UTILISING CITIZEN SCIENCE DATA FOR MONITORING RELEASED BIOLOGICAL CONTROL AGENTS ON INVASIVE WEED SPECIES

Kelli Pukallus
Queensland Department of Primary Industries, Biosecurity Queensland, Tropical Weeds Research Centre, Charters Towers, Queensland, 4820.

ABSTRACT

Monitoring is conducted to determine the establishment and spread of an introduced agent, detect any off-target damage and denote the success of a mass rear and release program. If the presence of agents is observed in this time, distribution data is collected, and once long-term establishment is achieved, the rear and release program enters into the field redistribution stage. Monitoring is normally done by people involved within the project, however in recent years the use of citizen science on data collection platforms such as iNaturalist Australia (iNaturalistAU) or Atlas of Living Australia (ALA) has expanded. This has created an opportunity for researchers to utilise released agent detections and spread on a wider scale through citizen science.

Keywords: data collection, establishment, iNaturalist Australia, mass rear, ALA.

INTRODUCTION

Mass rear and release programs for invasive weed species have been conducted in Australia since 1903 (Cullen *et al.* 2023). These programs often run for 3-4 years and involve releasing thousands of agents to hundreds of locations. Within the course of a mass rear program and for a few years past the completion of the program, monitoring is conducted. This involves revisiting release sites to see if the agents are still there, what impact they are having on the target weed species and if the agent has spread. With hundreds of release locations in play, this can be time-consuming, resulting in only a portion of all sites being.

It is often stated to assess the true successfulness of a biological control program you need to wait at least 10 years after the initial releases. Programs often don't have the resources to continue monitoring for long periods after the completion of mass rearing. This has led to programs being deemed unsuccessful due to the released agent not found in the field within the shorter time frame following the release program.

Data collection platforms utilising citizen science are not a new concept within Australia. Atlas of Living Australia (ALA) created the Biocontrol Hub over 15 years ago. In recent years, iNaturalistAU has become popular and provides an easy way of recording an organism observation with a photo and GPS location. Once research grade identifications are achieved, within iNaturalistAU uploads, the observer's species information is then shared into additional databases such as ALA. Biological control researchers can sift through numerous uploaded photographs to positively identify and agree with an observation or provide a suggested ID. The comparison of recent and historical observations provides insight into where an agent is and a guide to the agents spread since its release.

Within an agent's data profile, useful information can be found such as charts showing seasonality graphs, numbers of detections over time and life stage observed (such as adult, eggs, larva). Figure 1 shows the information available on iNaturalistAU for the biological control agent *Calligrapha pantherina*, an introduced agent for invasive weed, *Sida*. The profile includes uploaded pictures, the observer's profiles and a seasonality graph. The graph shows when the agent has been observed in the field and is consistent with the known biology and an increased prevalence during summer and autumn. Figure 2 shows the history uploaded observations of *C. pantherina* from 2008 through to 2025.

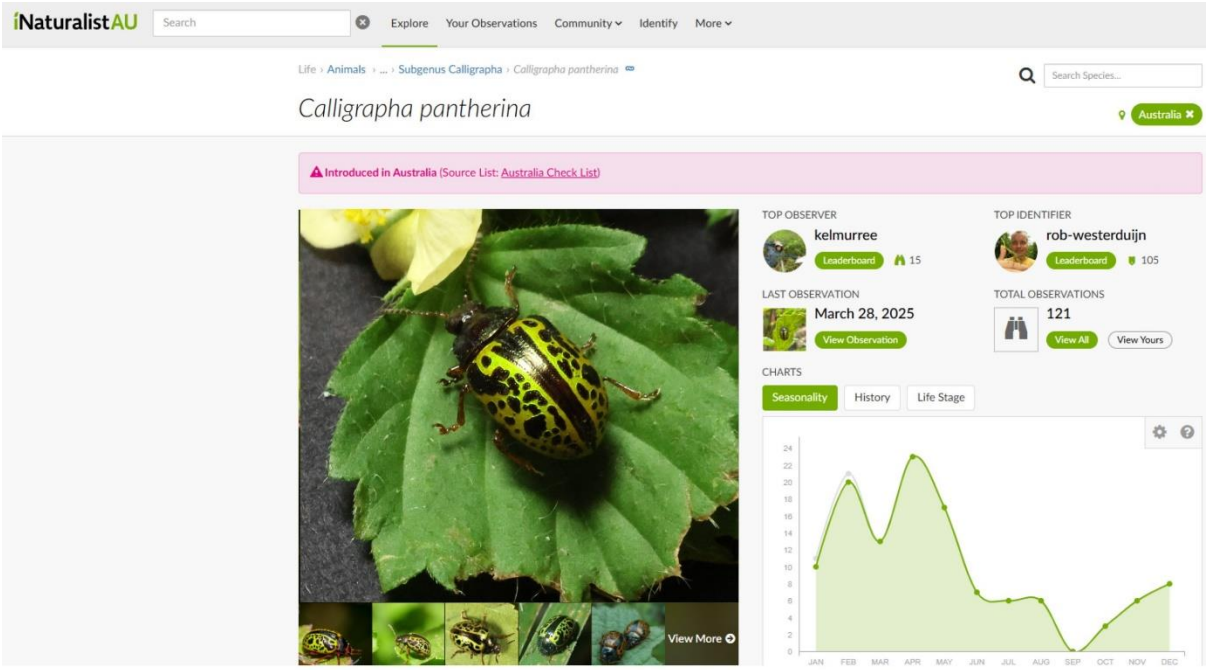

Figure 1. iNaturalist Australia observations for biological control agent *Calligrapha pantherina* (source & modified from: inaturalist.ala.org.au).

This information can be used for field collection and redistribution of agents to target seasonal timing and locations. Uploaded photos can also show damage to the target weed species, providing field impact assessments which can often be misreported or not collected as part of a mass rear program.

Maps showing observation locations can highlight an introduced agent's distribution within in Australia. They can prove an agent's updated presence and distribution, as in the case of *C. pantherina* (Figure 3). *C. pantherina* was classified as a widely established agent by Palmer *et al.* in 2010, compared to Heard and Day (2012) who deemed the agent to have only limited establishment around Townsville. Figure 3 shows the current wider distribution within Australia and adjoining islands with the history graph (Figure 2) showing most of the observations have occurred since the last reference in 2012. iNaturalistAU shows update location data across Australia, and observations in the country of origin (Figure 3).

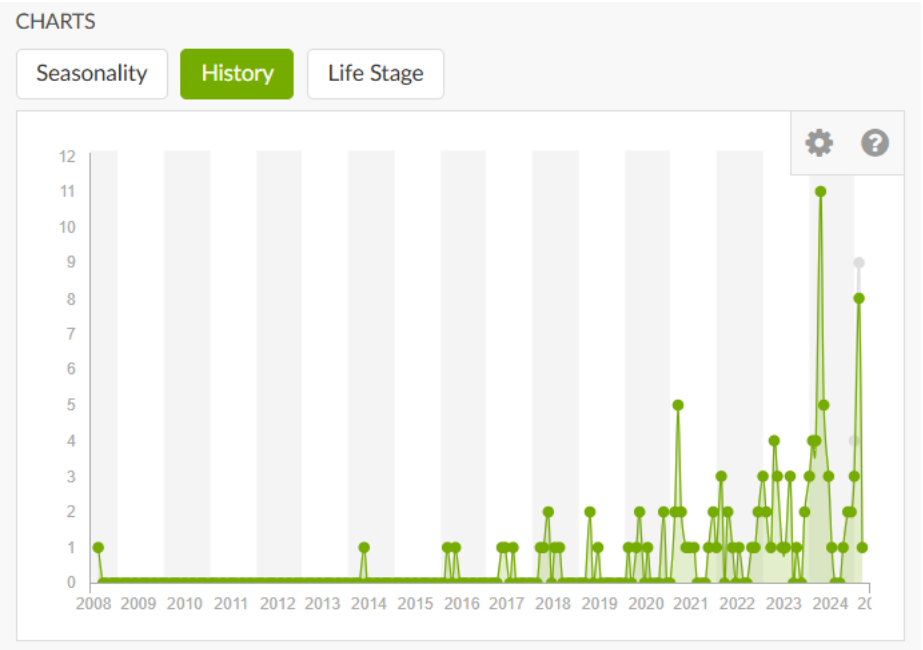

Figure 2. iNaturalist Australia history data for observations of biological control agent *Calligrapha pantherina* (source: inaturalist.ala.org.au).

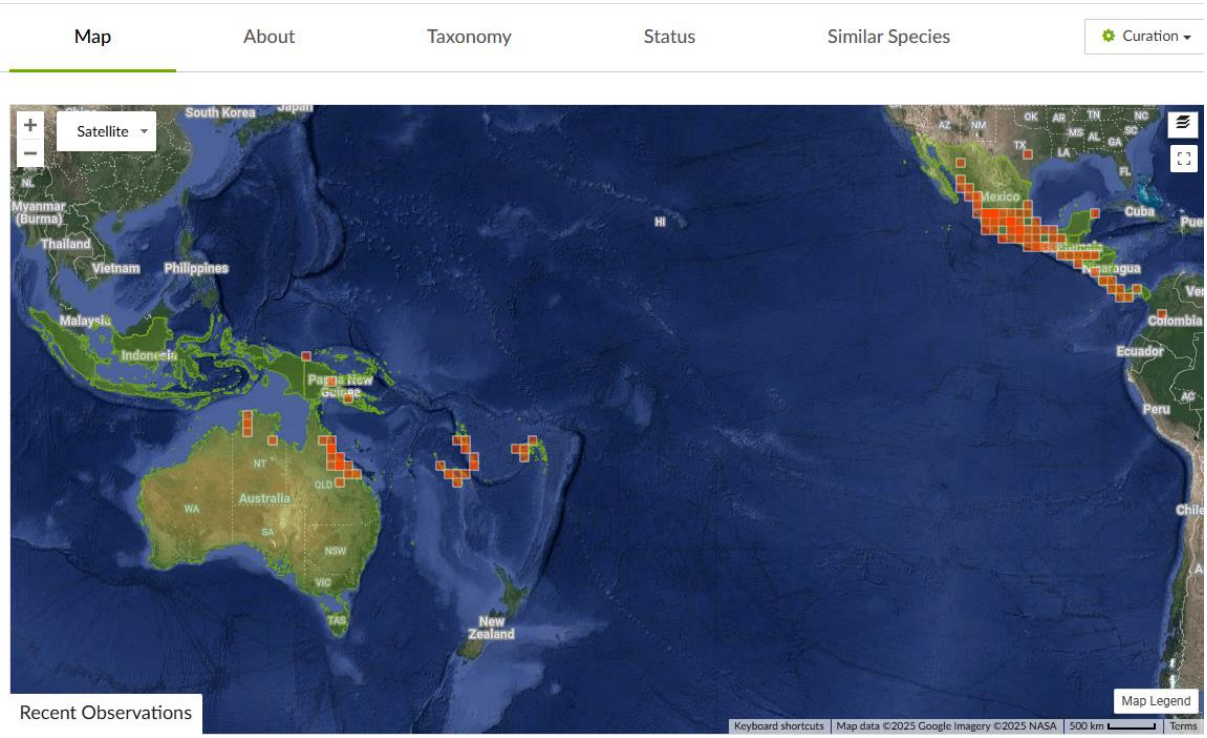

Figure 3. iNaturalist Australia map for observations of biological control agent *Calligrapha pantherina* (source: inaturalist.ala.org.au).

Limitations do exist using citizen science, such as the limited knowledge about agents by the broader community. Past introduced agents may have limited available photos to allow the assistance of identification to the observer or for iNaturalistAU to recognise and aid identification once a photo is uploaded. *Bucculatrix parthenica*, an introduced agent for *Parthenium hysterophorus*, is one such agent. The leaf-mining moth was

released in Australia from 1984- 1986 (Dhileepan *et al.* 2018). On iNaturalistAU, there is no default profile picture and only one entry into iNaturalist worldwide (Figure 4) (iNaturalist 2025) and five entries in ALA (ALA 2025). Originating from Mexico, it is stated to be widespread throughout Queensland (Dhileepan *et al.* 2018), despite limited observations seen on these data collection platforms. This limited knowledge, coupled with limited experience with scientific names can result in observations being incorrectly identified. Limitations such as these could be overcome by researchers entering their own data for release locations and detections and assisting with identifications. When adding observations, by completing the additional observation field of 'Host plant ID', providing a comment in the notes 'introduced biological control agent' or adding to a biocontrol project, guidance is provided to the citizen science cohort.

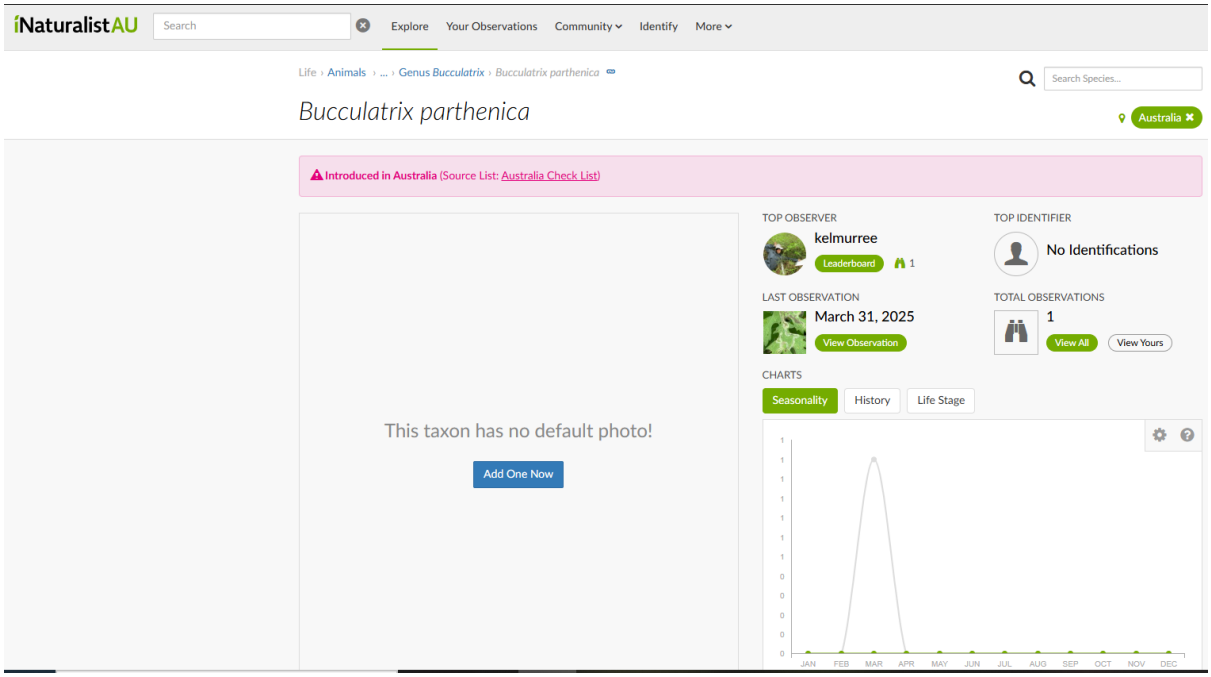

Figure 4. iNaturalist Australia observations of biological control agent *Bucculatrix parthenica* (source: inaturalist.ala.org.au)

The size of organisms can impact citizen science recognition in the field, with observers more likely to see a larger insect. *B. parthenica* for example is a small 5mm moth, compared to a brightly coloured *C. pantherina* beetle.

iNaturalistAU allows researchers to upload and keep track of their own and other's observations by subscribing to a personally selected taxon. Notifications of new uploaded observations are received, and this provides years of constantly updated monitoring information at your fingertips. This could include the agent, but also the host plant, to allow for undetected recordings of agent or agent damage in uploaded photos. Starting or joining a project is another way to pool observations of biological control agents.

CONCLUSION

The use of ALA or iNaturalistAU can provide up-to-date agent distribution data from the public and researchers. This information can be used as part of a current or past

mass rear and release program. The data collected can assist with field collection and redistribution timing of established agents, the discovery of “lost” agents from past projects, monitoring of off-target detections, improved agent identification and to shorten noted success timeframes. Utilising citizen science makes sense. By spreading knowledge and encouraging the use of data collection platforms, the data becomes more valuable. Embracing the adage ‘the more you look the more you find’, citizen science should be a tool in the biological control agents of invasive weed species toolbelt.

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