

The life history traits of the arctiine moth *Pareuchaetes insulata*, a biological control agent of *Chromolaena odorata* in South Africa

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Pareuchaetes insulata (Walker) (Lepidoptera: Erebidae: Arctiinae) was released in KwaZulu-Natal, South Africa, as a biological control agent against *Chromolaena odorata* (L.) King & Robinson (Asteraceae) between 2001 and 2009. Although the moth did establish at one out of some 30 release sites, its population level is generally low in the field. Two closely related biological control agents, *P. pseudoinsulata* Rego Barros and *P. aurata aurata* (Butler) had previously failed to establish despite several years of releases. Studies of life history traits of *P. insulata* (males and females) were conducted to determine whether several aspects of its developmental and reproductive biology can explain its poor performance, and to compare the development and reproductive biology of *P. insulata* with the two other closely related species. At 25 °C, overall mortality of immature stages was generally low (below 12 %). Although the duration of the larval life stage was statistically longer for females, overall they eclosed as adults before the males (i.e. protogyny). Pupal mass, growth rate and total leaf area consumed were higher in females. Mated females laid 74 % of their eggs on the first four nights following eclosion and lived an average of 5.92 ± 0.19 days. The moth also showed good biological attributes such as high fecundity (number of eggs), egg hatchability and female mating success (the number of matings that resulted in fertile eggs). Significant positive correlations were detected between insect performance metrics and leaf consumption and between fecundity and pupal mass. A 23 % greater lifetime reproductive output (387.62 ± 19.50 eggs per female) for *P. insulata* compared with *P. aurata aurata* was recorded. We hypothesize that the absence of protandry in *P. insulata* might have contributed to the low population level of the moth in the field. The results of this study contribute to our understanding of the life history traits of erebid moths in the subfamily Arctiinae deployed for the biological control of *C. odorata*.

Key words: Arctiinae, invasive alien plant, Lepidoptera, Erebidae, developmental and reproductive biology, weed biological control, protandry.

INTRODUCTION

Pareuchaetes insulata (Walker) (Lepidoptera: Erebidae) is a moth in the subfamily Arctiinae whose foliage-feeding larvae can cause extensive defoliation damage to *Chromolaena odorata* (L.) King & Robinson (Asteraceae). *Chromolaena odorata* is an invasive weedy shrub native to the Americas (McFadyen 1989), that has proven to be a significant economic and ecological burden to many tropical and subtropical regions of the world where it impacts negatively on agriculture, biodiversity and livelihoods (Zachariades *et al.* 2009; Uyi & Igbino 2013). A biotype of *C. odorata*, distinct from the more widespread Asian/West African biotype, was first recognized as naturalized in KwaZulu-Natal (KZN) province, South Africa, in the 1940s and has since spread to other

climatically suitable provinces (Zachariades *et al.* 2011). The biotype of *C. odorata* present in southern Africa originated in the Caribbean islands of Cuba and/or Jamaica while the origin of the widespread Asian/West African biotype has not yet been determined (Paterson & Zachariades 2013). The shrub has since been declared a 'Category 1' weed under the Conservation of Agricultural Resources Act (Nel *et al.* 2004) because of its invasiveness in the northeastern parts of South Africa. The invasive success of *C. odorata* is thought to depend upon the combination of several factors such as: (i) high reproductive capacity; (ii) high growth and net assimilation rates; (iii) its capacity to suppress native vegetation through competition for light and allelopathic properties and; (iv) its ability to grow on many soil types and in many climate

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