

## Local community involvement as a fast and effective way of monitoring invasive species in developing countries

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### Abstract

The rapid spread of the non-native species *Harmonia axyridis* in Algeria has the potential to harm local biodiversity, create new challenges for natural resources management, and impact economies. Through an investigation on social media and a citizen science platform, three new occurrences of this species have been discovered in different parts of the country, with one location being over 400km away from the first record. This highlights the important role of citizen science in the detection and for the spread monitoring of invasive species in developing countries where funding for research in this field is limited.

**Keywords:** Citizen Science, Harlequin ladybird, invasion, Algeria

### Introduction

Scientific research is a time-consuming activity that requires a significant mobilization of human and material resources that are sometimes very expensive. This question is particularly relevant in developing countries, where lack of funding opportunities is an issue of concern for scientific research development (World Bank, 2005). Citizen science then appears as a new fast-growing source of data that has the potential to add to our scientific knowledge of natural resources and biodiversity trends (Pocock et al., 2019). Scientists, governmental agencies, and NGOs would

clearly benefit from using citizen science to meet the collective obligations toward biodiversity conservation, and United Nations' Sustainable Development Goals (Chandler et al., 2017, Pocock et al., 2019). A study performed in the UK indicates that by using direct or verified citizen science, a program can collect 3–4 times the number of samples provided by traditional research for the same cost making citizen science programs a good alternative for data collection (Gardiner et al., 2012). However, when we see that the countries with fewer resources and which are nevertheless the most called upon to reflect on the different means of developing research at lower costs are those which make the least use of citizen science programs (Loos et al., 2015; Chandler et al., 2017; Pocock et al., 2019). This is probably due to the fact that in these regions it is challenging to get people who are preoccupied with their livelihoods to engage in sophisticated citizen science programs.

The harlequin ladybird *Harmonia axyridis* (Pallas 1773) (Coleoptera, Coccinellidae) is a non-native invasive species originally from Asia that has become the most invasive ladybird on Earth (Roy et al., 2006). It was introduced through accidental or intentional mean (as a biological control agent) and has since come into competition with local biodiversity, leading to negative impacts (Grez et al., 2016). In Africa, the species was first observed in the wild in South Africa in 2001, Egypt in 2007, and Kenya in 2010 (Brown et al., 2011). The predicted global distribution of "*Harmonia axyridis*" according to Brown et al. (2011) indicates that large areas of southern and eastern Africa and the coastal belt of northern Africa are suitable for the species.

During an excursion organized by a local NGO in April 2020 to observe insects in Guelma, Algeria, three species of ladybirds were identified, including the Asian ladybird "*Harmonia axyridis*", this species was first reported in Algeria in 2018 (Lakhal et al., 2018).

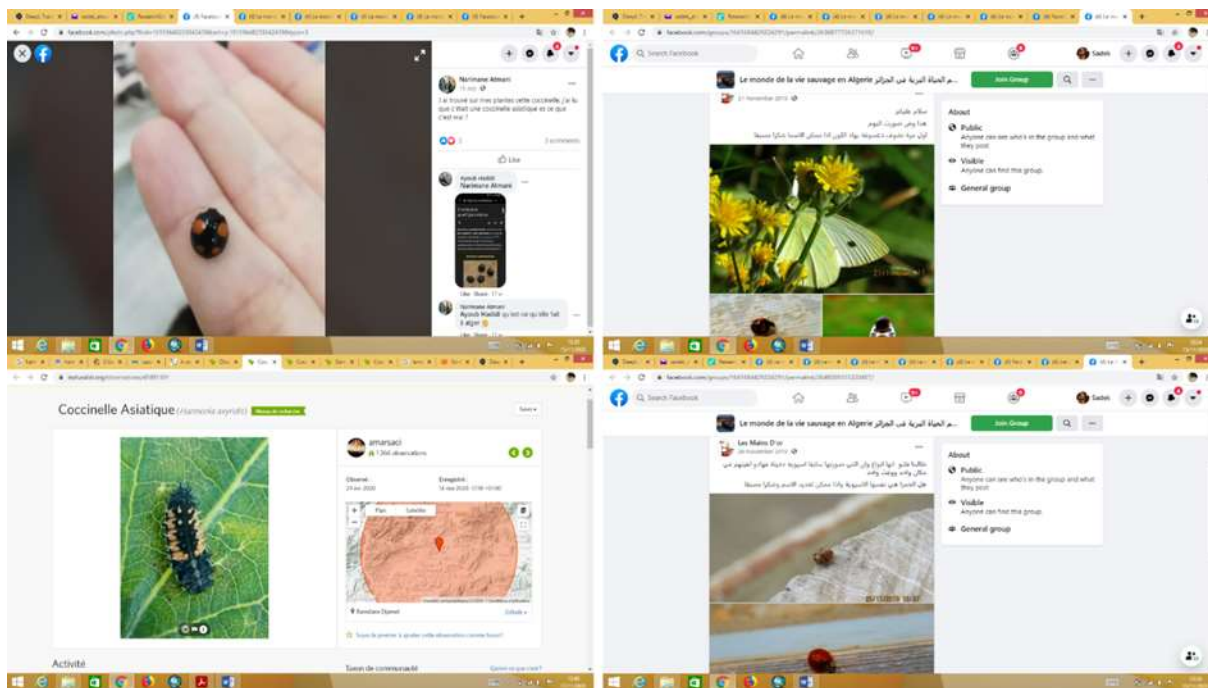
Our aim was to evaluate the effectiveness of using unsystematic citizen science data to detect and track the spread of the invasive harlequin ladybird in an African context. We researched two Facebook groups dedicated to wildlife observation, and on iNaturalist. We wanted to determine if citizens in Algeria: (1) Observed "*Harmonia axyridis*" ladybird and shared their observations on social media interest groups (2) Correctly identified the species (3) Reported data on the location of their observations, which could help to monitor the spread of the species?

## **Martial and methods**

### **Searching in the citizen science database**

Our research focused on two Facebook interest groups dedicated to wildlife observation, using keywords related to ladybirds in French, English, and Arabic (Figure 1). The first group "to save wildlife in Algeria" was created by the Algerian wildlife association on 17 July 2013 and has 21500 members. The second group "Le monde de la vie sauvage en Algérie" created on 9 January 2018 is a public group with more than 13000 members. We downloaded all the photos of ladybirds posted by the members of these groups, which were then identified by a specialist. We also obtained information on the dates and locations where the photos showing the species "*Harmonia axyridis*" were taken by contacting the photographers via messenger.

Additionally, we used the iNaturalist website (<http://www.inaturalist.org>), which is a multi-taxa citizen science project hosted by the California Academy of Sciences and National Geographic Society. Participants contribute observations (e.g., photos, recordings) of any living organism with location and date assigned. The records are then tagged and identified to the lowest possible taxonomic resolution by other iNaturalist community members. We searched using the word ladybird, in French, Arabic, and English and selected the region Algeria. The observations provided by this research were subsequently identified by a specialist to confirm the taxonomy.



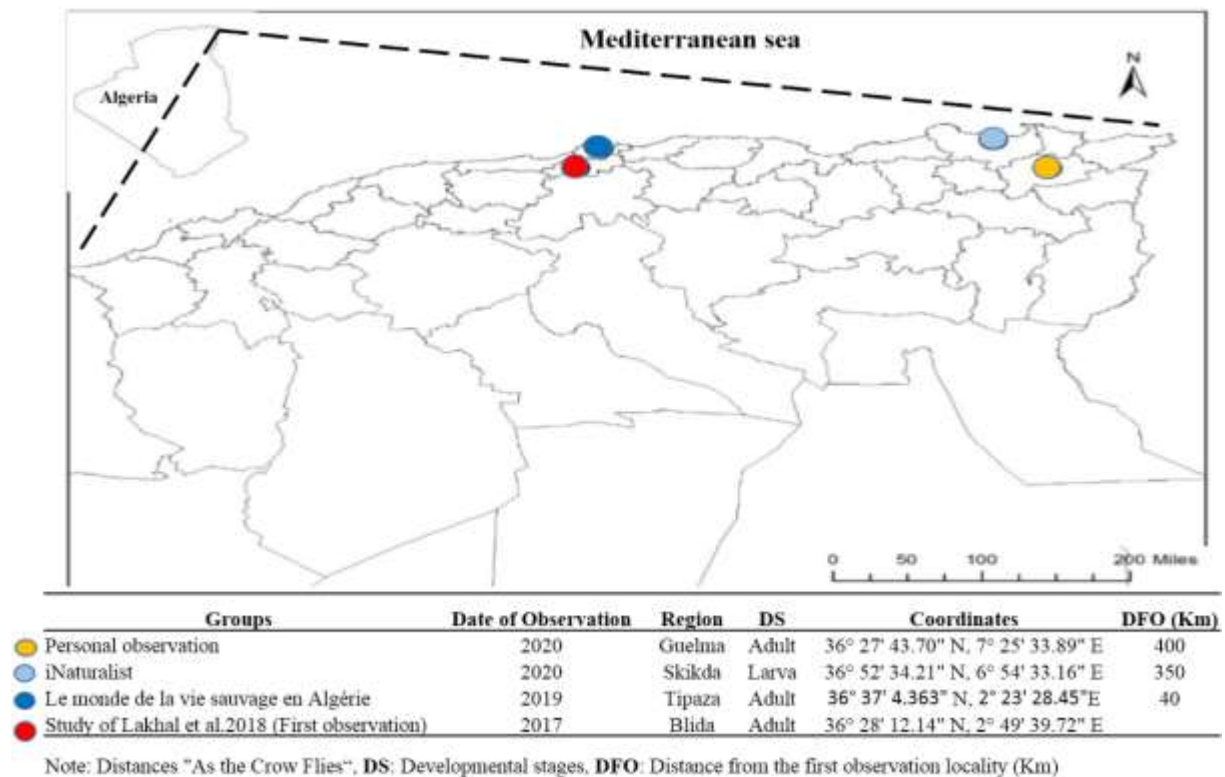
**Figure 1.** Research procedures within groups on Facebook and iNaturalist website

### *Ethical consideration*

We undertook a manual search in public groups, which means that the extracted data are made publically available. In addition, all the data were recorded respecting rights to data privacy, and data protection.

## Results and discussion

On Facebook, we found three photos of the invasive ladybird species “*Harmonia axyridis*” that was posted in the group "Le monde de la vie sauvage en Algérie". Two of them were posted by the same person and were dated, and the person who posted the photos reported that they were taken in the region of Tipaza, which is more than 40 km away from where the species was first observed. The third photo was taken on July 13, 2020, in Algiers. Additionally, it is worth noting that the species was correctly identified in the comments associated with the posted photos. On iNaturalist, we found one photo of a larva of “*Harmonia axyridis*” which was taken in the region of Skikda, which is about 350 km away from where the species was first observed. Combining this observation with personal observations and data collected through citizen science on Facebook and iNaturalist, it appears that the species is in at least three other locations, with the farthest being more than 400 km away from the initial observation site (Fig. 2).



**Figure 2.** Records of the species of *Harmonia axyridis* (Pallas, 1773) in Algeria. Developmental stages, region, date of observation, and distance from the first observation are provided

Our findings indicate that the ladybird *Harmonia axyridis* has spread beyond the location where it was first observed in Algeria, according to Lakhali et al. (2018). This supports the idea that this invasive species has the potential to quickly spread across the globe, both through direct and indirect means, to the region with tropical climates, whether they are wet or dry (Poutsma 2008; Loy et al., 2016; Nedvěd & Háva 2016; Biranvand et al., 2019).

Our findings demonstrate the rapid spread and high invasiveness of the harlequin ladybird in Algeria, highlighting the need for ongoing monitoring and management efforts. These results are crucial for protecting the native insect populations and ecosystems in the country. Further research on the impacts of non-native species on local communities and ecosystems is necessary to fully understand the consequences of the invasion.

## Conclusion

This study demonstrates that citizen science can be an effective tool for monitoring the spread of invasive species in Africa, even if previous research has shown that African countries have not been heavily involved in citizen science programs. By using social media, this study was able to collect valuable data on the spread of the invasive ladybird species "*Harmonia axyridis*" in Algeria. This highlights the potential for engaging citizens in African countries in citizen science programs, with the key being good communication and targeting the right people. Therefore, researchers, IT developers, NGOs, and government agencies need to work together to establish a framework for biodiversity monitoring based on citizen science, to meet the global goals for biodiversity conservation and sustainable development.

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