Feeding by adult *Cyrtobagous salviniae* was not influenced by the concentration of nitrogen in the buds of *Salvinia molesta*. The time spent feeding on a bud was dependent on temperature and the rate of bud development because adults abandoned a bud when it started to open. When 2 pairs of adults were placed on a partially developed bud at 35°C, bud development was stopped. Plants attacked by weevils for 3 days were heavier than insect-free plants but after another 10 days without further attack, growth of unattached plants was significantly greater.

**KEY-WORDS**: *Cyrtobagous*, feeding, temperature, nutrition, *Salvinia molesta*, nitrogen.

The weevil *Cyrtobagous salviniae* Calder and Sands (Calder & Sands, 1985) is native to South America and has been collected from all species of the *Salvinia auriculata* species complex of floating ferns (Forno & Bourne, 1984). In 1980 a population was collected from *Salvinia molesta* D.S. Mitchell in Brazil and, following host-testing studies (Forno et al., 1983), liberated in Australia for the control of *S. molesta*. In Australia, *C. salviniae* has successfully controlled *S. molesta* at numerous sites in the Northern Territory near Darwin, and in Queensland north of latitude 18° (Room et al., 1981, 1984), where mean daily air temperatures are above 20°C.

Temperature and plant nutrition influence both the growth of *S. molesta* (Cary & Weerts, 1983) and the development of larvae of *C. salviniae* on this plant (Sands et al., 1983). Adults survive in areas where air temperatures range from less than 0°C up to 45°C (Room et al., 1984) and feed on buds (Forno et al., 1983), which are known to be richer in nitrogen than other plant parts (Room & Thomas, 1984). Following the release in Australia of *C. salviniae*, adults often remained at and near the point of release for several months, even though the population density of adults increased and there was considerable variation in the nitrogen content of the host plant (Forno, unpublished data).

To understand in greater detail how *C. salviniae* can control *S. molesta*, the studies reported here were designed to examine how temperature, nitrogen content of the plant and population density of adults affect feeding by adult *C. salviniae*. Some information was also obtained on the response of the plant to attack by adult weevils at a high population density.
MATERIALS AND METHODS

INSECTS

Adult *C. salviniae* were randomly selected from a mixed culture of *F*₁ and *F*₂ generations reared from insects collected from the field in north-eastern Australia. Adults were separated into males and females.

PLANTS

*S. molesta* is a free-floating fern consisting of ramets interconnected with branching rhizomes (*Room*, 1983). Each ramet has a node which bears 2 floating leaves and a 3rd leaf which is submerged to form a root-like structure. The tertiary form of the plant (*Mitchell & Thomas*, 1972) which was used for the experiments, had short internodes and large, folded and compacted leaves. A preliminary experiment showed that adults fed on buds < 2 mm or > 8 mm in length, and avoided buds of intermediate sizes. To reduce the variability in feeding, only plants with an apical bud ca. 8 mm in length were used. In the feeding experiment, the youngest pair of leaves was included in the plant unit, while in the experiment on plant damage the 1st four mainstem ramets with connecting rhizomes formed the experimental unit. As it was difficult to maintain constant levels of nitrogen in *S. molesta* cultured in the laboratory, all plants were obtained as required from 2 field sites near Brisbane, Australia: (1) a lagoon at Mt. Gravatt where mean nitrogen content in the plant was almost always below 1 %; and (2) Bulimba Creek where mean nitrogen content was above 2.2 %. On each occasion when plants were collected for the feeding experiments, a subsample of 50 buds was separated from the plants, washed in distilled water, dried to constant weight at 70°C and analysed for nitrogen content by the methods described in *Room & Thomas* (1984). In the experiment on plant damage, 10 plants were analysed for nitrogen content.

ADULT FEEDING EXPERIMENTS-EFFECTS OF TEMPERATURE AND NITROGEN

There were 2 experiments, 1 using 1 adult per 4 buds (low density) and another using 4 adults per bud (high density). Adults in each experiment were placed on the bud of a plant unit held with 3 other plant units in a small plastic food container (7 cm dia. × 5 cm deep) so that the 4 units covered the water surface. In the high density experiment each container was partitioned into quarters by a transparent plastic barrier to confine adults to a particular bud. Each container was half filled with tap water which was replaced daily and covered with fine nylon organza. There were 5 replicates for each sex, at each of the 2 levels of plant nitrogen at constant 15°, 20°, 23°, 25°, 30° and 35°C for the low density experiment and similar treatments for the high density experiment at the same temperatures except that 27° replaced 25°C. The amount of feeding by adults was measured once or twice daily by rating damage to the bud in categories 0 to 10 % (very few feeding scars), 10 to 25 %, 25 to 50 %, 50 to 75 %, 75 to 100 %. In the low density experiment the old bud was removed when an adult moved to a fresh bud. On every 3rd day the plants on which the adult was not feeding were replaced and the experiment was terminated on the 10th day. In the high density experiment, feeding by adults was measured daily until either the bud was completely destroyed, or the adults had abandoned the bud. This procedure was repeated until 3 sets of recordings were obtained for each group of 4 adult weevils. For both densities of the weevil, the mean number of days spent feeding on a bud, the % damage/bud/day and the total % damage/bud were calculated. The number of days a bud took to open was recorded.