or for an established period of time [6]. Shipments found with GWSS can be treated, returned or destroyed and may be subject to fines. Furthermore, nurseries must put in place a rigorous, written GWSS management plan that must be approved by their local agricultural authority. This includes substantial monitoring by visual inspections, yellow sticky traps, beat sheets or sweep net and keeping detailed records of all data collected. Nurseries must also be surveyed by inspectors every two weeks. Treatments must be conducted such that no more than three adults are found in the same one-half acre block in a two-week period [i].

Overseas, insecticides are used to manage GWSS with varying degrees of success. Pyrethroids and systemically applied neonicotinoids were most effective against adults, while other pesticides were more effective against nymphs and were effective in preventing nymphs from emerging from egg batches, e.g. carbaryl and certain foliar neonicotinoids, and may provide protection for up to 11 weeks [10]. Certain immature growth regulators (IGR) have also been shown to be very effective in control of nymphs and adults, e.g. buprofezin [23], but some may actually serve to increase the

[i] Refer to the California Department of Food and Agriculture website for more details on management of GWSS in California nurseries. <http://www.cdfa.ca.gov/pdcp/Guidelines.html#Nursery>

rate of disease transmission, e.g. pymetrozine [2], and some are only effective against a specific stage of GWSS, e.g. pyriproxyfen is only effective against young nymphs [23]. In Australia, current registration and minor use permits allow for use of various products against all leafhoppers in ornamental crops, including organophosphates (maldison and methidathion), carbamate (carbaryl), synthetic pyrethroid (pyrethrins+piperonyl butoxide), neonicotinoids (imidacloprid and acetamiprid) and an IGR (buprofezin).

Monitoring for GWSS

Adults and nymphs of GWSS are most often found on stems and leaves of their host plants. They are large and distinctive compared to native leafhopper species. There are some Australian species which superficially resemble GWSS (Fig. 6), more of which are found at the PaDIL website [ii]. However, any adult leafhopper that is over 1 cm with red colouration on their wings, white colouration on the wings and abdomen, yellow underneath its head and prominent, enlarged eyes and head should be treated with suspicion. Egg batches of GWSS are difficult to detect and have been implicated in spread of the insect from eastern United States to California on nursery stock [6].

If you see this pest

If you see or suspect that you have seen GWSS contact your local biosecurity organisation or the Exotic Plant Pest Hotline (1800 084 881). Do not move the plant material with GWSS; eggs are particularly difficult to detect. There is no better way to manage GWSS than to keep it out of Australia; currently there is no management strategy of GWSS and *X. fastidiosa* that is completely successful overseas.

Fig. 6. A common native Australian leafhopper (*Amarusa australis*) that looks superficially similar to GWSS. Photo by Gordon Grigg, Brisbane.

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