Evaluation of *Serangium parcesetosum* (Coleoptera: Coccinellidae) as a Biological Control Agent of the Silverleaf Whitefly (Homoptera: Aleyrodidae)

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ABSTRACT The coccinellid predator from India, *Serangium parcesetosum* Sicard, was studied as a potential biological control agent of the silverleaf whitefly, *Bemisia argentifolii* Bellows & Perring [also known as the sweetpotato whitefly, *B. tabaci* (Gennadius) Biotype B]. Studies were performed on prey preference, and effects of host plant on predation, and temperature on life-history and predation rates. In one test, the predator was offered simultaneously 5 prey choices: corn earworm, *Helicoverpa zea* (Boddie) eggs; tobacco hornworm, *Manduca sexta* (L.) eggs; and ≈200 eggs and early instars of *B. argentifolii* reared on poinsettias, cantaloupes, or cucumbers. *S. parcesetosum* did not consume any lepidopteran eggs; however, they devoured nearly all whitefly prey offered averaging ≈600 prey per 24-h feeding period. Mean adult longevities were 27.6 d on cantaloupe, 24.5 d on cucumber, 44.2 d on hibiscus, and 27.8 d on tomato. Each *S. parcesetosum* adult consumed ≈170–200 whitefly eggs and immatures per 12-h feeding period. The predation rate was highest on cucumbers, followed by tomato and cantaloupe, and lowest on hibiscus. Under constant temperature conditions of 20, 30, and 40°C, adults survived best at 20°C with a mean longevity of ≈75 d. Adults lived ≈25 d at 30°C, whereas, 40°C resulted in death within 3 d. Predation rate was found to increase with temperature. The mean number of total immature *B. argentifolii* consumed by *S. parcesetosum* adults was 138.9, 180.8, and 187.4 per 12-h feeding period at 20, 30, and 40°C, respectively. The maximum cumulative lifetime predation was measured at >10,000 whiteflies consumed in the most long-lived individuals, despite feeding only 12 h/d at 1- to 3-d intervals. Mean cumulative lifetime predation was measured at 4,909.5, 2,586.1, and 224.9 whiteflies at 20, 30, and 40°C, respectively. Because of its voracity in both immature and adult stages, and its apparent preference for whiteflies, including *B. argentifolii* (compared with lepidopteran eggs), *S. parcesetosum* is a promising biological control agent against the silverleaf whitefly.

KEY WORDS: *Serangium parcesetosum*, predator, silverleaf whitefly

THE SILVERLEAF WHITEFLY, *Bemisia argentifolii* Bellows & Perring [also known as the sweetpotato whitefly, *B. tabaci* (Gennadius) Biotype B], caused crop losses of over $500 million in Arizona, Florida, Texas, and California in 1991 alone (Perring et al. 1993). Because of its resistance to insecticides, the action of natural enemies of silverleaf whitefly is receiving greater attention in inundative release efforts (Parrella et al. 1992), as natural control agents (Stansly et al. 1994), or as components of integrated pest management programs (Gerling 1996). Nordlund and Legaspi (1996) discussed the potential of predators as biological control agents of *Bemisia* listing 66 predatory species, within 8 orders, including the well studied and commercially available lacewings, *Chrysoperla rufilabris* (Burmeister) (Neuroptera: Chrysopidae) and *C. carnea* (Stephens). Another predator that has received much attention is the coccinellid *Delphastus pusillus* LeConte (Hoelmer et al. 1993, Heinz and Parrella 1994).

One whitefly predator that has received little research attention is *Serangium parcesetosum* (=*Catana parcesetosa*) Sicard. The predator was described by Sicard (1929) and first found in India where it remains an important predator of whiteflies in cotton (Kapadia and Puri 1989). The coccinellid is predaceous in both immature and adult stages. *S. parcesetosum* has also shown potential as a predator of citrus blackfly, *Aleurocanthus woglumi* Ashby (Homoptera: Aleyrodidae) (Kuchanwar et al. 1982), and the citrus whitefly, *Dialeurodes citri* (Ashmead) (Aleyrodidae) (Antadze and Timofeyeva 1975). *S. parcesetosum* was imported

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from India into Adzharia (in the former Soviet republic of Georgia) for biological control of the citrus whitefly where it consumed ≈90% of the citrus whiteflies and dispersed to nearby plantations (Timofeyeva and Nhûan 1979). *S. parcesetosum* was found in 1993 by A. Kirk and L. Lacey (ARS-European Biological Control Laboratory, France) feeding on *Trialeurodes ricini* (Misra) (Homoptera: Aleyrodidae) in Podumbu, India. The predator was imported into the United States, quarantined at the APHIS-Mission Biological Control Center (Mission, TX), and released from quarantine shortly afterward.

Little information exists on the biology of *S. parcesetosum*. Timofeyeva and Nhûan (1979) report that its fecundity ranges from 135 to 185 eggs, and larval development lasts 20–21 d at 20–23°C. Each larva consumed 900–1,000 citrus whitefly eggs during its lifetime, destroying as many as 200 daily. Developmental time of *S. parcesetosum* feeding on *B. tabaci* ranged from 25 to 53 d and population increase in the F_1 generation was estimated to be ≈9-fold (Yigit 1992). Cohen et al. (1995) compared the nutritional benefit derived from *B. argentifolii* by *Geocoris punctipes* (Say) (Hemiptera: Lygaeidae) and *S. parcesetosum*. They concluded that *G. punctipes* could not complete development using whitefly alone as prey because it required a broader diet to satisfy its methionine requirements. However, *S. parcesetosum* readily completed development on *B. argentifolii* because it is specialized for nutrient-poor prey (Cohen et al. 1995). Because of the scant biological information about this species, laboratory studies on its biology and predation rates are essential to evaluate its potential as a biological control agent of *B. argentifolii*. In this article, we present the results of studies on longevity, survivorship, and predation rates of *S. parcesetosum* provided the silverleaf whitefly, *B. argentifolii*, as prey.

Materials and Methods

Serangium parcesetosum and *B. argentifolii* were obtained from colonies maintained by APHIS Mission Biological Control Center. *B. argentifolii* was reared either on hibiscus, *Hibiscus rosasinensis* L. 'Kona Pink', or on eggplant, *Solanum melongena* L., 'Florida Marketer'. The whitefly colony was maintained in environmental growth chambers held at 24–29°C, 50–70% RH, and a photoperiod of 14:10 (L:D) h. Young potted plants were infested with adult whitefly and the developing immatures were allowed to mature to the 3rd and 4th instar before they were fed to *S. parcesetosum*. *S. parcesetosum* was reared in a greenhouse in screened cages (75 by 75 by 75 cm). New cultures of the predator were established each time an adult cohort developed. Because of the difficulty in differentiating between sexes of *S. parcesetosum*, the sex ratio of the predators used in this study was unknown. In the predation experiments described below, the approximate composition of the whitefly immatures used as prey was eggs, 36.9%; 1st instars, 22.7%; 2nd instars, 21.6%; 3rd instars, 16.6%; and 4th instars, 2.2%.

Predation by Larvae. Predation rates of 3rd-instar *S. parcesetosum* were measured for single and multiple larvae. Third-instar *S. parcesetosum* were isolated individually in petri dishes (9 cm diameter) containing an excised cantaloupe leaf infested with ≈270–900 silverleaf whitefly immatures of mixed age. Fifteen replicates of the following treatments were used: 1 predator per leaf and 3 predators per leaf. The control consisting of no predators confined on a leaf was replicated 10 times. The control is used to estimate prey losses caused by factors other than predation, including experimental error and mortality. The numbers of silverleaf whitefly were counted after a 24-h feeding period. The experiment was conducted in the laboratory at ambient temperatures (20–23°C) and a photoperiod of ≈14:10 (L:D) h.

Effect of Temperature on Life History and Predation Rates. Adult *S. parcesetosum* (≈7 d after emergence) were placed individually in plastic petri dishes (3.5 cm diameter) lined with damp filter paper, screened for ventilation, and secured with rubber bands. The predators were starved for 12 h before each feeding trial, after which they were provided ≈200 eggs–4th-instar silverleaf whitefly for 12 h on excised leaves at constant temperatures of 20, 30, and 40°C (50–60% RH, photoperiod of 14:10 [L:D] h). Twenty replicate dishes were set up for each temperature. Prey were replaced at intervals of 1–3 d until the predators died. To measure predation, numbers of silverleaf whitefly immatures were determined before and after each feeding period. Survivorship was measured by calculating the proportions of predators remaining alive as a function of time.

Prey Preference. Thirteen newly emerged adult *S. parcesetosum* of mixed sexes were individually isolated in plastic petri dishes (5 cm diameter) lined with damp filter paper and screened for ventilation. Each predator was presented with 5 different foods and allowed to feed for 24-h periods over a span of 11 d. The following 5 food choices were used: (1) 25 frozen corn earworm eggs, *Helicoverpa zea* (Boddie) (Lepidoptera: Noctuidae); (2) 20 frozen tobacco hornworm eggs, *Manduca sexta* (L.) (Lepidoptera: Sphingidae); (3) ≈200 silverleaf whitefly eggs and immatures reared either on poinsettias, *Euphorbia pulcherrima* Willd. 'V-14 Glory'; (4) cantaloupes, *Cucumis melo* var *cantalupensis* L. 'Perlita'; or (5) cucumbers, *Cucumis sativus* L. 'Poinsett 76'. Each dish was divided in 5 sections; 1 food choice was placed in each section and the predator placed in the middle of the dish. The eggs were placed directly onto the filter paper, whereas the whitefly immatures were counted on leaf sections that were excised and placed into the petri dishes (see Legaspi et al. 1994). Feeding trials were performed on days 1, 3,

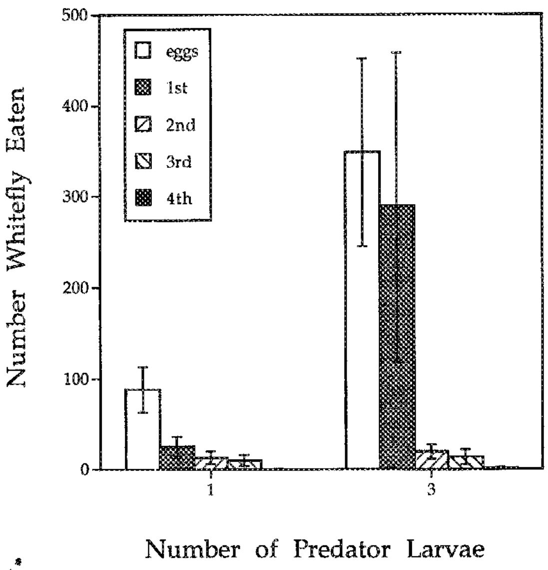

Fig. 1. Predation of *B. argentifolii* by 1 or 3 larval *S. parcesetosum* during 24-h feeding period (±SE). Silverleaf whitefly consumed are categorized by instar.

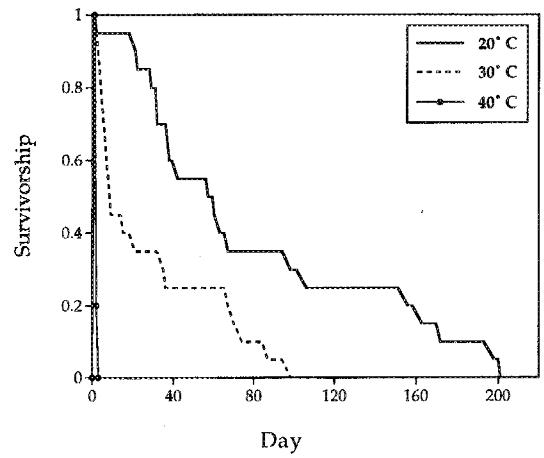

Fig. 2. Survivorship of adult *S. parcesetosum* at 3 different constant temperature regimes.

4, 8, 9, 10, and 11. A single meal of ≈600 whiteflies was provided between days 4 and 8.

Tritrophic Effects. Newly emerged *S. parcesetosum* adults of undetermined sex were placed individually into petri dishes (5.5 cm diameter) lined with filter paper. Cultures of *B. argentifolii* were maintained in a greenhouse. The experiment was conducted in a controlled environment room (20–23°C, 50–60% RH, and a photoperiod of 14:10 [L:D] h) using 4 host plants: cantaloupe, cucumber, tomato (*Lycopersicon esculentum* Mill.) and hibiscus. Treatments consisted of providing *S. parcesetosum* adults with whitefly prey reared on the different host plants for the duration of their lives. At each feeding period, ≈200 whitefly immatures were counted under a stereomicroscope and placed inside each petri dish on the excised leaves of the host plant. Each feeding trial consisted of a 12-h starvation period, followed immediately by a 12-h feeding period. After feeding, the leaves were removed and the remaining silverleaf whitefly were counted. Feeding trials were performed at regular intervals of 3–4 d until the death of the coccinellids. In between feeding trials, the predators were fed ad libitum. Each treatment consisted initially of 20 replicates.

Statistical Analyses. All statistical analyses were performed using the SYSTAT statistical package (Wilkinson et al. 1992) and means were separated using the Tukey honestly significant test. Survivorship, body weights, and daily and cumulative predation rates were analyzed using a general linear model (Wilkinson et al. 1992), where dependent variables were time and host plant, with the host plant specified as a categorical variable.

Results and Discussion

Predation by Larvae. Three larval coccinellids per leaf consumed significantly more whitefly eggs and 1st-instar whiteflies than did 1 coccinellid (Fig. 1). Multiple larval predators per leaf did not result in interference or competition for prey at the predator and prey densities used in the experiment. Larvae placed singly on the leaves averaged ≈137 total whitefly immatures consumed per predator per day. When 3 *S. parcesetosum* larvae were placed on each leaf, average whitefly consumption increased to ≈224 per predator per day. Experimental error, as estimated by loss in the control, was ≈17 prey immatures. These studies indicate that each *S. parcesetosum* larva is capable of consuming ≈200 whiteflies in a 24-h feeding period when the prey are presented on cantaloupe leaves. The predation rate was similar to that found by Timofeyeva and Nhûan (1979) on citrus whitefly eggs. Given a reported developmental time of 20–21 d (Timofeyeva and Nhûan 1979), *S. parcesetosum* larvae are promising control agents independent of their actions as adult predators.

Effect of Temperature on Life History and Predation Rates. Maximum longevity of *S. parcesetosum* adults was 200, 94, and 3 d at 20, 30, and 40°C, respectively (Fig. 2). The adult survivorship curves at different temperatures are slightly inverse hyperbolic functions or type III curves (Jervis and Kidd 1995), characterized by high early mortality rates followed by relatively high survivorship. Mean adult longevity of 79.2 d (SE = 14.1, n = 20) was longest for predators at 20°C. Mean longevities of 26.9 (SE = 7.2, n = 20) and 1.4 d (SE = 0.2, n = 20) at 30 and 40°C, respectively, were significantly shorter than longevity at 20°C (F = 18.8, df = 2, 57; $P < 0.01$; Tukey HSD; $P < 0.01$). Thus, the optimal temperature for survival of the coccinellid is 20°C, whereas, 40°C causes death within 3 d. No previous studies were

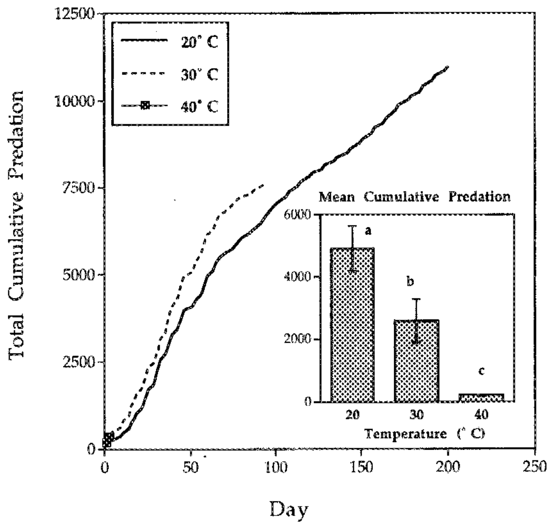

Fig. 3. Total cumulative predation by *S. parcesetosum* as affected by temperature. Cumulative predation is calculated by adding total mean predation rates (sum of all eggs and instars consumed) per predator and feeding over 12-h periods at 1- to 3-d intervals over their lifetimes. Inset is mean cumulative predation as affected by temperature (means with different letters are significantly different at $P < 0.05$, Tukey HSD). Error bars indicate 1 SE.

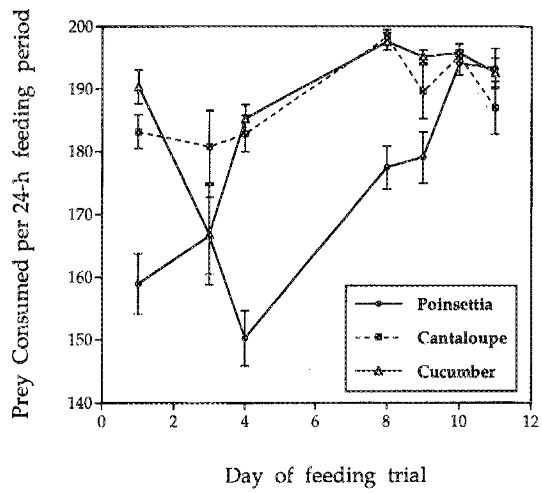

Fig. 4. Consumption by *S. parcesetosum* adults of silverleaf whitefly reared on different host plants. Means (±SE) indicate daily silverleaf whitefly predation by individual predators. Corn earworm and tobacco hornworm were not consumed.

found on life history traits of adult *S. parcesetosum*.

In preliminary experiments not described here, we determined whether *S. parcesetosum* displayed a preference for particular life stages of silverleaf whitefly prey. No significant differences were found in percentage of prey consumed according to instar ($F = 1.9$; df = 4, 88; $P = 0.12$; arcsine transformation). Of the total number of eggs available, 60.7% were eaten. In the other life stages, the percentages eaten were 1st instar, 50.9%; 2nd instar, 43.1%; 3rd instar, 60.3%; and 4th instar, 86.7% (J.C.L., unpublished data). In the current study, percentages of consumption (proportions of total numbers eaten rather than total numbers available) are eggs, 7.2%; 1st instar, 17.5%; 2nd instar, 43.2%; 3rd instar, 28.1%; and 4th instar, 4.0%. The percentage of predation is probably a reflection of the percentages of prey life stages available because *S. parcesetosum* does not appear to prefer specific life stages of silverleaf whitefly prey.

Predation rate increased with temperature ($F = 118.2$; df = 2, 1,039; $P < 0.01$). The mean number of immature *B. argentifolii* consumed by *S. parcesetosum* adults was 138.9 (SE = 1.5, $n = 732$), 180.8 (SE = 2.5, $n = 286$), and 187.4 (SE = 6.6, $n = 24$) per 12-h feeding period at 20, 30, and 40°C, respectively. Only the predation rate at 20°C was significantly different than for the other temperatures (Tukey HSD; $P < 0.01$). Prey consumption is shown in Fig. 3 as total cumulative numbers of whitefly per predator. The inset shows mean cumulative numbers of silverleaf whitefly consumed per predator. Both time and temperature were found to significantly affect mean cumulative predation ($F = 1,663.2$; df = 1, 124; $P < 0.01$; $F = 25.7$; df = 2, 124; $P < 0.01$, respectively). It is apparent that adult *S. parcesetosum* are voracious feeders of the whitefly, with the 20°C treatment resulting in maximal cumulative predation of >10,000 prey per predator, when the predators are allowed feeding periods of 12 h/d at intervals of 1–3 d. Mean cumulative predation was highest at 20°C ($F = 15.9$; df = 2, 57; $P < 0.01$), no doubt because of the extended survivorship at this temperature. Mean cumulative predation was measured at 4,909.5 (SE = 736.9, $n = 20$), 2,586.1 (SE = 698.6, $n = 20$), and 224.9 whiteflies (SE = 16.9, $n = 20$) at 20, 30, and 40°C, respectively. All means are significantly different from each other (Tukey HSD, $P < 0.05$).

Prey Preference. *S. parcesetosum* adults did not feed on the earworm or hornworm eggs presented, indicating a preference for whiteflies. After ≈10 d, *S. parcesetosum* adults were consuming almost all whitefly immatures presented, resulting in a daily predation rate of ≈600 whitefly immatures per predator (Fig. 4). It is possible that predation was limited by the rate at which the prey were offered. Numbers of prey consumed were significantly affected by both time ($F = 16.1$; df = 6, 198; $P < 0.01$) and plant host ($F = 25.9$; df = 2, 198; $P < 0.01$; 2-way ANOVA). The time * plant host interaction also was significant ($F = 4.3$; df = 12, 198; $P < 0.01$). Statistically similar numbers of whiteflies were consumed when reared on either cantaloupe or cucumber. However, fewer whiteflies were eaten when reared on poinsettia plants

(Tukey HSD, $P < 0.01$), although predation on this treatment increased after ≈10 d. Mean daily predation was 187.4 on whiteflies on cantaloupe (SE = 1.5, n = 73), 187.2 on cucumbers (SE = 2.0, n = 73) and 171.6 on poinsettia (SE = 2.4, n = 73). These predators were reared on silverleaf whitefly on hibiscus and eggplant, thereby reducing the possibility of prey preference induced in the rearing process. It is possible that *S. parcesetosum* displayed an initial aversion to feeding on silverleaf whitefly reared on poinsettia, but that this was overcome in the later stages of the experiment. A contributing factor could be that the single meal between days 4 and 8 was insufficient to satiate the predators. The hunger induced may have resulted in increased consumption on day 8.

It may be argued that the lepidopteran eggs did not constitute a fair prey option because they were placed directly onto the filter paper in the petri dish, whereas, the silverleaf whitefly had the plant leaf as a substrate. However, the same experimental design was used in *C. rufilabris*, which fed on all prey offered, including the lepidopteran eggs (Legaspi et al. 1994), which indicates a greater degree of polyphagy than that found for *S. parcesetosum* in the current study. Although, *S. parcesetosum* may also be reared on the pink bollworm eggs, *Pectinophora gossypiella* (Saunders) (Lepidoptera: Gelechiidae) (Cohen et al. 1995), they appear more robust when reared on *B. argentifolii* (J.C.L., unpublished data). Furthermore, Yigit (1992) also advocates rearing *S. parcesetosum* on *B. tabaci* rather than *D. citri*. Therefore, *S. parcesetosum* is a voracious feeder of silverleaf whitefly and is apparently a specialist predator of Aleyrodidae, including *B. argentifolii* (Cohen et al. 1995).

Tritrophic Effects. The survivorship curves of *S. parcesetosum* on the 4 plant hosts are again type III (Fig. 5). Survivorship was significantly affected by both time (F = 558.8; df = 1, 127; $P < 0.01$) and host plant (F = 19.9; df = 3, 127; $P < 0.01$). The significant effect of host plant is caused by higher survivorship on hibiscus, with no significant differences found among the other host plant treatments (Tukey HSD, $P < 0.05$). The higher survivorship on hibiscus may be partly because *S. parcesetosum* larvae were reared on silverleaf whitefly using hibiscus as the host plant. Mean adult longevities on different host plants were 27.6 d on cantaloupe (SE = 5.2), 24.5 d on cucumber (SE = 5.1), 44.2 d on hibiscus (SE = 6.1), and 27.8 d on tomato (SE = 5.8) (F = 2.6; df = 3, 76; P = 0.059; n = 20).

In a similar experiment, Legaspi et al. (1996) found that host plants produced more measurable effects on life history traits of the generalist predator *C. rufilabris*. Silverleaf whitefly prey were reared on poinsettia, cucumber, cantaloupe, and lima bean (*Phaseolus limensis* L.). Survivorship was significantly affected by both time and host plant, and survival of *C. rufilabris* on poinsettia and lima bean was significantly less than that on cantaloupe and cucumber.

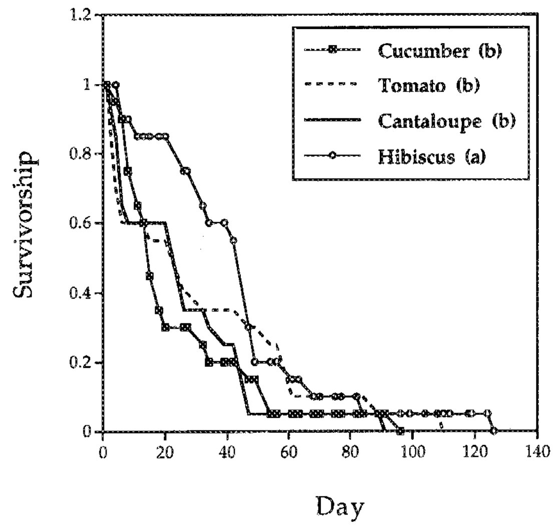

Fig. 5. Effect of host plant on survivorship of *S. parcesetosum* adults. Plant hosts followed by identical letters are not significantly different at P = 0.05 (Tukey HSD).

Each *S. parcesetosum* adult consumed a mean of ≈170–200 silverleaf whitefly eggs and immatures per 12-h feeding period. Mean daily predation was significantly affected by plant host (F = 9.2; df = 3, 822; $P < 0.01$), but not by time (F = 2.9; df = 1, 822; P = 0.09). Predation on the cucumber host plant averaged 194.7 silverleaf whitefly per 12-h feeding period (SE = 2.9, n = 166), and was significantly higher than for all other plant hosts (Tukey HSD; P = 0.05). Total mean prey eaten on the other plant hosts was: 181.7 (SE = 2.4, n = 203) for tomato, 180.9 (SE = 3.5, n = 172) for cantaloupe, and 174.4 (SE = 2.1, n = 286) for hibiscus. Predation rates in all plant host treatments neared the total of 200 prey made available, suggesting that the predators may have been prey limited despite restricting the feeding period to 12 h. Furthermore, prey were presented only at intervals of 3–4 d, suggesting that the maximal cumulative consumption of ≈4,900–6,600 whiteflies per predator may be increased by providing prey ad libitum.

Cumulative predation was calculated by determining the mean number of silverleaf whitefly consumed according to life stage during each feeding period. The means were added to estimate mean number of whiteflies consumed across all life stages. The running totals of these means constituted the cumulative predation curves (Fig. 6). Both time (F = 14,018.8; df = 1, 124; $P < 0.01$) and host plant (F = 30.5; df = 3, 124; $P < 0.01$) significantly affected mean cumulative numbers of prey eaten. Moreover, the cumulative predation rate was highest on cucumbers, followed by tomato and cantaloupe, and lowest on hibiscus (Tukey

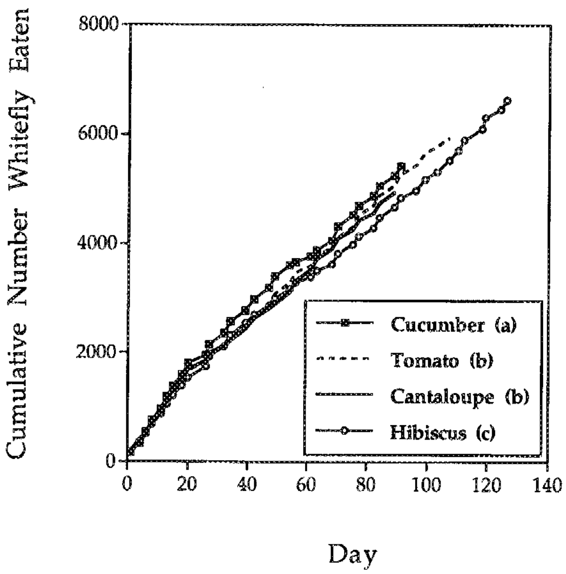

Fig. 6. Effect of host plant on cumulative predation by *S. parcesetosum* adults. Prey was offered for 12-h durations at intervals of 1–3 d until the predators died. Plant hosts followed by identical letters are not significantly different at $P = 0.05$ (Tukey HSD).

HSD; $P < 0.01$). The hibiscus host plant had the dual effect of increasing survivorship, but also of reducing the cumulative predation rate. This analysis of predation is admittedly subject to 2 criticisms: (1) the necessary use of means reduced error in the data and (2) replication is reduced with time as the individuals die. However, in both the cumulative and daily mean predation analyses discussed previously, predation rates were significantly higher with cucumber as the host plant.

Generalist Versus Specialist Predators. The prey preference experiment indicates that *S. parcesetosum* adults prefer to feed on *B. argentifolii* immatures, regardless of host plant. Even an apparent aversion to silverleaf whitefly on poinsettia was overcome in the later stages of the experiment, and predation rates approximated 600 silverleaf whitefly per 24-h feeding period, the total number of prey available. No corn earworm or tobacco hornworm eggs were eaten throughout the experiment. The predator thus displays a marked preference for silverleaf whitefly, and has also been shown to feed on related prey, such as the citrus blackfly (Kuchanwar et al. 1982) and citrus whitefly (Antadze and Timofeyeva 1975, Timofeyeva and Nhûan 1979). This specific feeding behavior is in contrast to *C. rufilabris*, which has been found to consume all prey types offered, but did not complete development on silverleaf whitefly reared on poinsettia or lima bean (Legaspi et al. 1994). Survivorship of *C. rufilabris* also declined on poinsettia and lima bean host plants, possibly because of nutritional deficiencies or the accumulation of plant toxins in the whitefly. One cannot conclude from this study that *S. parcesetosum* is not subject to these nutritional deficiencies, or immune to the effects of putative plant toxins, because the survivorship experiment did not include poinsettia or lima bean host plants. However, the apparent acceptance of prey reared on poinsettia suggests that *S. parcesetosum* adults may survive on these plants, even though no detrimental effects could be measured because each predator consumed prey from the 3 host plants used and the experiment was not continued until the death of the predators.

This study provides some evidence that *S. parcesetosum* is a specialist predator of *B. argentifolii.* Cohen et al. (1995) make this argument based on its small size, shorter life span, lower carcass protein, and methionine content relative to the generalist predator *G. punctipes.* Both immature and adult *S. parcesetosum* are voracious feeders of silverleaf whitefly. Predation rates reported here may have actually been limited by the rates at which the silverleaf whitefly prey were offered. Also predation between feeding trials was not recorded. Interestingly, much of the predation recorded occurred during the scotophase. Furthermore, *S. parcesetosum* displays a preference for Aleyrodidae, including *B. argentifolii,* and suffers no apparent ill effects when subsisting on silverleaf whitefly prey. Because of these attributes, together with the ease with which the coccinellids are reared, *S. parcesetosum* may be a viable commercial control agent against the silverleaf whitefly and related pests. Studies currently are underway to assess searching efficiency of the predator and effects on whitefly populations under field conditions where prey population densities are not always as high as those used in the laboratory.

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