

### 19.3. DEUTEROTOKY IN *MONONYCHELLUS CARIBBEANAE* (ACARI: TETRANYCHIDAE) ON CASSAVA IN GUADELOUPE. KARYOTYPE AND PRELIMINARY BIOLOGICAL DATA.

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#### INTRODUCTION

Species of the genus *Mononychellus* Wainstein (Tetranychidae, Tetranychinae), which attack cassava, originate in the Neotropical region. Their identification raises several problems, since information concerning them has been collected over more than fifty years by several authors working independently. Moreover, confusion is all the greater because the length of the dorsal setae can vary between strains of the same species and even between specimens of the same sample (Gutierrez 1987).

Based only on field sampling, it was first assumed that there were no males in one of these species, *Mononychellus caribbeanae* McGregor. When Livshits and Salinas Croche (1968) published their summary description of the male, their work first remained unnoticed, and when it was more widely distributed, questions were raised concerning the validity of the species, since one of the criteria for distinguishing *M. caribbeanae* was precisely the absence of males. We found the species on cassava in Guadeloupe and by rearing a strain we were able to determine several aspects of its mode of reproduction and life history.

#### MATERIALS AND METHODS

##### Summary of the main modes of reproduction in the Tetranychidae

In the subfamily of Bryobiinae Berlese, which is considered to be more primitive, the different genera include species showing both arrhenotokous and thelytokous parthenogenesis, whereas in the subfamily of Tetranychinae Berlese, arrhenotoky is the most frequent mode of reproduction, with several exceptions. Only one of the latter species

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shows stable reproduction by thelytoky, i.e. *Oligonychus thelytokus* Gutierrez (Gutierrez 1977).

Three species that are usually bisexual also occasionally have thelytokous strains: *Oligonychus ilicis* (McGregor), mentioned by Flechtmann and Flechtmann (1982), *Tetranychus pacificus* (McGregor) by Helle and Bolland (1967), and *Tetranychus urticae* Koch by Boudreaux (1963). Two cases of apparently ephemeral deuterotoky have been reported, one in *T. urticae* by Jesiotr and Suski (1970, in Helle and Pijnacker (1985) and the other in a female of *Eurytetranychus buxi* (Garman) raised by Ries (1935).

#### Data from the literature and field observations

Among the species of the genus *Mononychellus* collected on cassava in the Neotropical region, *M. caribbeanae* is morphologically characterized by chaetotaxy of ordinary setae on tibiae I and II. Tibia I has 8 or sometimes 9 ordinary setae and a bothridial seta, and tibia II has 6 ordinary setae, whereas *Mononychellus* of the same group have 9 ordinary setae and a bothridial seta on tibia I, and 7 ordinary setae on tibia II. The aedeagus has a very characteristic globular form quite similar to that of *Mononychellus tanajoa* (Bondar, 1938) [= *M. estradai* (Baker et Pritchard, 1962), Gutierrez 1987].

The only previously available life-history data on the species, apart from the rarity of the males, concerned the geographical distribution and the host plant. *M. caribbeanae* has been found on cassava, *Ichtyomethia* sp., *Dalbergia sisso*, and *Platymiscium trifoliatum*. No males have been collected in any of the samplings in Florida, Haiti, Puerto Rico, St. Kitts Island, Costa Rica, and Mexico (McGregor 1950, Pritchard and Baker 1955, Estebanes and Baker 1968, Paschoal 1971). Only Livshits and Salinas Croche (1968) have found males, in Cuba. *M. caribbeanae* lives on the underside of leaves and preferentially attacks young leaves. We examined many specimens from five different samplings carried out by J. Etienne on cassava in Guadeloupe. Three samples came from the region of Petit Bourg, one from Canal Perrin, and the fifth from St. François. The life-history studies only concern the strain collected in Petit Bourg in 1987.

Breeding was carried out in an air-conditioned room at  $25 \pm 1^\circ\text{C}$ , RH  $70 \pm 10\%$ , under luminescent tubes in a 12L/12D photoperiod. Mites were placed on cassava leaf disks (18 mm in diameter) resting on water-soaked cotton. The disks were replaced every 3 days.

#### Sex ratio

Descendants of 80 virgin females were isolated in the teleiochrysalis stage and raised separately on leaf disks until the adult stage.

#### Total development time

Females were placed on 30 leaf disks (2 or 3 females per disk), left to oviposit for 4 h and then removed. One egg was retained and the rest were destroyed. The disks were examined every 6 h until adults emerged.

### Longevity and fecundity

Young females from the preceding experiment were placed on separate leaf disks and examined at the same time every 24 h. Ovipositions were counted by destroying all eggs each day.

### Rate of population increase

The intrinsic rate of natural increase ( $r_m$ ) as defined by Birch (1948) was calculated here according to the simplified method used by Carey and Bradley (1982). The net reproductive rate ( $R_0$ ) is the sum of the products  $l_x m_x$  in the life table ( $l_x$  = modified longevity,  $m_x$  = age-specific fecundity). The mean generation time  $T$  was obtained using the formula  $T = \sum X l_x m_x / \sum l_x m_x$ . The  $r_m$  was calculated from  $T$  and  $R_0$  using the formula  $r_m = \text{Log } R_0/T$ .

### Chromosome number

Chromosome number was determined with eggs containing embryonic tissue, using the orcein-squash technique (Helle and Bolland 1967).

## RESULTS AND DISCUSSION

Three generations of *M. caribbeanae* were observed.

### Sex ratio

Out of 80 young females whose descendents could be monitored, only one produced a male and 20 females, in the second generation, while the others produced only females. Thus the strain studied here reproduced by thelytoky, with the possibility of deutero-toky.

### Total development time

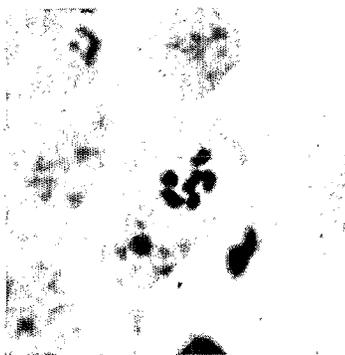
Out of 30 initial eggs, one did not hatch and two larvae were drowned, leaving 27 females whose total development time was  $12.6 \pm 0.3$  days.

### Longevity and fecundity

These were studied in the 27 preceding females. Two of them were drowned in less than 48 h without ovipositing, so that the calculations concern 25 females (survival = 0.83). Table 1 summarizes the information obtained, which was used to calculate the net reproductive rate ( $R_0$ ) under these experimental conditions.  $R_0 = 17.8$  eggs and  $T = 19.5$  days, which yields  $r_m = \text{Log } R_0/T = 0.148$ . This  $r_m$  value seems low compared to those obtained under similar conditions with the bisexual species *Mononychellus progresivus* Doreste at 24°C ( $r_m = 0.180$ ) and 27°C ( $r_m = 0.246$ ) (Yaninek et al. 1989). A low  $r_m$  value has previously been reported in the thelytokous species *Oligonychus thelytokus* (Gutierrez 1977) compared to values obtained in other bisexual *Oligonychus* species.

Table 1. Life table of *Mononychellus caribbeanae* at  $25 \pm 1^\circ\text{C}$ .

Age (days)	Longevity	Age-specific fecundity		
X	lx	mx	lx mx	X lx mx
0-14	0.83	0.00	0.00	0.00
15	0.83	0.14	0.12	1.80
16	0.83	2.12	1.76	28.16
17	0.83	2.70	2.24	38.08
18	0.80	3.70	2.96	53.28
19	0.77	3.53	2.72	51.68
20	0.70	3.37	2.36	47.20
21	0.63	2.98	1.88	39.48
22	0.50	2.96	1.48	32.56
23	0.47	2.55	1.20	27.60
24	0.43	1.40	0.60	14.40
25	0.30	0.93	0.28	7.00
26	0.13	1.23	0.16	4.16
27	0.07	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00
		$\Sigma =$	17.76	345.40
$R_0 = 17.8$		$T = 19.5$		$r_m = 0.148$

Figure 1. Mitotic stage in an egg squash of *Mononychellus caribbeanae*,  $2n = 6$  (length of chromosomes: 1-1.5  $\mu\text{m}$ ).

### Chromosome number

A chromosome number of 6 was observed in 20 squashed eggs (Fig.1). It can thus be assumed that  $2n = 6$  in this species, as in the case of four other species of the genus *Mononychellus* analyzed for chromosome number (Helle and Pijnacker 1985).

### SUMMARY

Examination of five strains of *Mononychellus caribbeanae* collected on cassava in Guadeloupe (French West Indies) revealed only immature stages and females whose dorsal setae varied in length among strains.

In a laboratory study of the offspring of three successive generations of one of these strains: one out of about eighty virgin females gave one male and 20 females, the rest producing entirely female offspring.

The life-history parameters of this strain were determined under the following conditions:  $25 \pm 1^\circ\text{C}$ ,  $70 \pm 10\%$  RH and 12L/12D. The total developmental time was  $12.6 \pm 0.3$  days, the net reproductive rate ( $R_0$ ) 17.8 eggs, the intrinsic rate of natural increase ( $r_m$ ) 0.148 and the mean generation time (T) 19.5 days. The chromosome number of *M. caribbeanae* in embryonic tissue cells was found to be  $2n = 6$ .

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