Evidence of the bivoltine life cycle of the kowhai moth *Uresiphyta polygonalis maorialis* (Felder) (Lepidoptera: Crambidae).

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Abstract
I recorded fluctuations of larval abundances of the kowhai moth, *U. polygonalis maorialis*, occurring on *Sophora* spp plants in gardens and suburban areas located in the Wellington region during two consecutive spring – summer seasons. Based on these observations, I found evidence of the existence of a bivoltine life cycle, with overlapping generations. This short communication gives the first evidence of the existence of this type of life cycle for this species.

Introduction
Uresiphyta polygonalis maorialis is one of the over two hundred and fifty five species of Crambidae (Crowe, 2002), native from New Zealand. Described as a native subspecies of the widely distributed *U. polygonalis*, it is known to occur on the north (Mulvay, 1978; Leen, 1997) and south (Molloy, 1991) islands of New Zealand. In the Wellington region, *U. polygonalis maorialis* is a well known defoliator of legume plants, particularly *Sophora* spp, it being possible to observe caterpillars feeding on the foliage of *Sophora* spp plants during their larval stages. The only reference to the life cycle of this species in New Zealand has been given by Mulvay (1978). In his unpublished thesis the author describes *U. polygonalis maorialis* as being a univoltine species. Based on observations

of larvae abundances on *Sophora* spp plants, I here discuss evidence of the existence of a bivoltine life cycle of this species, with a high prevalence of overlapping larval stages.

Methods

Observations were made during two surveys carried out from late spring to early autumn in two seasons, 2007 – 2008 and 2008 – 2009, in gardens and suburban areas of the Wellington region. Larvae were counted from *Sophora* spp plants on a fortnightly basis (weather allowing), during the two consecutive spring – summer seasons, using a white sheet. Larvae of early instars (1^{st} to 3^{rd}) and late instars (4^{th} and 5^{th}) were counted and returned to the trees to avoid depleting local populations. Sampled host plants were located in the Wellington suburbs of: Thorndon, Kelburn, Karori, Wainuiomata, Lower Hutt, Hataitai, Eastbourne and Northland.

Results

Larvae abundances appear clearly divided into two generations, with two peaks of abundances. The first one occurs between December - February and the second one occurs between March - May (Figs 1a-b). It is interesting to observe the presence of adults flying in the middle of October (Table 1), which could be explained by the emergence of overwintering pupae. The adults emerge in early spring to mate and then lay the first generation of eggs. I have recorded the existence of overwintering pupae from laboratory reared specimens. I kept specimens, under controlled laboratory conditions, which pupated in May and emerged in September. These observations of larvae with long pupation periods have also been recorded by Mulvay (1978), who reported at least one adult emerging after more than 200 days in the pupal stage. Pupae in general, and overwintering pupae in particular, are extremely difficult to find in the field, as usually last instar larvae migrate away from the host plant to pupate far away from it. This migration occurs throughout the entire season, but it is more

noticeable in mid to late December and mid to late February. This is coincident with the two periods of highest larval abundance. During this migration it is possible to observe last instar larvae moving away from *Sophora* trees. In trees located in the vicinity of houses, they climb nearby walls, making them conspicuous to the common observer and perhaps more vulnerable to predators, such as sparrows. In these active periods I have personally seen sparrows collecting larvae from infested plants and nearby walls and then flying away towards their nests with a load of larvae in their beaks.

Discussion

In general, my observations indicate that the high variablity of the abundances of *U. polygonalis maorialis* on *Sophora* spp plants observed through the late spring – early Autum season proves the presence of a bivoltine lyfe cycle with overlapping generations. The first generation originates from the emergence of adults from overwintering pupae by the beginning of October. This generation is the one that shows the highest abundance on the host trees during the entire spring - summer season. The second generation mostly originates from the eggs laid by the first generation. Although based on laboratory observations, I can't rule out the possibility that pupae from the first generation could stay in such stage and emerge the following season. The second generation also exhibits lower abundances compared to the first one and originates in mostly all the overwintering pupal stages.

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Table 1. Life cycle chart showing the presence of different developmental stages of *U. polygonalis maorialis* at different months between October and June. Data summarized here include observations from both surveyed seasons.

	Oct	Nov	Dec	Jan	Feb	March	Apr	May	Jun
Egg		X	X	X	X	X	X		
Larva (1st to 3rd instar)		X	X	X	X	X	X		
Larva (4th to 5th instar)		X	X	X	X	X	X	X	X
Pupae			X	X	X	X	X	X	X
Adult	X[a]		X	X	X				

[a]Adult collected by Dr. George Gibbs, Eastbourne

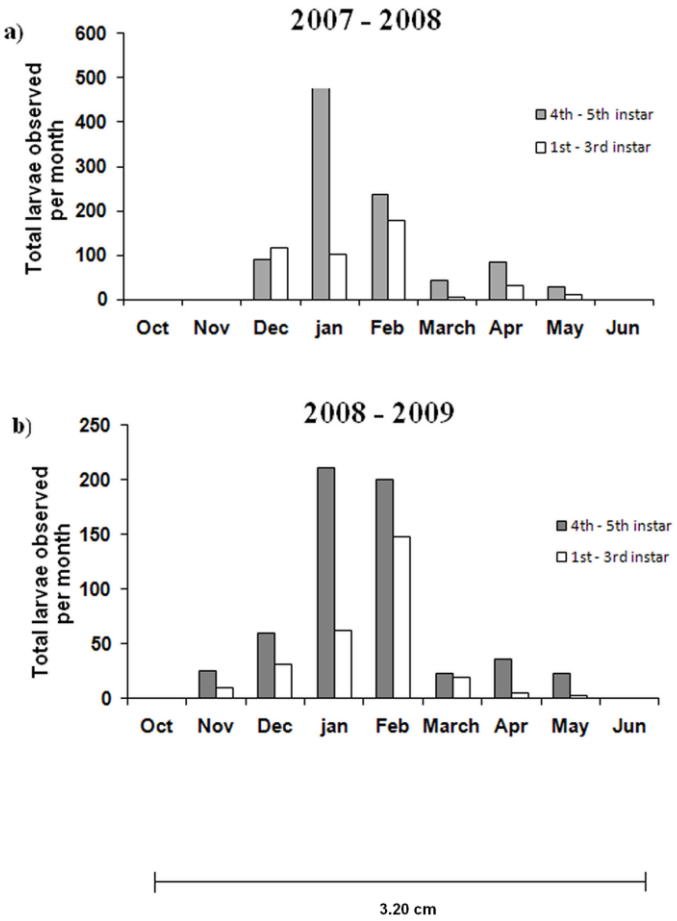

Fig. 1. Total number of larvae, belonging to different instars, observed during each sampling season: a, 2007-2008; b, 2008–2009.