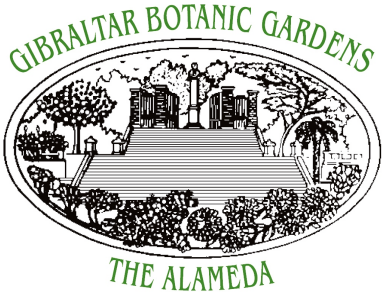

The Citrus Flatid Planthopper *Metcalfa pruinosa* (Say, 1830) in Gibraltar

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The Citrus Flatid Planthopper *Metcalfa pruinosa*.

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Introduction

Metcalfa pruinosa (Say, 1830), the Citrus Flatid Planthopper, is native to North America but has become naturalised elsewhere, including throughout southern Europe (Mifsud *et al.*, 2010). Adults and nymphs feed on the sap of a wide variety of plants.

The first records of *M. pruinosa* in Europe were from Italy (Zangheri & Donadini, 1980). The species was first identified from Gibraltar in 2010, but it had been present at the Botanic Gardens for at least two years before that (*pers. obs.*). It was first seen in pest proportions at the Botanic Gardens and the South District in 2009 and is now well established within the Upper Rock Nature Reserve. Although it is not the only exotic hopper present in Gibraltar (e.g., Wilson *et al*., 2011) it is the most noticeable species, and the one that occurs at highest densities. High abundances of *M. pruinosa* have been observed throughout all invaded parts of southern Europe (e.g., Conti & Bin, 1999; Pon *et al*., 2002; Preda & Skolka, 2011).

Scale of Problem

M. pruinosa is harmless to humans and is not known to cause any public health issues. The main problems caused by *M. pruinosa* are:

Infestation of Plants

M. pruinosa feeds on a wide variety of plants throughout the Mediterranean, native and exotic (Pons *et al.*, 2002; Souliotis *et al.*, 2008). This is likewise the case in Gibraltar, where the species has been observed feeding on a very wide range of species (Table 1). However, although infestations on some plants can be considerable, serious damage to plants is rare and restricted mainly to indirect damage via facilitation of colonisation by sooty moulds, as a result of the deposition of honeydew on plants (Lauterer, 2002; Strauss, 2009). No direct damage has been observed on the Rock, but sooty mould is common on infested plants. Some economic damage has been caused to a variety of crop species (Alma *et al.*, 2005; Strauss, 2009) but this is not relevant to Gibraltar, which has no agriculture.

Table 1. Plant species on which *Metcalfa pruinosa* has been recorded in Gibraltar.

Family	Species/Genus	Status
Anacardiaceae	*Pistacia lentiscus*	native to Gibraltar
Araliaceae	*Hedera helix*	native to Gibraltar
Asparagaceae	*Asparagus* (several spp.)	a native genus, but recorded on exotic spp.
Convolvulaceae	*Ipomoea carica*	exotic
Euphorbiaceae	*Euphorbia* (several succulent spp.)	a native genus, but recorded on exotic spp.
Geraniaceae	*Pelargonium* (several spp.)	native to Gibraltar
Iridaceae	*Chasmanthe floribunda*	exotic
Iridaceae	*Iris foetidissima*	native to the Mediterranean
Lythraceae	*Punica granatum*	exotic
Malvaceae	*Hibiscus* (several spp.)	exotic
Malvaceae	*Malvaviscus arboreus*	exotic
Malvaceae	*Pavonia columnella*	exotic
Nyctaginaceae	*Bougainvillea* (two spp.)	exotic
Oleaceae	*Fraxinus angustifolius*	native to Gibraltar
Oleaceae	*Olea europaea*	native to Gibraltar
Rosaceae	*Pyracantha* (various cultivars)	exotic
Rosaceae	*Rosa* (various cultivars)	exotic
Rosaceae	*Rubus ulmifolius*	native to Gibraltar
Santanalaceae	*Osyris quadripartita*	native to Gibraltar
Simaroubaceae	*Ailanthus altissima*	exotic
Verbenaceae	*Lantana camara*	exotic
Xanthorrhoaceae	*Aloe ciliaris*	exotic

Secretions and Honeydew

Nymphs of *M. pruinosa* produce fluffy, wax secretions (Fig. 1) that rub off onto passers-by when these come into contact with infested plants. The species also excretes large amounts of honeydew. This honeydew is not in itself harmful in any way. In fact, bees collect this honeydew to produce honey, and *Metcalfa* honey is marketed in Italy and southern France for its quality (Wilson & Lucchi, 2007). However, it does facilitate colonisation by sooty moulds on plants, and the mould may then harm the plants, or at least detract from their aesthetic appearance. When produced in large enough quantities, the honeydew may soil e.g. cars parked under infested trees or shrubs (Lauterer, 2002; Alma *et al.*, 2005). This has already been observed in Gibraltar.

Figure 1. Infestation of *M. pruinosa* on a garden rose, showing the fluffy, wax secretions produced by the nymphs.

Invasion of Homes

M. pruinosa is strongly attracted to light (e.g., see Fig. 2). Residents of houses and buildings close to infested green areas may therefore expect to have some *Metcalfa* flying into them at night if the lights are on and windows are not protected by mosquito netting.

When is *Metcalfa pruinosa* Active?

M. pruinosa has one generation per year, both in Europe and in its native range in North America (Alma *et al.*, 2005). In Greece, adult activity occurs between June and late September (Souliotis *et al.*, 2008). Systematic light-trapping at the Botanic Gardens has shown that the situation in Gibraltar is similar, with adults active between June and October and peak counts during July and August (Fig. 2). Eggs are laid during late summer and early autumn, and hatch in the spring of the following year, from which time the juvenile stages (nymphs) are present (Alma *et al.*, 2005). The problem disappears completely between October and the spring.

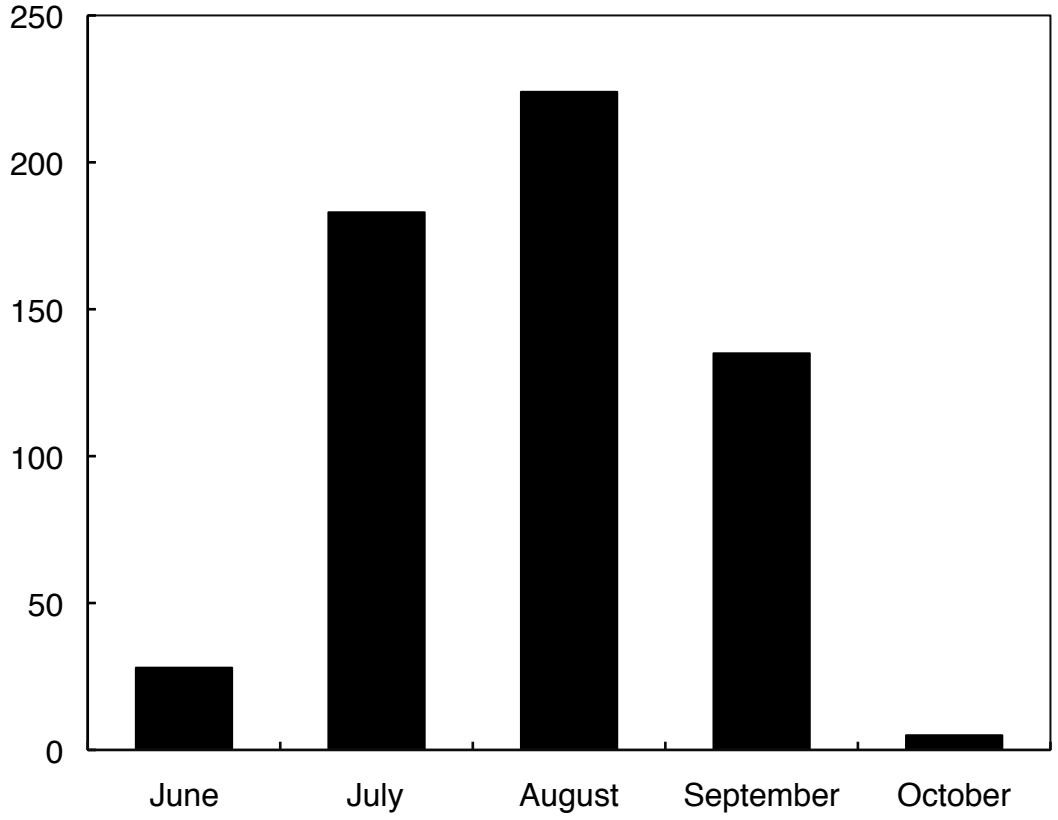

Figure 2. Phenology of *Metcalfa pruinosa* in Gibraltar based on data collected with a Rothamsted light trap at the Gibraltar Botanic Gardens. Adults of the species are not active outside of these months.

[a] Most data was collected in 2010, except that for June, which was collected 2011.

[b] No sampling took place throughout a large part of July 2010 and this month could well be the species' peak, with 354 recorded in July 2011.

Possible Courses of Action

Pesticide

Pesticides such as the nicotine-based, systemic insecticide Imidacloprid can be used against *M. pruinosa*. However, these are non-selective and could have a serious impact on other entomofauna. Furthermore, the impact of pesticides is at best short-term and recolonisation will follow shortly after application from other infested areas.

Soapy Water

Application of soapy water is a useful way of removing insect pests from plants, and is particularly useful against a range of hemipteran pests such as aphids, coccids and the nymphs of larger species. It is also far less harmful to other invertebrate species than pesticides. However, this method also has limitations relating to recolonisation. Spraying vegetation with strong jets of water is likewise only a very temporary solution, with the hoppers quickly returning to the vegetation in question.

Mosquito Netting

During the summer of 2011, complaints were received from residents in areas infested with *M. pruinosa* about these insects flying into their houses at night. *M. pruinosa* is strongly attracted to light and will fly in through open windows if the lights are on. The most effective way to tackle this is to erect mosquito netting at windows that face green areas. Treatment of the vegetation will not be as effective, because the infestation is Gibraltar-wide, including the Upper Rock Nature Reserve (where large numbers were captured with a Robinson light trap on a nightly basis during the summer of 2011), and green areas will quickly be recolonised.

The Parasitoid Wasp Neodryinus typhlocybae

The rapid spread and population growth of *M. pruinosa* throughout southern Europe has been largely a result of a lack of natural enemies (Alma *et al.*, 2005). The parasitic wasp *Neodryinus typhlocybae* (Ashmead, 1893), also from North America, has been used to control populations of *M. pruinosa*. It has been introduced to Italy (Girolami, 1999), southern France (Malausa, 1999), Switzerland (Jermini *et al.*,

1999), Croatia and Slovenia (Alma *et al.*, 2005), Greece, the Netherlands and Spain (Strauss, 2009). The wasp does not eliminate *M. pruinosa*, but it can reduce populations significantly (Malausa, 1999) and it offers a long-term solution with reduced impact to other species. All introductions of *N. typhlocybae* have met with considerable success in reducing populations of *M. pruinosa* (e.g., Malausa, 1999;), for example in Slovenia where *M. pruinosa* is no longer common (G. Seljak & G. Strauss, *pers. comm*.). Furthermore, it can become established even with a low initial size of the founder population (Fauvergue *et al*., 2007) and has the ability to disperse and colonise new habitats (Malausa *et al*., 2003). There is no doubt that if introduced, the wasp would eventually spread throughout Gibraltar from the points of introduction. In fact, the species has already reached the Rock, most likely from neighbouring Spain (a single female specimen was recently collected at the Botanic Gardens; Fig. 3).

N. typhlocybae is fairly host-specific, targeting only some species of Flatidae: it has been recorded on *M. pruinosa* and three other species in North America, and none of the European Flatidae have so far been reported as hosts (Guglielmino & Olmi, 1997; Strauss, 2009). Trials in Austria reported no effect on a selection of native Auchenorryncha (the suborder to which *M. pruinosa* belongs) but no species of Flatidae were tested (Strauss, 2009). Eight species of Flatidae occur in Europe (Alma *et al.*, 2005) of which one, *Cyphopterum difformis* (Spinola, 1849), is native to Iberia. This species inhabits salt marshes (Alma, 1999) and is unlikely to be present in Gibraltar, but may be present at estuaries in nearby Spain.

N. typhlocybae (illustrated in Fig. 3) is a small species of wasp, much smaller than the social wasps that most people are familiar with. It is not harmful to humans, nor is it aggressive. Parisitoid wasps generally show little interest in anything other than their hosts. The term 'wasp' is applied to a disparate collection of hymenopteran groups and has no taxonomic value. *N. typhlocybae* belongs to the family Drynidae, whereas the large and often vicious social wasps belong to the family Vespidae. As an example of the inconsistent use of the term 'wasp', the social wasps are more closely related to ants than they are to most other groups termed 'wasps', including the Dryinidae (Sharkey, 2007).

Figure 3: Female of *Neodryinus typhlocybae* captured at the Gibraltar Botanic Gardens on 12th August 2011.

Other Parasitoids

The possibility of using egg-parasitoids of *M. pruinosa* for biological control has also been discussed, but parasitoid species identified so far have a negligible effect on *M. pruinosa* (Conti & Bin, 1999; Alma *et al.*, 2005).

Action taken within the Botanic Gardens

So far, little action has been taken against *M. pruinosa* at the Botanic Gardens, apart from very localised application of pesticide in the enclosed plant propagation area. This is because damage to plants has not been observed so far, and is consistent with the Botanic Gardens' policy of keeping the use of pesticides and herbicides to an absolute minimum so as to have no impact on wildlife. *M. pruinosa* has been observed returning to plants shortly after the application of soapy water and insecticide, suggesting that the use of pesticide has, at best, a limited effect. However, as noted above, the presence of *N. typhlocybae* has already been recorded and introduction of additional wasps has been considered (subject to external approval), as many plant species look quite unsightly during the late spring and summer period, when nymphs of *M. pruinosa* infest these.

Recommendation

Only a permanent, cost-effective method should be seen as a feasible solution to infestations of *Metcalfa pruinosa*. The use of water, or soapy water, can only be considered a very temporary, time-consuming and inefficient exercise. Large-scale use of pesticides, such as is now required to control *M. pruinosa* in Gibraltar, is not recommended. These can have serious impacts on a range of other entomofauna, as well as knock-on effects on fauna and flora that rely on insects for, e.g., food or pollination (and that includes the vast majority of, if not all terrestrial organisms). Furthermore, any reduction in populations as a result of the application of insecticide can at best be seen as temporary, as *M. pruinosa* will eventually recolonise sites from neighbouring populations. Sites where *M. pruinosa* is well established now include the Upper Rock Nature Reserve, where the use of pesticides should not be considered under any circumstances.

The wasp *Neodryinus typhlocybae* presents the most feasible, cost-effective and environmentally friendly solution. It is also the least labour intensive method, requiring only the release of specimens. Experience from other countries shows that *N. typhlocybae* has the ability to establish itself well where *M. pruinosa* is present, and has an important long-term impact on populations of *M. pruinosa*. No impact has been recorded on other species of Hemiptera as a result of introductions of *N. typhlocybae*, but this issue is largely academic in Gibraltar anyway, as the wasp has seemingly arrived on the Rock on its own. Although the wasp is already present, increasing its population density locally via introductions would most likely increase the impact over the short term. Therefore, introduction of this species is advised, subject to approval by the Nature Conservancy Council, to which this report should be forwarded. Introductions should be carried out in several areas in conjunction, during the spring, once M. pruinosa has hatched. Methods of introduction can be found in Malausa (1999) and Gervasini (1999).

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