The ecology of *Melangyna viridiceps* and *Simosyrphus grandicornis* (Diptera: Syrphidae) and their impact on populations of the rose aphid, *Macrosiphum rosae*

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A thesis submitted for the Degree of Doctor of Philosophy in the Faculty of Agricultural and Natural Resource Science at the University of Adelaide

Department of Crop Protection
The University of Adelaide
July 1996
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Summary

Some syrphid flies are regarded as important control agents of aphids. Their larvae feed mainly on aphids and other Sternorrhyncha and the adults feed on pollen and nectar of flowers and honeydew of Steynorrhyncha. Some of these species have been utilised to suppress aphids in some cropping systems in Europe and New Zealand by planting attractive flowers near to crops on which aphid pests occur. The work reported in this thesis aims to describe sufficient of the biology of two common species of Australian syrphids, *Melangyna viridiceps* (Macquart) and *Simosyrphus grandicornis* (Macquart) to evaluate their potential as biological agents of aphids in the Mediterranean climate of South Australia. To test the hypothesis that the impact of these syrphids in suppressing aphids could be enhanced by providing supplementary pollen plants, a model system of the two syrphid species and rose aphids, *Macrosiphum rosae* (Linnaeus.) was studied in Adelaide during 1993-1995.

To test the effects of pollen supplementation, rose aphids were used because they are evidently present during nine months of the year in South Australia. The rose flowers are not attractive to syrphid flies so any effects of pollen supplementation by other plants could be easily detected. A number of native and introduced plants were tested as pollen sources for syrphids in one rose garden. Then, the numbers of syrphids and rose aphids at this rose garden were compared with other rose gardens without such plants. *M. viridiceps* and *S. grandicornis* adults laid more eggs on rose aphid colonies near to pollen sources than those not provided with pollen (chapter 9). However, any reduction in rose aphid numbers could not be attributed to providing supplementary pollen.

At least several factors may have contributed to the failure of pollen supplementation to reduce aphid numbers: 1) the seasonal cycles of syrphids (especially that of *M. viridiceps*) were not synchronised with those of the rose aphids, and neither syrphid species was most abundant when the aphids were most abundant, 2) both aphid species can utilise prey other than rose aphids and 3) parasitoids of these syrphids may reduce their effectiveness.
Pollen preferences of adults of both syrphid species were measured by comparing species of pollen in dissected adults with the availability of flowers in a 1.5ha study area (chapter 6). Both species use flower resources selectively from the three strata of herbs, shrubs and trees. *M. viridiceps* preferred pollen from herbs to that of the other two strata. Although *S. grandicornis* is highly attracted to wild radish (*Raphanus raphanistrum*), most of the flowers which attracted this species were from trees. *S. grandicornis* appeared to eat mainly nectar and honeydew.

*S. grandicornis* and *M. viridiceps* differ in their seasonal occurrence; adults of *S. grandicornis* were active during August to May and *M. viridiceps* during April-May to November (with the peak in July-September) in the two years 1993-1995, while rose aphids were numerous during October (spring peak) and April-May (Autumn peak). *S. grandicornis* was the more important predator of rose aphids as the density of its immature stages on rose aphid colonies was greater than that of *M. viridiceps*. However, the number of immature stages of *S. grandicornis* declined prior to the peak of rose aphids in autumn.

In the field, female *S. grandicornis* laid eggs equally on buds with aphid densities above and below the mean number of aphid per infested bud (MNAI) for any particular site and sampling occasion. However, once eggs were found on buds, total number of eggs was significantly higher on these buds which were infested with numbers of aphids higher than the MNAI. In laboratory experiments, females of *S. grandicornis* showed a functional response to increasing rose aphid density up to an optimum of 71-100 aphids per bud. The response to high density of aphids by *S. grandicornis* minimises the risk of starvation for the offspring. The first instar larvae of *M. viridiceps* consumed green plant materials when deprived of aphids.

Parasitization of *S. grandicornis* eggs and larvae by *Diplazon laetatorius* (Fabricius.) (Hymenoptera: Ichneumonidae) may have limited the ability of *S. grandicornis* to prevent the increase in rose aphids numbers in summer and autumn when parasitism increased to
80%. This parasitoid did not appear to affect *M. viridiceps* perhaps because of different seasonal activity. Other natural enemies recorded were not important during the study; the larval parasitoid *Syrphophagus nigricornis* (Girault) (Hymenoptera: Encyrtidae) parasitised 0.65% of larvae and the nematode *Syrophonema* sp. (Syrphonematidae) parasitised 1.9% of adults.

Suction trap catches of adults in winter indicate that *S. grandicornis* probably overwinters as adults, but its main periods of activity are during the warm months of the year. *M. viridiceps* was captured by water trap in summer, indicating that this species oversummers as adult, but the peak activity is during cool months (winter-spring). *M. viridiceps* started activity at 0900-1000 with the estimated flight threshold of 12.8°C and peaked mostly around noon. In spring, when both species occurred together, *M. viridiceps* was active earlier in the day than *S. grandicornis*. During hot days, *M. viridiceps* peaked and left the sunny sites earlier than *S. grandicornis*. Some individuals of both species were then observed in the shade of *Acacia* trees located close to the rose garden. This confirms the importance of shelters for protecting natural enemies. The recapture rate of less than 10% of marked *M. viridiceps* indicated that the adult populations of these syrphids were very mobile with respect to the 1.5ha. study area.

The number of generations of *S. grandicornis* and *M. viridiceps* was estimated as 10 and 11-13 per year, respectively, during this study. The pre-oviposition period of females was 6.8±0.66 SE days for *M. viridiceps* and 5.6±0.64SE for *S. grandicornis* after which an average of 288±34SE and 307.9±23.2SE eggs were laid during the total adult life span of 19.5±1.65 and 13.8±1.3 days respectively. The total duration of the three larval instars at 20°C was 10.8 and 12.3 days for *M. viridiceps* and *S. grandicornis*.

and for the pupa was 8.3 and 7.7 days, respectively.

These results suggest that manipulation of syrphid numbers to control pest aphids in crops may be difficult in habitats similar to those described in this study. Although the results refer specifically to rose aphids, other pest aphids on crops in South Australia occur at similar times to rose aphids.