

# HOST SPECIFICITY TESTING OF A NEW CANDIDATE FOR THE BIOCONTROL OF MOTHER-OF-MILLIONS

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## ABSTRACT

Mother-of-millions *Kalanchoe* (= *Bryophyllum*) *delagoensis* is native to Madagascar. Introduced to Australia as an ornamental plant, it has become a widespread major weed in Queensland and northern New South Wales. Under a 4-year biological control project funded by the Australian Government and Agrifutures, and in collaboration with New South Wales DPI, potential candidates in Madagascar were investigated. As a result a small flea beetle, *Bikasha* sp. (Coleoptera: Chrysomelidae), was imported into the quarantine facility at the Ecosciences Precinct in Brisbane for biology studies and host specificity testing. Both adult and larval life stages feed on mother of millions with the adult feeding on plant phyllodes (leaves) and stems and the larvae tunnelling within the plant roots. In host specificity trials the beetle fed on several plants species including ornamental and weedy *Kalanchoe* species. Current trials have shown it can complete its life cycle on several species. This off-target damage suggests that this beetle may not be suitable for release in Australia and further surveys for potential agents in Madagascar are warranted. In the meantime, alternative methods of controlling weedy *Kalanchoe* species should be employed.

**Keywords:** mother-of-millions, biocontrol, *Bikasha* sp., host specificity.

## INTRODUCTION

Mother-of-millions (*Kalanchoe* spp. = *Bryophyllum* spp.) (Crassulaceae) is native to Madagascar and is a major weed in Queensland and northern New South Wales. In Queensland it is a restricted invasive plant under the Biosecurity Act 2014. Originally an escaped garden plant it has spread widely through dispersal of its seeds, phyllodes and plantlets by animals, vehicles and machinery as well as abiotic factors such as flooding. Mother-of millions impacts on pastures and grazing lands and the plant, particularly when flowering, is toxic to livestock.

Mother of millions was accepted as a candidate for biological control in 2001. Previous field surveys in Madagascar found four potential insect agents and host specificity was assessed on two species of beetles (*Osphilia tenuipes* and *Alcidodes sedi*) in Australia. These attacked closely related, mostly ornamental plants in several genera and so *A. sedi* was not further pursued as a biological control agent in Australia while the risk posed by *O. tenuipes* is still being assessed. Under a new 4-year project funded by the Australian Government and Agrifutures, a small flea beetle, *Bikasha* sp. (Coleoptera: Chrysomelidae) was found in Madagascar and imported into the quarantine facility at the Ecosciences Precinct in Brisbane in November 2017 for host-specificity testing. This paper describes the biology and host specificity testing conducted to date.

## MATERIALS AND METHODS

*Bikasha* sp. biology investigations and host specificity testing were conducted within the quarantine facility at Ecosciences Precinct, Dutton Park, Queensland. Beetles were reared on potted mother-of-millions plants within gauzed cages under glasshouse conditions at 27°C day/22°C night and 70%RH.

The life cycle of the beetle was explored to determine longevity, sexual maturity, time until egg lay and hatching, and the time until adult eclosion. A microscopic examination was conducted to establish whether gender could be determined without destructive sampling.

Host test plants were sourced from multiple nurseries to obtain a variety of species from within the genera *Kalanchoe* and *Crassula*. These plants were re-potted where necessary and maintained within a shade-house under ambient conditions until required for culture and host-testing experiments in the quarantine glasshouse.

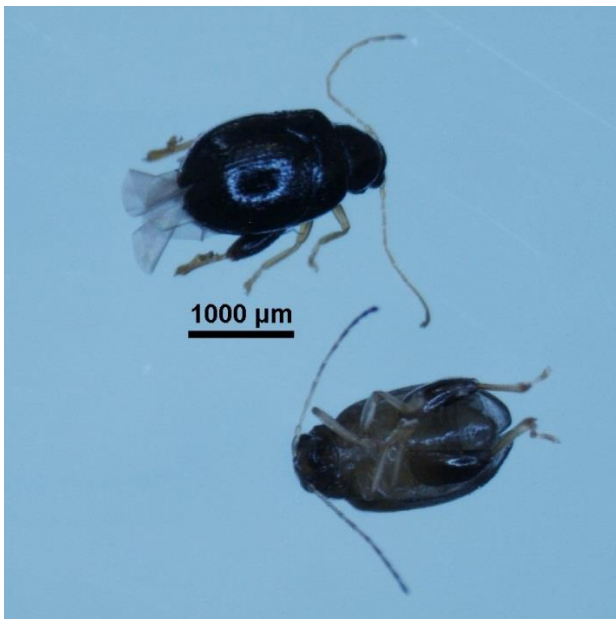
A series of no-choice trials with *Kalanchoe* and *Crassula* species was conducted to determine the degree of adult feeding on each species. Two unsexed adults were placed in a small plastic cup with a phyllode of a test plant. Numbers of feeding scars were counted after a 24hr period and their area measurements taken to provide a comparison with feeding on the control species *K. delagoensis*.

To determine if beetles could complete their life cycle on test plants, a group of 10 eggs was positioned on the roots of a semibare-rooted test plant which was placed in a disposable plastic container with a vented lid. Containers were maintained in a controlled environment cabinet at 27°C day/22°C night and 50% RH. Egg hatch was recorded and containers monitored for larval activity and adult eclosion.

## RESULTS

### ***Bikasha* sp. biology**

Adults feed on plant phyllodes (leaves) and stems and can live for over eight months under laboratory conditions. The bright yellow eggs are laid at the base of the plant among the roots and hatch in 14 days. The larvae feed on and in plant roots for 21-28 days prior to pupation in the soil. Adults emerge about seven days later. New adults are light brown and darken after a few hours to glossy black as the exoskeleton hardens. The complete life cycle generally takes between 35-50 days at 27°C. However, this is dependent on plant quality and other factors. Gender cannot be determined visually with a microscope. Females commence laying eggs between 7- 10 days after eclosion and lay multiple batches of several eggs over their lifetime. Beetles use their well-developed hind legs to jump when disturbed (Figure 1.).



**Figure 1.** *Bikasha* sp. adult

### **Damage**

Aboveground damage to mother of millions occurs as phyllodes are attacked by adults and below ground larval tunnelling kills plant roots. In glasshouse cultures, attack by numerous adults and larvae can cause the collapse of potted plants within four weeks.

### **Host specificity testing**

Initial host testing indicates that the beetle is not specific, as it feeds as both adults and larvae on other weedy and ornamental *Kalanchoe* spp. To date, two *Crassula* species (including one native) tested, were found to be susceptible to adult feeding. Larval host testing is currently underway, and initial results show that the beetle can complete its life cycle on at least five ornamental *Kalanchoe* species and one *Crassula* species.

### **DISCUSSION**

Host specificity trials to date indicate that *Bikasha* sp. may not be a suitable insect for release in Australia due to the number of species which can support adult feeding and larval development. All plant species tested to date are closely related to mother-of-millions. As some of the plant species supporting development are also weedy and some are viewed as ornamentals, further host specificity testing may be required to see if other plant species which are less related and also native are also attacked.

Depending on the results of these additional trials, work on this species may be terminated. If so, it will be necessary to investigate other potential biological control agents from Madagascar. In the meantime, other methods of controlling mother-of-millions are required to minimize its spread and impact.