

Notes on the Natural History of Two *Ozophora* Bugs (Heteroptera: Lygaeidae) in Costa Rica

RAFAEL LUCAS RODRÍGUEZ S.
Escuela de Biología, Universidad de Costa Rica,
Ciudad Univeristaria Rodrigo Facio,
San José, Costa Rica

ABSTRACT: The seed bugs *Ozophora baranowskii* and *O. maculata* were found on branches of the fig *Ficus padifolia* with mature fruits, and on the ground below. Adult *O. baranowskii* were more common on branches, while adult *O. maculata* were almost always on the ground. Nymphs of both species were found only on the ground. Adults and nymphs of both species fed on seeds of the fig. In female *O. baranowskii*, insemination is apparently associated with mature eggs. Several parasitoids attacked adults and nymphs on the ground.

A diverse fauna of seed bugs (Heteroptera: Lygaeidae) are seed predators of figs (Moraceae: *Ficus*) (Slater, 1972), many of which belong to the genus *Ozophora* (Slater, 1972, 1983, 1987). However, little is known about their natural history. This paper presents for the first time observations on the natural history of *Ozophora baranowskii* Slater & O'Donnell and *Ozophora maculata* Slater & O'Donnell. They live on or under *Ficus padifolia* H.B.K. figs (= *F. pertussa* sensu Burger). This fig is native to the Central Valley of Costa Rica (W. Ramirez, pers. comm.), and is often used as a "living fence post".

Materials and Methods

Bugs were captured near San Antonio de Escazú (el. 1300–1400 m), San José Province, Costa Rica, in an area of coffee plantations and secondary forest. Bugs were captured from the branches of figs by placing a sweep net around the tips of 1–2 branches and shaking 20 times. Bugs on the ground below figs were collected with an aspirator by searching the leaf litter and soil in an area of 4–6 m² under each tree, for 30–60 min.

From July 1993 to December 1995, 14 fig trees were checked for mature fruits and bugs every two weeks during the wet season (May to December), and every three weeks during the dry season. Another 10 trees were checked sporadically. During the first year, trees with and without mature fruits were checked for bugs (at least 18 visits to 10 trees). Later, only trees with mature fruits were checked. Trees with bugs were checked up to three times per week for the duration of fruit set. There were 64 visits during the study period (48 in the rainy season, 16 in the dry season), and on 32 of these visits more than 10 bugs were present on a given tree. Only data from these visits were used to compare sex ratios between trees, collection dates, and captures on branches vs. the ground. In all, more than 300 *O. baranowskii* and 70 *O. maculata* adults, and more than 200 nymphs of both species, were taken.

Nymphs were kept in Petri dishes and fed fig fruits with their seeds, and sunflower seeds. The fruits were kept in a freezer, then thawed and dried before use. Food was changed every 2–4 days to minimize the presence of fungi. Water was provided in a glass vial stoppered with cotton that was fixed in the Petri dish with plasticine. A

piece of cork impregnated with fungicide (Nipagin) was kept in each Petri dish. This formed a complex, three-dimensional environment that allowed the nymphs to develop (Coulianos and Kugelberg, 1973).

Sixty-two field-collected females were dissected to examine the sperm content of their spermatheca and the presence of mature eggs (approximately the same length as eggs laid by field-collected females: 0.79 ± 0.001 mm [av \pm SE], $n = 4$ averages of 4 females [Rodríguez S., 1996]).

Voucher specimens of the bugs and their tachinid parasitoids were deposited at INBio (Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica).

Results

HABITAT: Bugs were abundant during the rainy season on branches bearing mature fruits, and on the ground below. Not all fruiting trees had bugs present, and populations on individual trees varied from one fruiting to the next. Bugs were seldom present during the dry season. Only 2 visits (both in January) out of 16 during the dry season yielded bugs, and they were on the ground below trees that had fruited in the preceding 2–4 weeks. In both instances fewer than 10 bugs were found. Bugs were never found on branches of trees without mature fruits.

Adults of *O. baranowskii* were more common on branches (287 of 296 individuals) than adults of *O. maculata* (13 of 22 individuals were collected on the ground, $G = 60.2$, d.f. = 1, $P \ll 0.001$). All nymphs of both species were found on the ground.

The fruits of one fig tree in a secondary forest had fallen on the leaves of understory plants as well as on the ground, on an area of approximately 9 m², although there seemed to be more fruits on the ground. There were six male and four female adults of *O. maculata* on the ground, but no bugs were found on the understory plants.

SEX RATIO: The overall sex ratio of adult *O. baranowskii* that were captured was male-biased. In all, 232 males and 70 females were captured in 1995 ($\chi^2 = 86.90$, d.f. = 1, $P \ll 0.001$). In captures of at least 10 individuals on branches, the sex ratio did not vary significantly between capture dates ($\chi^2 = 0.76$ and 0.99 , d.f. = 1, $P > 0.10$ in two trees), or between trees after pooling data from different dates for single trees ($\chi^2 = 4.00$, d.f. = 11, $P > 0.10$). However, the sex ratio of adults captured on the ground was female-biased (5 males and 10 females, $\chi^2 = 16.76$, d.f. = 1, $P \ll 0.005$).

The overall sex ratio of adult *O. maculata* that were captured was close to 1:1. In all, 37 males and 33 females were captured in 1995 ($\chi^2 = 0.23$, d.f. = 1, $P > 0.10$). The sex ratio of captures of at least 10 individuals did not vary between trees ($\chi^2 = 0.005$, d.f. = 4, $P > 0.10$).

REPRODUCTIVE STATUS OF FIELD-COLLECTED FEMALES: Fifty-six *O. baranowskii* females were collected and dissected. Twenty-three females had no sperm in the spermatheca, and 20 of them had no "mature" eggs; their abdomen was instead full of oil globules. However, 31 of the 33 females that had sperm also had "mature" eggs ($\chi^2 = 37.16$, d.f. = 1, $P \ll 0.0001$). Only one female had oil globules in her abdomen as well as sperm in the spermatheca and mature eggs. The number of females without sperm in the spermatheca did not vary significantly between captures on branches (27 females with, 16 without sperm) and the ground (17 females with, 6 without sperm, $\chi^2 = 0.33$, d.f. = 1, $P > 0.10$), or between early and late in the rainy season (from May to July there were 28 females with and 21 without sperm; and from September to November there were 6 females with and 1 without sperm, $G = 2.37$, d.f. = 1, $P > 0.10$).

Six *O. maculata* females (5 from the ground, 1 from branches) were collected and dissected. Four females, all from the ground, had mature eggs and sperm in their spermatheca. Two females (1 from the ground and 1 from branches) had neither mature eggs nor sperm.

Females without sperm and mature eggs were probably virgins. However, reproductive females sometimes ran out of sperm in the lab (Rodríguez S., 1996).

LONGEVITY: Some adults captured in the field died within 1–2 days, and most lived 1–2 weeks after capture. One field-collected *O. baranowskii* male lived 117 days after capture, but for *O. baranowskii*, the longest adult life spans for a male and a female were in lab-reared individuals (187 and 72 days, respectively). For *O. maculata*, the longest life spans for a male and a female were seen in field-collected adults (119 and 74 days after capture, respectively).

REARING OF FIELD-COLLECTED NYMPHS: Seventy-two second to fifth instar nymphs were captured and reared in the lab. The rate of mortality by parasitoids was 12%, and “unexplained” mortality was 21%. Of the 48 nymphs (67%) that reached adulthood, 79% were *O. baranowskii* (19 males and 19 females), and 21% were *O. maculata* (1 male and 9 females). One of the *O. maculata* females reached adulthood in spite of having a parasitoid that could not be identified (see Parasitoids below).

All attempts at establishing a colony in the lab failed. Females laid fertile eggs and many nymphs hatched, but there was almost a 100% nymphal mortality rate. Only three *O. baranowskii* adults could be reared from eggs, and all were unusual in that they retained the pale reddish coloration of recently molted adults. In contrast, this happened with only one *O. baranowskii* female out of 48 adults reared from field-collected nymphs.

PARASITIDS: Three *Catharosia* flies (Diptera: Tachinidae: Phasiinae) were reared from two *O. maculata* females and one *O. baranowskii* female. The fly larvae emerged from the abdomen of the bug and pupated in the Petri dish. The pupal stage lasted 12–14 days.

One *O. baranowskii* female had an approximately 1 cm-long unidentified nematode in her abdomen. Another *O. baranowskii* female, one *O. maculata* female, and 9 nymphs were parasitized by an insect larva that emerged from their abdomens and pupated. No adult parasitoids were obtained from these pupae, but one had the form typical of a euphorine braconid wasp (Hymenoptera) (P. Hanson, pers. comm.).

Several days before the emergence of all these parasitoids, the abdomen of the host bug swelled, and the intersegmental membranes became distended. The parasitoids emerged by rupturing a membrane on either the posterior portion of the abdomen of a nymph, or the ovipositor of a female. The abdomen of the bug was left relatively empty, but the bug remained alive for approximately one day after the parasitoid emerged.

All 15 parasitized bugs were collected on the ground (15 instances out of 119 nymphs and adults of both species captured on the ground). No bugs captured on branches were affected (out of 301 adults of both species), and no male was affected (out of 258 males of both species taken from the ground and branches).

Discussion

Adult *O. baranowskii* probably feed on seeds exposed on the branches and trunk of figs, or on seeds inside fruits on figs, because they were mainly found on branches. One *Ozophora* sp. pair was observed mating on a fruit, with the labium of each in-

dividual inserted into the flesh of the fruit. Adult *O. maculata* were mainly found on the ground, and nymphs of both species were only found there, suggesting that they feed on the seeds of fallen fruits. Other possible habitats for the bugs, such as forest leaf litter and other trees, were not searched. Some *Ozophora* species do not feed exclusively on *Ficus* (Slater, 1972; pers. comm.).

The sex ratio of field-collected *O. baranowskii* was male-biased, and the operational sex ratio may be even more biased, since 39–41% of females caught in the wild were not in a reproductive state. The sex ratio of lab-reared adults was 1:1. The difference in the field could be due to a greater longevity of males, or to males being more easily collected from the branches than females.

The sex ratio of field-collected *O. maculata* was 1:1, but the operational sex ratio may also be male-biased, because some females were not in a reproductive state.

The rearing of the *Catharosia* flies is the first record of a parasitoid for *Ozophora* bugs, and the first record of a host for *Catharosia* flies in Costa Rica. Phasiine tachinid flies usually attack bugs (Hemiptera sensu lato) (Wood, 1987). There are several instances of *Catharosia* flies attacking lygaeid bugs (Ashlock and O'Brien, 1964; Sweet, 1964). Because only bugs caught on the ground were parasitoidized, female *Catharosia* flies may concentrate searches for hosts on the ground.

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