

ARTÍCULO:

**Notes on the Taxonomy and Biology of the Neotropical Harvestman *Goniosoma catarina* sp. n. (Opiliones: Gonyleptidae)**

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**NOTES ON THE TAXONOMY AND BIOLOGY OF THE NEOTROPICAL HARVESTMAN *GONIOSOMA CATARINA* SP. N. (OPILIONES: GONYLEPTIDAE)**

Glauco Machado, Ricardo Pinto-da-Rocha & Arioaldo A. Giaretta

**Abstract**

In this study we describe *Goniosoma catarina* and provide information on the biology of the species at South Brazil. Such as other species in the subfamily Goniosomatinae (Gonyleptidae), *G. catarina* (type-locality: Santo Amaro da Imperatriz, Santa Catarina Brazil) presents maternal care, gregarious habits and nocturnal foraging activities.

**Key words:** *Goniosoma*, defense, gregariousness, maternal care, taxonomy

**Taxonomy:** *Goniosoma catarina* sp. n.

**Notas sobre la biología y taxonomía del opilión neotropical *Goniosoma catarina* sp.n. (Opiliones, Gonyleptidae)**

**Resumen**

Se describe *Goniosoma catarina* y se aporta información sobre la biología de esta especie en el sur de Brasil. Como las otras especies de la subfamilia Goniosomatinae (Gonyleptidae), *G. catarina* (localidad tipo: Santo Amaro da Imperatriz, Santa Catarina Brazil) presenta cuidado maternal, hábitos gregarios y actividad de alimentación nocturna.

**Palabras clave:** *Goniosoma*, defensa, hábitos gregarios, cuidados maternales, Taxonomía.

**Taxonomía:** *Goniosoma catarina* sp. n.

**Introduction**

Among the highly diverse Neotropical harvestmen fauna, the genus *Goniosoma* Perty (Laniatores: Gonyleptidae) deserves special attention since several species have already been studied from an ecological and behavioral standpoint (Bristowe, 1925; Pinto-da-Rocha, 1993; Ramires & Giaretta, 1994; Gnaspini, 1995, 1996; Gnaspini & Cavalheiro, 1998; Machado & Oliveira, 1998; Machado *et al.*, 2000, 2002). The genus includes more than 40 species of large and conspicuous harvestmen which occur exclusively along the Brazilian Atlantic rainforest.

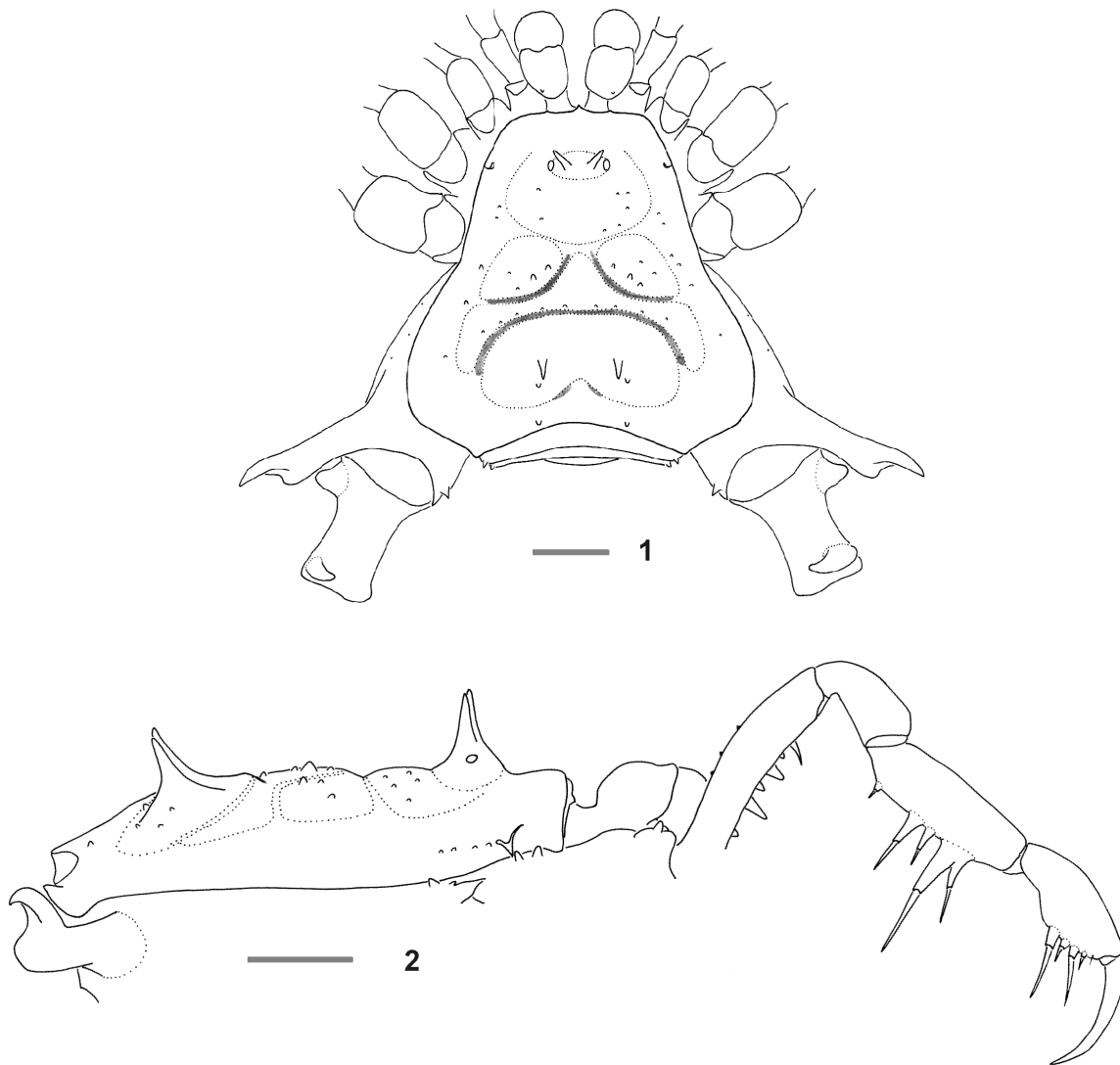
Despite its importance as models to ecological and behavioral studies the systematics of the genus is still poorly known. There are several species to be described and many problems related with incomplete descriptions and synonyms. The revision of the genus conducted by Jim (1985, 1995) was never published and the species were diagnosed mainly by the general shape of the penis, leading to an incomplete understanding of the group (Gnaspini, 1999). A review of the subfamily is been conducted by Márcio B. Silva (IBUSP). In this study we describe a new species of *Goniosoma*, and provide biological information on a population occurring at southern Brazil.

**Taxonomy**

***Goniosoma catarina* sp.n.**

(Figs. 1-9)

**DIAGNOSIS:** *Goniosoma catarina* belongs to the group composed by *Acutisoma inscriptum* Mello-Leitão, 1922, *A. proximum* (Mello-Leitão, 1922), *A. longipes* Rower, 1913, *G. badium* C.L.Koch, 1839 and *G. spelaum* (Mello-Leitão, 1922) based on the hexagonal ventral plate, stylus cylindrical and longer than the serrate ventral process. The species is similar to *Acutisoma inerme* Mello-Leitão, 1927 that was redescribed by Soares & Bauab (1970), without mentioning the penis morphology. All these species show an *Goniosoma catarina* differs from the related species (except *A. inerme*) by the presence of a pair of large spines on eye mound and dorsal scute area III; and differs from *A. inerme* by the absence of a



**Fig. 1-2.** Habitus of male *Goniosoma catarina* sp.n. **1.** Dorsal. Grey color means white patches. **2.** Lateral. Grey color means white patches. Scale bar = 2 mm.

ventral large tubercle on male trochanter IV, small number of tubercles on dorsal scute and weaker armature (few tubercles of small size) on femur IV. The femoral spines of leg III-IV are similar to those of *G. badium* (*sensu* Jim, 1985, 1995) and *G. spelaeum*.

Note: Among all related species, only *A. inerme* was recorded in the state of Santa Catarina. *Goniosoma badium* was described based upon a female without an exact locality (only Brazil was mentioned).

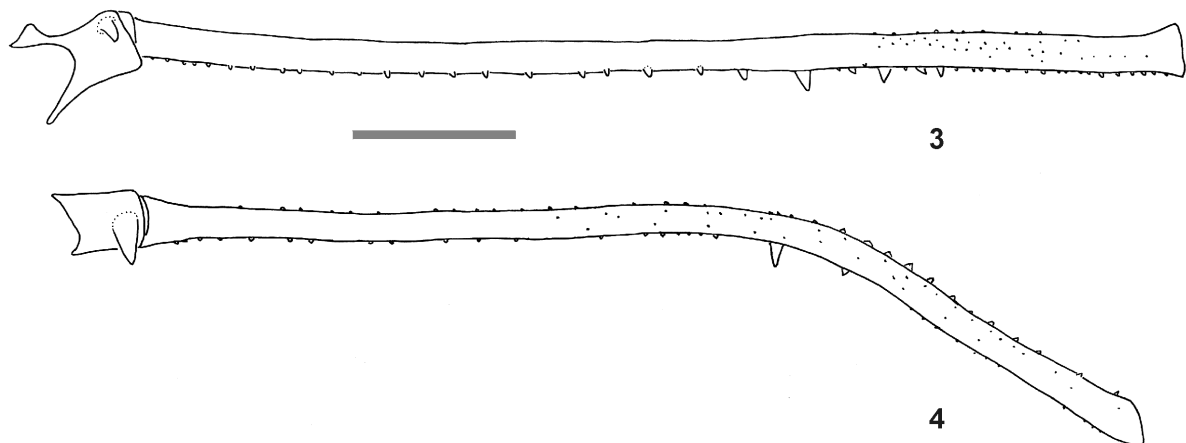
**TYPE-LOCALITY AND MATERIAL EXAMINED:** Santo Amaro da Imperatriz (27°41'S, 48°46'W, 100 m elevation), state of Santa Catarina Brazil, XII.1997, A.A. Giaretta *leg.*, male holotype and male paratype (Museu de Zoologia da Universidade de São Paulo, MZSP-16699); *idem*, Hotel Caldas da Imperatriz, 23-26.XII.1998, A.A. Giaretta *leg.*, 6 males and 6 females paratypes (MZSP-16641); *idem*, male and female (Museu Nacional do Rio de Janeiro).

**ETYMOLOGY:** In aposition to the State of Santa Catarina (Brazil).

**DESCRIPTION OF THE MALE:**

**Measurements** (in mm): Dorsal scute length 8.1; width 8.4; cephalothorax length 3.5; width 4.7; length of palpus 12.8; leg I 54.8, II 139.5, III 82, IV 102.5.

**Dorsal** (Fig. 1-2): Anterior margin smooth. Eye mound with two high acute spines, slightly leaned forward. Cephalothorax with 7 tubercles behind eye mound. Two ozopore followed by 3 tubercular pegs (visible on lateral view). Area I divided, with 4-5 tubercles each side; II with 10 tubercles; III with two high and acute spines slightly backwards, with 2 tubercles on posterior part. Lateral margin with 5-6 tubercles. Posterior margin with 2 tubercles. Free tergites I-III with one tubercle each side. Anal plate with one large and short posterior tubercle.



**Fig. 3-4.** Right male trochanter-femur IV of *Goniosoma catarina* sp.n. **3.** Dorsal view. **4.** Pro-lateral view. Scale bar = 5 mm.

**Ventral:** Coxa I with one median row of 8 tubercles, 5 apical; II-IV, stigmatic area and genital opercle with minute tubercles scattered.

**Chelicera:** Segment I with 1 dorsal tubercle; II with several pilous minute tubercles, fixed finger with 3-4 teeth; III with 3-4 teeth.

**Pedipalp** (Fig. 5): Coxa with 1 ventral tubercle, smooth dorsally; trochanter with 2 dorsal tubercles, 1 large ventral; femur with 6-7 ventral tubercles (first and third basal larger), one subapical mesal larger than other on the same segment, 3 dorsal; patella smooth; tibia mesal IiIi, ectal IiIi; tarsus with 2 ventral rows of setae, mesal IiI, ectal IiIi.

**Legs** (Figs. 3-4): Coxa I with one large anterior tubercle, 4 small median tubercles, 1 large tubercle directed to coxa II; II with one large tubercle anterior to the anterior ozopore, 2 bifid tubercles, 1 fused with another of coxa III; IV minute tuberculate, with large pro-lateral apophysis, 1 small acute retrolateral tubercle. Trochanters I-III with 3 ventral tubercles; IV twice longer than wide, with one large antero-lateral tubercle, 1 large curved tubercle on dorsal apex. Femora I-II minute tuberculate; III with one row of 8 ventro-apical tubercles; IV curved downwards, 3-4 larger lateral tubercles on curved region, 9-10 ventral tubercles, 1 apical tubercle large. Tibiae I-III minute tuberculate; IV with 3 crescent tubercles on subapical region. Tarsal segmentation: 11(3), 19-20(3), 11-12, 13.

**Genitalia** (Figs. 6-8): Ventral plate hexagonal, distal side concave, lateral with 4 flat and wide spines on basal part, 4 spines on distal half (basal cylindrical, others flattened) and 1 on dorsal side. Stylus 1/3 longer than ventral process and smooth; ventral process laterally flattened, fan-like shape with serrate prominence on the posterior edge.

**Color:** Body brownish light, grooves I-IV yellowish. Spines of eye mound yellowish, with Y-shape yellowish line dividing part of cephalothorax and areas I-IV, from base of spines of eye mound to the middle of groove IV. The dried specimens show two white patches on grooves II and IV, one on groove III, one on dorsal base of trochanter and femur IV. Spines of area III, apophysis of coxa IV and tubercles of trochanter IV brown to almost black. Appendices with yellowish patches.

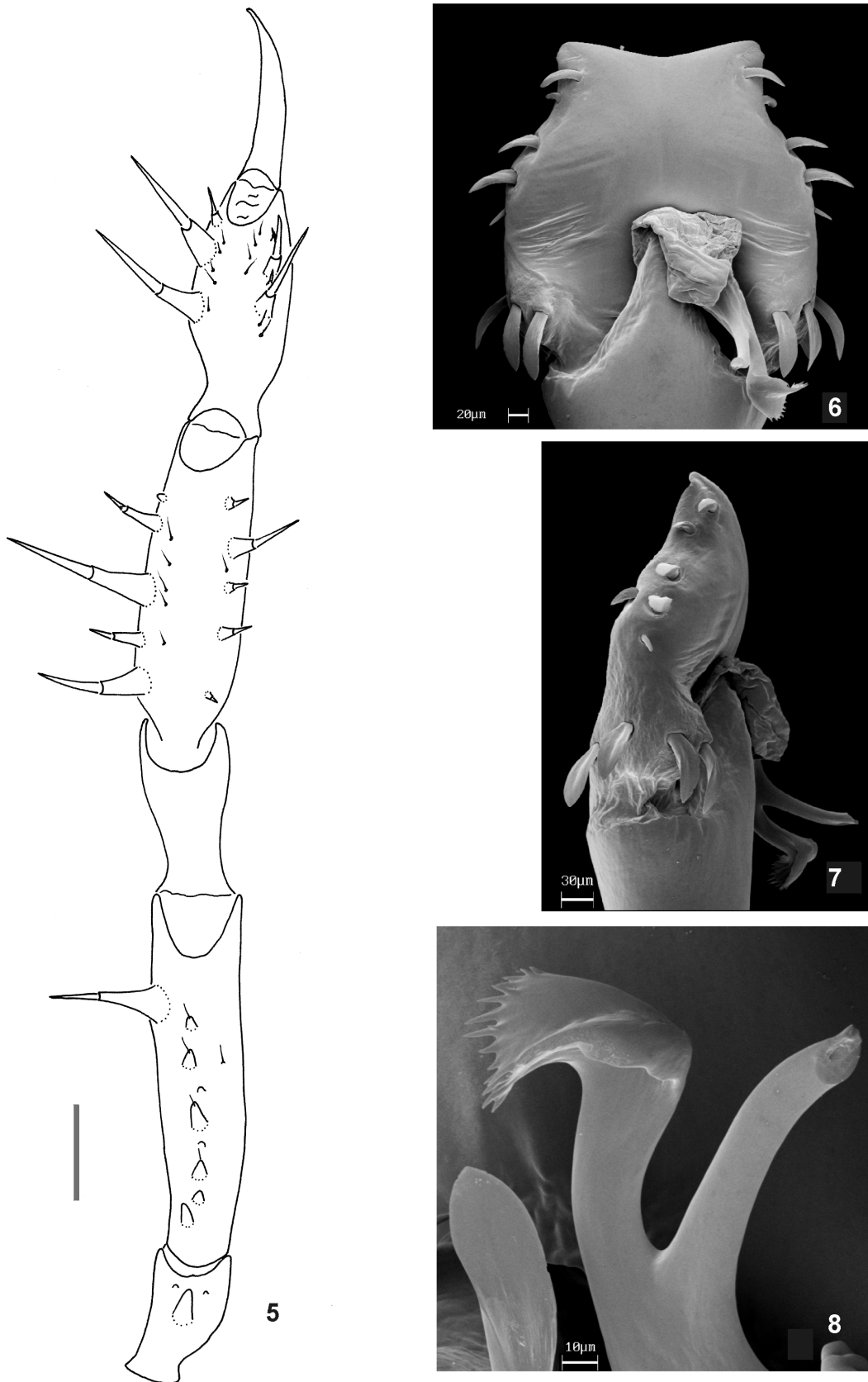
#### DESCRIPTION OF FEMALE:

Measurements: Dorsal scute length 8.1; width 8.6; cephalothorax length 3.4; width 4.9; length of palpus 12.9; leg I 45.9; II 97.2, III 68.7, IV 85.5. Area I with 9-11 tubercles each side; II with 6 tubercles each side; III with a 1 spine and 5 tubercles each side. Free tergites with tubercles on the corner much larger than male. Coxa IV with a small dorso-apical tubercle. Legs I-IV minute tuberculate. Femur IV straight. Color pattern similar to male, grooves II-IV, Y-like of cephalothorax, base of tubercle of coxa IV, trochanter IV and femur IV with white patches; that of groove III divided in two. Free sternites with several ventral white patches. Pedipalp: femur with 6 ventral tubercles (first and fourth basal larger); tibia mesal IiIi, ectal IiIi; tarsus mesal Iii, ectal IiIi. Tarsal segmentation: 10(3); 19(3); 11; 13.

#### Biology

##### Methods

**Study site.** – Field observations on *Goniosoma catarina* sp.n. were conducted at the area of the Hotel Caldas da Imperatriz, which is located in the north region of the Parque Estadual da Serra do Tabuleiro, and the vegetation around the hotel consists of secondary Atlantic Forest. In the hotel, a bridge was built over a stream



**Fig. 5-8.** 5. Male left pedipalp of *Goniosoma catarina* sp.n. Ventral. Scale bar = 1 mm. 6-8. Penis of *Goniosoma catarina* sp.n. 6. Dorsal. 7. Lateral. 8. Stylus and ventral process.

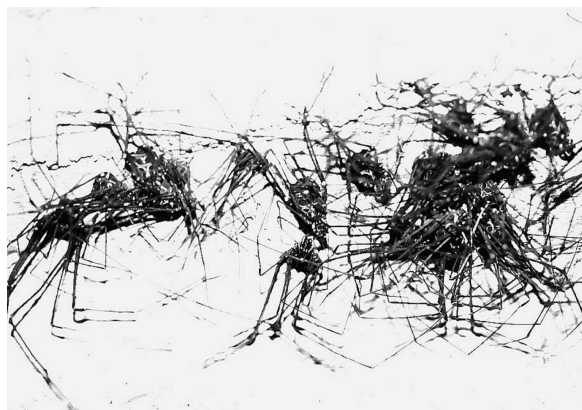
and under this construction was formed a low illuminated cave (around 15 m long; 5 m wide) with walls of cement and granite rocks that were used by harvestmen as shelter. The individuals were also searched in rock fissures along the margins of two small rivers, totaling a transect of 150 m.

**Field observations.** – Field data were taken from 23 to 27 December 1998 and the observations were conducted between 08.00 and 23.00 h, totaling about 6 h/man of fieldwork. Biological data were focused on parental care activities, gregariousness, and defensive behavior. An aggregation was considered any group of at least three harvestmen whose legs were widely overlapped (Machado *et al.*, 2000). Three aggregations were collected and the individuals were counted and had their sex and age (adult or juvenile) determined. After manipulation all individuals were released at the same place of collection. During the collection and manipulation the harvestmen, were also recorded all defensive responses of the individuals. Two females taking care of the offspring were monitored up to three times and the number of eggs was estimated through photographs. Continuous recording was made of all relevant behavioral event (Martin & Bateson, 1986). Voucher specimens of *G. catarina* sp.n. were deposited in the Museu de Zoologia da Universidade de São Paulo (MZSP-16641, 16699) and Museu Nacional do Rio de Janeiro, Brazil.

## Results and discussion

**Maternal care.** – On 23 December two females of *Goniosoma catarina* sp.n. were found taking care of their egg-batches (about 100 eggs per batch). These two egg-batches were never found unguarded ( $n = 8$  observations), both during the day and night. Egg-guarding females were about 40 cm apart from each other, in the same rock surface. The batches were located in a low-illuminated and wet place (ca. 4 m from the stream) between the gaps of large granitic rocks. Guarding-females were found either sit on the eggs or next to the batch. Eggs were laid in a single layer, spaced out by 1-2 mm within the batch and were covered by a thick mucous layer. On 24 December one entire egg-batch hatched and the nymphs remained aggregated under the guarding female at least until 27 December. The other egg-batch did not hatched until 27 December. When illuminated, the female caring for nymphs abandoned her offspring more frequently than the female caring for eggs.

Maternal care is widely distributed behavior among the Neotropical family Gonyleptidae, in which there are records for representatives of seven subfamilies (Machado & Raimundo, 2001). Apparently, in the subfamily Goniosomatinae maternal care is present in all representative genera and species, which suggests that this behavior was present in the ancestor of the group and was retained throughout its radiation. The adaptive meaning of maternal care for a *Goniosoma* species was assessed through a field experiment by



**Fig. 9.** Aggregation of *Goniosoma catarina* sp.n. inside an artificial cave at Santo Amaro da Imperatriz, Santa Catarina South Brazil. Note the leg overlapping and the narrow body contact.

**Table I**

**Frequency of sexes and age classes within three different aggregations of *Goniosoma catarina* sp.n. in Santo Amaro da Imperatriz, Santa Catarina State, Brazil.**

Adults		Juveniles	Total
Females	Males		
12	3	1	16
17	2	7	26
23	11	3	37
X = 17.3	X = 5.3	X = 3.7	X = 26.3

Machado & Oliveira (1998). These authors demonstrated that egg-guarding by females in *G. longipes* significantly reduces intra- and inter-specific predation but fails to prevent fungal attack. The degree to which female assistance can play a relevant role in other species of Goniosomatinae is still to be experimentally investigated.

**Gregariousness.** – During daytime individuals of *Goniosoma catarina* sp.n. were found resting on the walls of the artificial cave (see figure 9). Few harvestmen were found isolated but most were forming dense aggregations. The aggregations consisted of motionless individuals, with bodies 0 - 5 cm apart from each other, and legs widely overlapped. In this position the animals maintained the legs retracted over the dorsum and body close to the substrate. The aggregations contained 16, 26, and 37 individuals each, and were formed by adults and juveniles (Table I). Adult males composed a small fraction of the individuals in the aggregates, while females were quite abundant (Table I).

Harvestmen aggregated in both vertical ( $n = 2$ ) and horizontal (upside down) ( $n = 1$ ) cement walls. The aggregations were 1 - 2 m from the cave entrance and 1.5 m apart from each other. In all cases the aggregates were not in the darkest portion of the cave and one of them were found in an well-illuminated place. One day after collection for counting the aggregates were not recomposed and the individuals were found isolated

around the original point of aggregation. After two days, however, they had aggregated again in the same previous places and in similar numbers. At night, the aggregates dispersed and the individuals (adult males, females and juveniles) were found walking on the river rocks outside the cave. This observation suggests that the *G. catarina* as well as *G. spelaeum* (Gnaspini, 1996) and *G. longipes* (Machado *et al.*, 2000), is a nocturnal forager that leave the diurnal retreat after dusk to search for food.

Gregarious behavior in the genus *Goniosoma* have been recorded for several species: *G. aff. badium* (9 - 34 individuals; Pinto-da-Rocha, 1993), *G. longipes* (7 - 200 individuals; Machado *et al.*, 2000), *G. aff. proximum* (3 to 79 individuals; Machado *et al.*, 2002), *G. geniculatum* (30 - 50 individuals; Machado in prep.), and *G. spelaeum* (?; Gnaspini pers. comm.). Previous studies with *G. longipes*, another gregarious species, suggest that the gregariousness in harvestmen may be related to the choice of suitable microconditions in the environment and/or with group chemical defense (Machado *et al.*, 2000).

**Defensive behavior.** – Fleeing was a common defensive response and it was promptly employed when individuals of *G. catarina* were disturbed by touching or by artificial lightening. Upon manipulation attacking with the pedipalps and biting with the chelicerae was also a frequent defensive behavior (personal observation). Besides the mechanical defenses, individuals of *G. catarina* released a repugnatory liquid when manipulated. In this case, a large transparent drop runs along the lateral margin of the scutum and accumulates in the posterior margin of the body (enteric fluid). If persistently disturbed, a second fluid is also secreted by the repugnatorial glands, which adds to the previously colorless fluid a yellowish coloration and a characteristic sour smell. The mixture of these secretions promotes red stains on the point of contact with the human skin.

Physical disturbance usually provokes discharge of repellent secretions in many laniatorean harvestmen (Eisner *et al.*, 1971; Acosta *et al.*, 1993; Gnaspini & Cavalheiro, 1998; Machado & Vasconcelos, 1999). Chemical nature of the scent gland secretions produced by *Goniosoma* are mainly benzoquinones (Gnaspini & Cavalheiro, 1998; G. Machado and J. R. Trigo, unpublished data), which are a widespread predator deterrents among arthropods (Blum, 1981). Recently, it was demonstrated that the defensive secretion of *Goniosoma* aff. *proximum* also works as an alarm pheromone and elicits dispersion among aggregated individuals (Machado *et al.*, 2002).

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