250 MHz ^{1}H-NMR data for 8-(R)-HETE (**1**) and (**2**)

H at C	1	2
2	2.28 t (6)	2.28 t (6)
3	1.69 qui (6)	1.69 qui (6)
4	2.12 m	2.12 m
5, 6	5.40–5.49	5.40–5.49
7	2.32 t (6)	2.32 t (6)
8	4.16 q (6)	4.16 q (6)
9	5.70 dd (15,6)	5.70 dd (15,6)
10	6.57 dd (15,10)	6.58 dd (15,10)
11	6.00 dd (10,10)	6.01 dd (10,10)
12	5.40 m	5.40 m
13	2.96 t (6)	3.00 t (6)
14, 15	5.40–5.49	5.40–5.49
16	2.12 m	2.86 t (6)
17	1.35 m	5.40–5.49
18	1.35 m	5.40–5.49
19	1.35 m	2.12 m
20	0.94 t (6)	1.00 t (6)

Measured in CD_3OD; chemical shifts in ppm; coupling constants in Hertz enclosed in parentheses; d = doublet, t = triplet, q = quartet, qui = quintet, m = multiplet.

The EI mass spectrum of the 8-HETE methyl ester (diazomethane esterification) gave a small peak at m/z 316 for M^+-H_2O and the base peak at m/z 193 due to the cleavage of C-7/C-8 bond, shifted after trimethylsilylation to m/z 265, diagnostic for 8-HETE structure. Smallest peaks at m/z 171 (methyl ester) and 243 (silylated methyl ester) corresponding to the alternative cleavage of C-8/C-9 bond were also observed. In the spectra of silylated methyl ester of **2** the base peak was observed at m/z 263, indicating the location of an extra double bond on this fragment. The peak due to the cleavage of C-8/C-9 was observed at m/z 243 unshifted relative to the silylated methyl ester of **1**. The UV maximum at 234 (ε = 26 000) nm for both **1** and **2** indicated the presence of a *cis-trans*-conjugated-diene. ^{1}H-NMR double resonance experiments showed that the *trans* double bond was adjacent to the hydroxyl-bearing carbon and also allowed all signals to be assigned (table). Thus the structures **1** and **2** were established. We also note that the spectrum of compound **1** was superimposable on that reported for 8-HETE [11, 13].
The configuration at C-8 in **1** and **2** was determined by the exciton-split c.d. curve of their *p*-bromobenzoates [c.d. in methanol: 227/246, $\Delta\varepsilon$ + 1.2/− 1.6, A = + 2.8 for both **1** and **2**]. We have assumed that the circular dichroic exciton chirality method for determining configuration of acyclic allylic alcohols [17] is extendable to conjugated diene acyclic allylic alcohols. Namely, a predominance of the rotamer with the carbinyl hydrogen and double bond eclipsed should give rise to a negative c.d. when the configuration is R and accordingly a positive c.d. when the configuration is S.

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Communication and synchronized molting in a colonial araneid spider, *Eriophora bistriata*

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Summary. The colonial orb-weaving spider, *Eriophora bistriata*, coordinates molting cycles through communication. Colonies with differing molting cycles synchronize when combined. Intercycle intervals depend upon food availability. The possible coordination of this synchrony by chemical communication among spiders is discussed.
Key words. Spider; molting; coloniality; Araneidae; synchronization.

In the majority of arthropods, molting is commonly cued by external stimuli [1]. In general, synchrony in molting is achieved only during one molt, for example when the induction of diapause for a specific instar is cued by some phenological cue [2]. In the colonial orb-weaving spider, *Eriophora bistriata*, the instar composition of any colony is essentially

uniform, although colony to colony variations are found in terms of instar number[3]. Colonies of this spider are essentially comprised of siblings, but adjacent colonies do fuse with no overt aggression[3]. In this spider, all colonial members form a communal roost during the day, and at night the roost disintegrates and spiders spin individual capture webs[3]. Because colonies are known to consist only of spiders in the same instar[3], molting synchrony is a necessary prerequisite. Here we suggest that molting is indeed synchronous, and that this synchrony is coordinated by chemical communication and dependent upon food availability.

Methods and materials. Incipient colonies of *E. bistriata* were collected near Itiripina, São Paulo, Brazil, and transported to an accessible field site near Rio Claro, São Paulo. Eight colonies of 100 individuals each were established in small fruit trees, and one-half of these colonies were provided with back illumination nightly to attract more insect prey. The other colonies were provided with no additional illumination. Two colonies of each group were split into 2 sub-groups of 50 spiders each, once their molting cycles had been determined. The molting cycles of each of the colonies were followed through 2 molts. At this time experimental colonies were formed by fusing one-half of the undivided colonies from each test group with colonies from the other (food augmented and natural). These colonies were then maintained in 'food augmented' conditions through back lighting.

Results. Molting is an individual behavior in *E. bistriata,* and is highly stereotyped (fig. 1). However, colonies do molt synchronously (fig. 2), and this synchrony was maintained for all experimental conditions. Significant differences were found between groups both in the timing of molting, and in the length of the molting cycle. Back illuminated colonies spent an average of 7.1 days ($s = 0.884$) vs 7.5 days ($s = 0.861$) for control colonies from first to last molt ($T = 1.776$, 58 df, $p < 0.05$). Control colonies were significantly faster molting than slow-fast combined colonies (8.7 days, $s = 1.201$; $T = 2.832$; 34 df; $p < 0.05$).

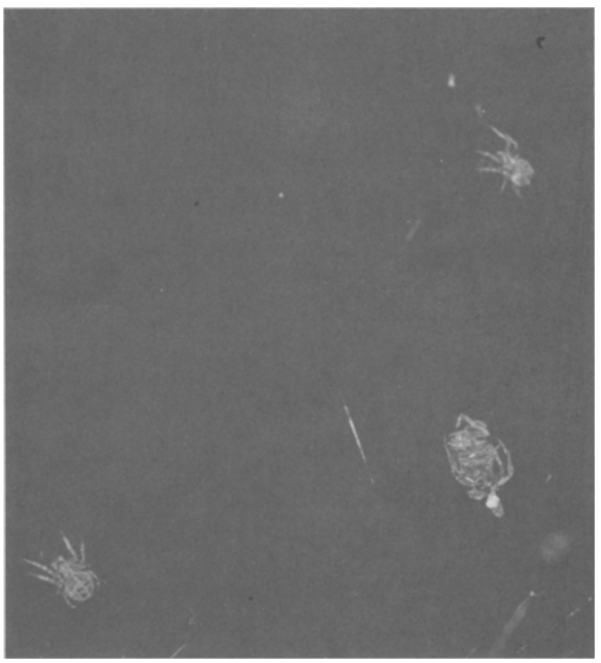

Figure 1. The normal molting position of *Eriophora bistriata.* Spiders molt while hanging by a silk thread during the nocturnal prey capture cycle. Note 2 adjacent non-molting spiders in their individual orb-webs.

Combined colonies (fig. 2) synchronized to the molting cycle of the earlier molting colony, when examined in terms of days elapsed to last molt ($T = 1.912$; 6 df; $p > 0.05$). Back illuminated colonies, which molted faster, were significantly different from control colonies, when days elapsed to last molt are considered ($T = 15.805$; $p < 0.005$). Combined colony groups followed the same general patterns as their source colonies (fig. 3). A Kolmogrov-Smirnov test demonstrated that no differences were found in the cumulative frequencies of molting spiders in back illuminated and control colonies, although combined colonies did molt at a significantly slower rate ($D = 0.19$, $p < 0.05$); however, the total time interval from first to last molt did not differ from their source colonies.

Discussion. Very few examples have been found of chemical communication affecting development in animals. Some examples are known from social insects (ants and termites), but these chemical cues generally serve to inhibit the production of reproductives or a specific morphological caste[4]. Primer pheromones are also thought to synchronize reproductive maturity in some Orthoptera[5], while other pheromones have been shown to delay molting in the coleopteran *Dermestes maculatus*[6].

Molt synchrony has been reported in hymenopteran parasitoids[7], and in the predatory pentatomid *Apateticus bracteatus*[8], and, most recently, for a group-living collembolan[9]. All of these synchronized molting patterns are probably chemically mediated and cued. In the case of parasitoids, as well as predatory bugs and spiders, maintaining the same body size as that of the rest of a cohort would serve

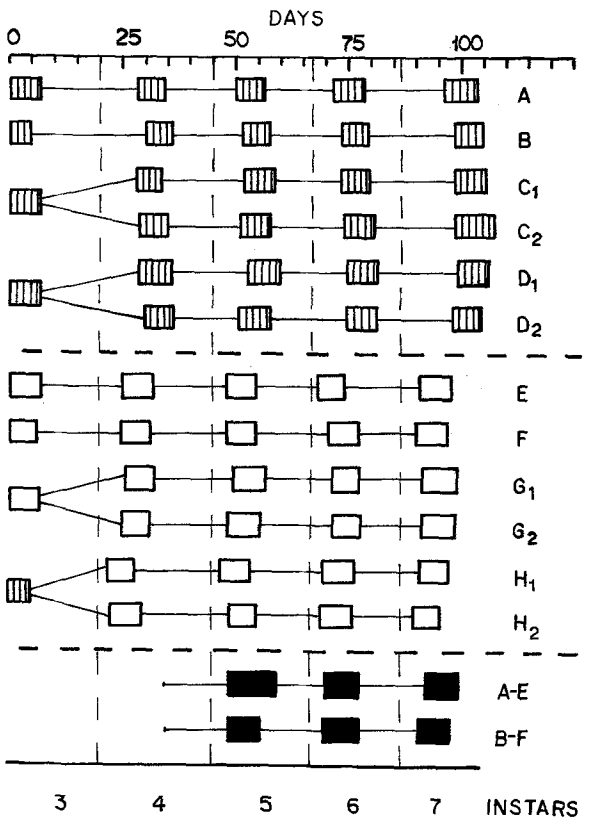

Figure 2. The molting cycles of *Eriophora bistriata* colonies. A and B, natural (control) molting cycles; C and D, molting cycles of split natural colonies; E and F, molting cycles in colonies provided with back illumination to increase prey capture; G and H, molting cycles of split back-illuminated colonies; A–E and B–F, molting cycles of combined control and back-illuminated colonies. Shown is the interval between molts, and the interval from first to last molt in each colony.

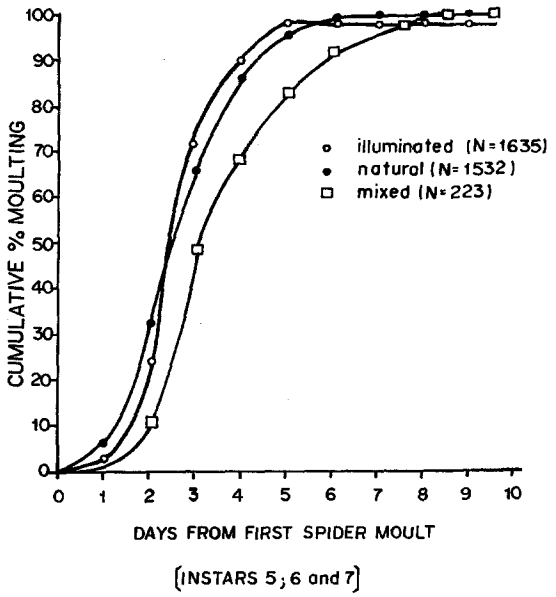

Figure 3. Molting rates of natural, back-illuminated, and combined colonies. See figure 2 for more details.

to reduce the risk of cannibalism, as generally larger individuals prey upon smaller ones. In fact, cannibalism is never observed in *E. bistriata* in the field[3].

For *E. bistriata,* synchronizing the molting cycle could also have a further advantage, that of permitting cooperative prey capture[10]. *E. bistriata,* like all araneids, constructs individual orb-webs nightly for prey capture. However, extraordinarily large prey can be ensnared in individual orb-webs, and captured through the cooperation of neighboring spiders which enter the individual orb-web to subdue the prey[10]. Although cooperative prey capture is common in species which construct a collective web[11], this behavior among orb-web spinning spiders is unique to *E. bistriata*[10], and is probably coordinated by vibrational stimuli perceived by neighboring spiders. These vibrational stimuli are probably interpreted allometrically, depending upon spider size. The possibility of recognizing spiders from neighboring webs could facilitate communal prey capture, while, at the same time, minimizing potentially fatal aggressive confrontations in the individual orb-webs, which are defended unless an extremely large prey is ensnared[3].

We suggest that molting is synchronized by chemical communication, probably transmitted during the diurnal roosting period, when all spiders are in close physical contact. Whether this chemical cue is a primer pheromone, or the liberation of molting hormones perceived on a newly molted individual, its effect is quite clear-cut, leading to a high degree of colony molting synchrony.

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Adventitious juice vesicle initiation in lemon (*Citrus limon* L.), mandarin (*Citrus reticulata* Blanco), sour orange (*Citrus aurantium* L.), and sweet orange (*Citrus sinensis* (L.) Osb.) fruit explants

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Summary. Adventitious juice vesicles have been obtained from lemon, mandarin and navel and sour orange juice vesicle explants cultured for prolonged periods on a nutrient medium containing 3.0% sucrose in vitro.
Key words. Aurantioideae; callus; maturation; morphogenesis; proliferation; Rutaceae; tissue.

The citrus fruit is unique among the angiosperms[1]. The fruit is a berry (hesperidium) consisting of 6–20 united carpels. These carpels are oriented vertically with their margins curved adaxially to join the floral axis thus forming locules. Exterior to the locules is the pericarp which is subdivided into three regions: the exocarp (flavedo or exterior peel), masocarp (albedo or interior peel), and the endocarp (locule membrane). Juice vesicles arise from primordial bumps on the surface of the endocarp. Through cell division they differentiate into elliptical shaped juice vesicles consisting of a distinct stalk and a single terminal body with tapered ends. Citrus vesicles are characterized as being uniform solitary stalked structures which accumulate juice[1]. Since the juice vesicles are the edible portion of the citrus fruit they are of great economic value.

Other investigators have attempted to culture either individual juice vesicles or fruit explants containing juice vesicles on nutrient medium containing high concentrations of carbohydrates and growth regulators[2–6]. Past studies were short-term (typically less than 30 days) and invariably resulted in the deterioration of the original vesicle tissue into a callus mass. Described herein, is a long-term fruit bioassay system to analyze the effects of chemical and physical environments on citrus fruit tissue growth and metabolism in vitro. In the