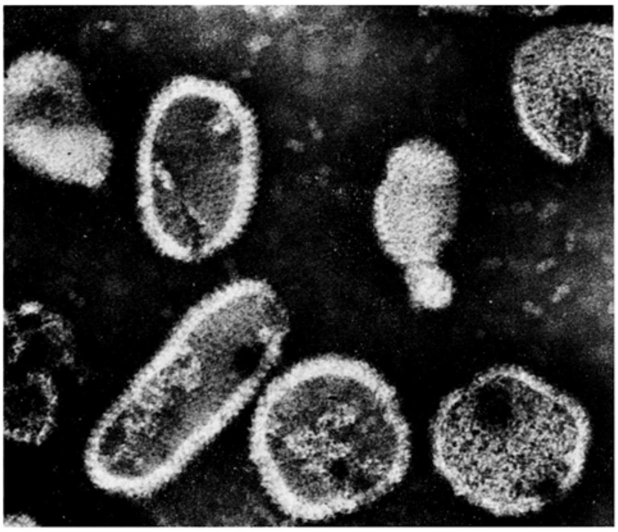

Infectious viral particles isolated from the haemolymph and the haemocytes of diseased *Macropipus depurator* ×. 126,000

ed in regular lines forming a helical structure on the surface. The virion is homogenous inside but contains several elements denser to electrons (Figure).

The cytoplasm of heart cells observed in electron microscopy on ultrathin sections shows an arrangement in groups of ovoid virions.

These virions have been purified by differential and density gradient centrifugations. Injection of purified viruses to healthy crabs provoked the disease.

Further studies on the nucleic acid and the ultrastructure will enable us to define the position of this virus which shows some characteristics common to rhabdoviruses. Nevertheless, it seems that this virus cannot be included in one of the types of viruses already known in comparative virology.

The disease seems frequent in crab populations of the Mediterranean Coast, for many samplings enabled us to observe lesions and isolate the virus. It is sometimes associated with another virus, 50–60 nm in diameter, probably the one found by VAGO[1] in the same Mediterranean area.

*Résumé*. Une maladie virale a été mise en évidence chez le Décapode *Macropipus depurator*. Le virus isolé et purifié est de 150 à 300 nm de long, ovoïde et enveloppé. Il est expérimentalement très pathogène. Les groupements de virions ont été montrés dans le cytoplasme des cellules cardiaques.

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## The Spatial Orientation of Desert Ants, *Cataglyphis bicolor*, Before Sunrise and After Sunset

In two early papers SANTSCHI[1,2] suggested that desert ants (*Formicinae: Cataglyphis bicolor*; *Myrmicinae: Monomorium salomonis*) would be able to use the moon and even some brighter stars for nocturnal orientation. Although these conclusions are often cited in handbooks and review articles about ant behavior[3,4], they have not been scrutinized until now. In recent years, however, the problem of celestial orientation during the night has become more interesting, since 1. the orientation toward the moon's azimuth has been tested in several arthropods[5–8], and 2. the ability to recognize patterns of bright circumpolar stars could be proved in vertebrates[9–11]. In contrast to the overwhelming evidence for a sun-compass orientation in both arthropods and vertebrates, there are no unambiguous data about a compass orientation towards the azimuth of the moon or even of some brighter stars. Studying the visual orientation of desert ants, *Cataglyphis bicolor*[12–15], we therefore investigated the orientation performances of these desert ants during different time intervals between sunset and sunrise.

Since *Cataglyphis bicolor* is a predatory and solitary hunter, never performing mass foraging along scent trails, single ants can be successfully trained to go to feeding places. In the experiments dealt with here, the individually marked ants were trained from the nest entrance to a special azimuth $\alpha_f$ along a distance of 10–20 m. As in *Cataglyphis bicolor* foraging is usually restricted to day-time, the ants had to be trained under day-light conditions and were afterwards tested during the night. For each foraging run $R_f$ the coordinates of the feeding place were determined by means of a grid of thin threads (training grid, mesh width 1.0 m), which extended over the whole experimental area. During the night, 2–100 h after having been captured at the feeding place (azimuth $\alpha_f$), the ants were placed in a testing grid, far away from the training grid and completely unknown to the ants. There they were released at point $P_1$. Using a red light beam (Filtraflex-DT edge filter 580 nm) the return runs $R_r$ could be exactly recorded until the ants started to search around at random (point $P_2$). For each return run $P_1P_2$ the mean direction $\alpha_r$ was determined graphically. Data about light intensity LI (Lux), wind direction $w_f$ and $w_r$, wind velocity WV (m/sec), temperature, relative humidity and atmospheric pressure were automatically recorded during $R_f$ and $R_r$.

For direction-finding during the time between sunset and sunrise, *Cataglyphis bicolor* would be able theoreti-

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cally to use astromenotactic or anemomenotactic orientation mechanisms. Irrespective of the special cues involved in celestial orientation, the presumed direction (zero-direction) $\alpha_r$ (AS) of an astromenotactic orientation can be calculated as

$$\alpha_r(\mathrm{AS}) = \alpha_f - 180°.$$

If the ants orient anemomenotactically, the zero-direction would be

$$\alpha_r(\mathrm{AN}) = \alpha_f - 180° - (\mathrm{w}_f - \mathrm{w}_r).$$

Therefore the two deviations

$$\Delta\alpha_r(\mathrm{AS}) = \alpha_r(\mathrm{AS}) - \alpha_r \quad \text{(astromenotactic error)},$$
$$\Delta\alpha_r(\mathrm{AN}) = \alpha_r(\mathrm{AN}) - \alpha_r \quad \text{(anemomenotactic error)}$$

can be calculated for each $\alpha_r$. According to the relation

$$\text{astromenotaxis } 1 < \frac{\Delta\alpha_r(\mathrm{AN})}{\Delta\alpha_r(\mathrm{AS})} < 1 \text{ anemomenotaxis}$$

we were able to decide which of the two orientation mechanisms dominates in determining the return course $\alpha_r$. It is evident that such a discrimination is impossible when $w_f$ coincides with $w_r$, because then $\alpha_r$ (AS) would be equal to $\alpha_r$ (AN).

*Results.* 1. Moonless nights: *Cataglyphis bicolor* orients anemomenotactically even when WV $\leqslant 0.4$ m/sec and when the ants are released in the testing grid not before the 3rd night after the time of $R_f$ (Figure 1A). The circular distribution of the experimental data (direction and length of mean vector[16]) does not differ from the one obtained during day-time, when the compound eyes and the ocelli of the ants were covered with black paint (Figure 1B)[17]. After elimination of the antenna, the ants searched around at random showing no statistically significant preference direction.

2. Moonlight nights with LI < 1 Lux (only nights with full moon ± 4 days): As the ants are able to perform a positive or negative phototactic orientation according to the moon's azimuth, a $\alpha_r$ (M)-value, similar to $\alpha_r$ (AS), can be calculated. The alternative decisions between that tropotactic moon-orientation and the anemomenotactic orientation mechanism (Figure 2, ○) is not influenced by the wind velocity or the angle height of the moon[18].

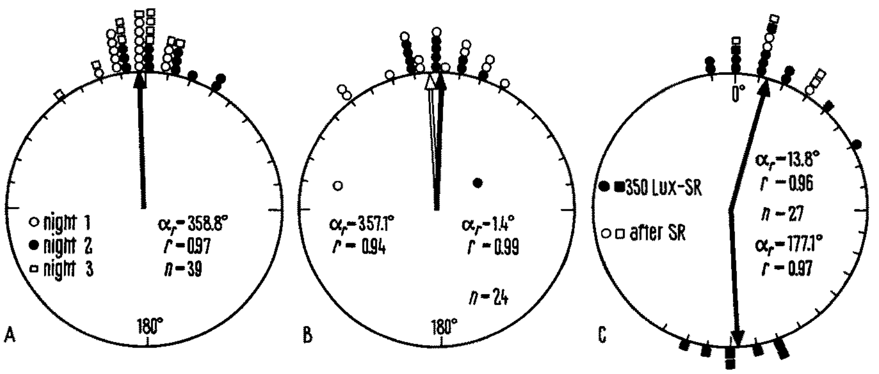

Fig. 1. Circular distributions of home-directions (return directions) measured after displacement of the ants to an unknown area. 0°, home direction (presumed return direction). A) Return runs in the 1st 2nd and 3rd night following the day-time foraging runs: ○, $\alpha_r = 358.0°$, $r = 0.99$; ●, $\alpha_r = 5.5°$, $r = 0.97$; □, $\alpha_r = 355.4°$, $r = 0.98$. B) Return runs during day-time immediately following foraging runs. Compounds eyes and (or without) ocelli are covered with black paint: ○ $|w_f = w_r|$, ● $|w_f - w_r| > 30°$ C.) Return runs just before (● ■) and after (○ □) sunrise: ● ○ $|w_f - w_r| < 120°$, ■ □ $|w_f - w_r| > 120°$. $\alpha$, mean vector of orientation; $r$, length of the mean vector; $n$, number of individually trained and tested ants; $w_f$ and $w_r$, wind directions during foraging and return runs; SR, sunrise.

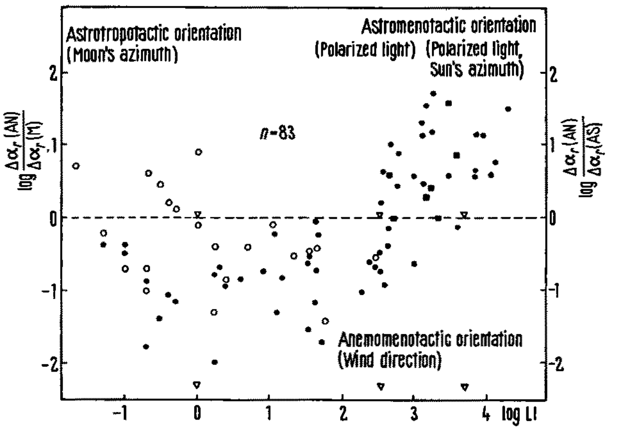

Fig. 2. The orientation mechanisms used by *Cataglyphis bicolor* during night-time orientation in moonless (● ■) and moonlight (○) nights. Abscissa: light intensity LI (logarithmical scale); the 3 white arrows mark the critical values of LI = 1 Lux, 350 Lux and the LI of sunrise and sunset (ca. 5000 Lux). Ordinate: the values $\Delta\alpha_r$ (AN, AS, M) mean the deviations of the return runs from the zero-directions of anemomenotactic (AN), astromenotactic (AS) and astrotropotactic (positive resp. negative phototactic) orientation towards the azimuth of the moon (M). For further explanations see text.

3. Dusk (1 < LI < 350 Lux): Under these dim light conditions all ants showed an anemomenotactic orientation, irrespective of whether the moon was visible or not (Figure 2, ○ and ●).

4. Dusk (350 < LI < 5000 Lux [sunrise, sunset]): In this time interval (ca. 30 min before sunrise and after sunset) the ants orient towards the pattern of polarized light in the sky. According to the symmetrical polarization pattern at that time they show a bimodal distribution of the directions of $\alpha_r$ (Figure 1C): as a function of wind direction, the zero-(home-) direction or the 180°-counter-direction is preferred. After sunrise or before sunset, however, only zero-directed runs could be recorded.

*Conclusions.* For direction-finding during the night, *Cataglyphis bicolor* makes use of an anemomenotactic

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[17] R. Wehner, *in preparation.*

[18] R. Wehner and P. Duelli, *in preparation.*

orientation mechanism, which until now has been proved only for a few arthropod species[19–23]. That mechanism may be switched off in favor of a tropotactic orientation towards the azimuth of the moon or a menotactic orientation towards the pattern of polarized light, which is already visible before sunrise and after sunset. The ants always decide alternatively between astromenotactic and anemomenotactic courses and never perform compromise directions. If one wants to state a hierarchy between the different orientation mechanisms used by the ants for night-time orientation, the mechanisms must be ordered in the following way: astromenotactic orientation towards the pattern of polarized light $>$ anemomenotactic orientation $>$ astrotropotactic orientation towards the azimuth of the moon (LI $>$ 1 Lux). For LI $<$ 1 Lux the two latter orientation performances occur simultaneously. SANTSCHI's early results[1, 2] can be satisfactorily explained by these 3 types of orientation performances. A celestial orientation by means of some brighter stars could not be proved in *Cataglyphis bicolor*[24].

*Zusammenfassung.* Nachts orientiert sich die Wüstenameise *Cataglyphis bicolor* vorwiegend anemomenotaktisch. Einerseits kann jedoch in Mondnächten bei Lichtintensitäten $<$ 1 Lux eine Astrotropotaxis nach dem Mondazimut (positive oder negative Phototaxis) die Windorientierung ausschalten. Andererseits dominiert bei Lichtintensitäten $>$ 350 Lux (ca. 30 min vor Sonnenauf- und nach Sonnenuntergang) die astromenotaktische Orientierung nach dem Polarisationsmuster über die Anemomenotaxis. Wegen der Spiegelsymmetrie des Polarisationsmusters bei horizontnahem Stand der Sonne treten in diesem Zeitintervall bimodale Laufverteilungen auf, die jedoch bei Sonnensicht sofort in unimodale übergehen.

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[24] The experiments were performed in a desert area near Maharès 34.53 °N x 10.49 °E, southern Tunisia) during July and August 1970. Financial support of the Claraz-Foundation, Switzerland, and the Fonds national suisse de la recherche scientifique, No. 3.315 70, is gratefully acknowledged.

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## Induction of Root-Coiling by 2-Chloroethane Phosphonic Acid and its Reversal by 2,3,5-Triiodobenzoic Acid

The role of ethylene in plant growth regulation is becoming increasingly important; and, on the basis of recent evidence, the gas may well be referred to as an endogenous bio-regulant[1]. The new chemical ethrel (2-chloroethanephosphonic acid, CEPA) releases ethylene directly to plant tissues and causes a variety of physiological responses[2]. We have observed that following treatment with CEPA the main roots of the *Ipomoea pentaphylla* indicate extensive coiling, much like that of the tendrils; and furthermore this effect of CEPA can be almost completely reversed by a simultaneous application of 2, 3, 5-triiodobenzoic acid (TIBA). The results are presented in this report.

Effect of CEPA and TIBA on seedling growth and pigmentation of *Ipomoea pentaphylla*

| Treatment Concentration in ppm | Seedling growth after 5 days Seedlings showing coiling (%) | Root (mm) | Hypocotyl (mm) | No. of laterals | Fresh wt. (mg) | Dry wt. (mg) | Total pigments µg/g fresh wt. | Anthocyanins/2 hypocotyls (O.D. at 525 mm) |
|---|---|---|---|---|---|---|---|---|
| Control | — | 58 | 50 | 28 | 445 | 40 | 2365 | 0.42 |
| TIBA$_1$ | — | 53 | 35 | 15 | 470 | 42 | 2360 | 0.40 |
| TIBA$_{10}$ | — | 21 | 23 | — | 420 | 40 | 2345 | 0.41 |
| TIBA$_{50}$ | — | 20 | 22 | — | 310 | 39 | 2325 | 0.48 |
| CEPA$_{120}$ | 70–80 | 20 | 18 | 30 | 440 | 42 | 490 | 1.18 |
| CEPA$_{120}$ + TIBA$_1$ | 20–25 | 23 | 28 | 8 | 350 | 39 | 525 | 0.98 |
| CEPA$_{120}$ + TIBA$_{10}$ | 2– 4 | 24 | 25 | — | 300 | 38 | 705 | 0.88 |
| CEPA$_{120}$ + TIBA$_{50}$ | — | 20 | 22 | — | 280 | 38 | 690 | 0.82 |

*Material and method.* Seedlings of *Ipomoea pentaphylla* were raised in 9 cm petri dishes containing a single layer of filter paper moistened with 5 ml of distilled water or an equivalent amount of the test solution. During the experimental period the seedlings were grown at 28 °C and received cool flurescent light from 2 Philips 40 Watt lamps hanging at a distance of about 1 m. Data relating to seedling length, fresh weight, dry weight, synthesis of pigmentation in cotyledons, as well as development of anthocyanins, were recorded regularly commencing from 16th till the 6th day after germination. Pigments were analyzed according to the method of RÖBBELEN[3] ,while for antho-

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