

## Introduction

The species *Spinotarsus caboverdus* appeared early 70's on the island Santo Antão, the second agricultural island of the Archipelago of Cap Verde. Since that, the millipede infested almost all agricultural areas on the island, damaging important crops, such as potato, sweet potato, corn and beans. Despite the internal quarantine measures taken by the Government, the species landed on the neighbour island of São Vicente.

## Material and Method

The field research was carry out on the island of Santo Antão and included the sampling of individuals in agricultural fields and soil in search of eggs. At the laboratory of Humboldt University, the animals were bred under laboratory conditions in terrarium by 22 to 26°C, 50% to 80% relative humidity and 12 h light. For specific tests we used Petri dishes with aperture covered with net. Pieces of potato, sweet potato, foils of lettuce and germinating beans were used as food. Weekly the developmental dates of individuals were noted.

## Results and Discussion

### Adults and reproduction

- We recognized a slight dimorphism between females and males in size.
- The average length of female is 36 mm and of male - 33 mm. The average number of body rings of adult is 67 (fig. 1).
- The adults can live approximately up to 8 months. They are present on the field during the whole year with a especially aggregation in June, July and August (fig. 5 and 6).
- Females and males find themselves coincidental. Copulation is only caused after body contact and takes 40 minutes in particular case. Females can copulate several times in short period.
- Females deposits the eggs (1,0 x 0,8 mm) 8 cm deep into the soil. Every egg is included into a soil capsule separately (fig. 2).
- Essentially, the females start the oviposition after first rain, at the end of summer. On the irrigation fields, especially banana, it can be observed through the whole year.
- The embryogenesis takes approximately 22 days under laboratory conditions.



Fig. 1



Fig. 2



Fig. 3



Fig. 4

Stages of development of *S. caboverdus*:

Fig. 1: Adults, Fig. 2: Soil capsule with egg (open), Fig. 3: Juvenile stage I, Fig. 4: Juvenile stage IV,

### Juveniles

- Development of the species encloses ten juvenile stages, which are separated by moulting.
- The first stage with length of 2 mm is white, transparent, with 8 body rings and 3 pair of legs (fig. 3). In this stage they don't have ocelli.
- The stages between I and III develop still inside of the soil capsule.
- The stage III is the first active stage. It has 17 pair of legs and two ocelli, one on each side of the head.
- Starting in stage IV (fig. 4), the juveniles gain more mobility and appear on the soil surface.
- For moulting each juvenile build a chamber using particles of soil. The process takes approximately one week in all stages.
- Exactly dates for each juvenile stage are summarized in Table 1.



Fig. 5



Fig. 6

Aggregation of *S. caboverdus* on the fruits dropped to the soil surface:  
Fig. 5: Mango; Fig. 6: Papaya

- It was determined that the duration of the stadium X is very variable because the individuals can take 14 weeks till to moult. So, the reproduction time is synchronized with climatic condition, particularly with the rain season.
- The last moult is observed by the change from immature adult to sexual mature adult. The mature adults of *S. caboverdus* don't moult.
- In the field the development of juveniles is finished in May/June every year.
- The development period from eggs to adult takes approximately 7 months.
- In conclusion of this, the species has an annual development cycle adapted to the local climate conditions, especially to the rain season.

Table 1: Characteristics on juveniles of *S. caboverdus*: Number of segments, defensive glands and ocelli of juveniles in all stages (n = 200)

Stadium	Number of				
	Leg-bearing segments	Apodous segments (Collum and Telson not included)	Defence glands	Ocelli	Ocelli in the last row
I	3	2	0	0	0
II	5	5	1	1	1
III	10	5	6	2	1
IV	20-21	5	16 or 17	3	2
V	25-27	5-6	21 to 23	6	3
VI	30-33	5-7	26 to 29	10	4
VII	38-41	5-8	34 to 37	15	5
VIII	44-50	4-9	40 to 46	15, 20 or 21	6
IX	52-59	4-6	48 to 55	26 or 27	7
X	58-66	1-3	54 to 62	32, 34, 35 or 36	8

- By each moult process the number of new segments with two pair of legs correspond to the number of apodous segments in the previous stage. But in the change from stage III to stage IV, instead of five new leg-bearing segments, 10 or 11 new segments with legs appear (table 1).
- The number of ocelli in the last row facilitated the determination of juvenile stages in *S. caboverdus*. So the stage of juvenile (excepted of stadium III) corresponds to the number of ocelli in the last row plus two (table 1).