

Short communication**(S)-2-Methyl-1-hexanol, characteristic mandibular gland substance of ants of the *Cataglyphis bicolor* group**D. Agosti¹, C. Austin², O. A. Gökçen², W. A. König³, E. D. Morgan^{2,*}, E. D. Scott², and R. Wehner¹¹Zoologisches Institut der Universität Zürich, Winterthurerstrasse 190, CH-8057 Zürich, Switzerland²Department of Chemistry, Keele University, Staffordshire, ST5 5BG, United Kingdom³Institut für Organische Chemie, Universität Hamburg, D-20146 Hamburg, Germany

Summary. In all the species of the *Cataglyphis bicolor* group examined yet, i.e. *C. bicolor*, *C. diehli*, *C. isis*, *C. nodus*, and *C. viaticus*, 2-methyl-1-hexanol is the characteristic substance and almost the only substance found in the mandibular glands. Its chirality has been determined in *C. bicolor* and shown to be exclusively (S)-2-methyl-1-hexanol.

Key words. mandibular glands – chemotaxonomy – chirality – synthesis – 2-methyl-1-hexanol – Hymenoptera – Formicidae – Formicinae – *Cataglyphis*

Introduction

There are some 104 described species and others yet undescribed in the ant genus *Cataglyphis*, which are distributed in the Old World from Mauritania to the Gobi desert. Almost all species thrive in open habitats, either on Mediterranean evergreen vegetation or on deserts and dry salt plains. From an examination of existing museum collections and over 100 specimens collected in North Africa and Asia Minor, Agosti (1990) has recognized several species in the *bicolor* complex in North Africa which have been the subject of intensive research for more than two decades, chiefly in neuroethology (Wehner 1994), and more recently in taxonomy and biogeography (Agosti 1990; Wehner *et al.* 1994), when it became apparent that “*Cataglyphis bicolor*” included three species in the study area. Determination of species from morphological features alone is difficult in some cases and so Wehner and co-workers resorted to a combined analysis, using morphology, allozymes, DNA-sequences and chemical secretions of exocrine glands to help in diagnosing species.

In the chemical work we have found that mandibular gland secretion is variable with species groups in some representative *Cataglyphis* species (Keegans *et al.* 1992). For example, two species from the *altisquamis* group, *C. altisquamis* and *C. mauritanicus* have citronel-

lol as the major mandibular gland substance, *C. cursor* and *C. frigidus* of the *cursor* group contained citronellol and farnesene and *C. ruber* of the *albicans* group has the simple aldehydes nonanal and decanal, while the *bicolor* group species *C. isis*, *C. niger*, *C. nodus* and two described there as *C. bicolor-1* and *C. bicolor-2* all contain a substance, new to pheromones, 2-methyl-1-hexanol (Keegans *et al.* 1992).

We have now synthesized this compound in its optically active form and determined its chirality in the *Cataglyphis bicolor* mandibular glands.

Experimental

Ants of the *Cataglyphis bicolor* complex were collected in Tunisia and Egypt and taken live to Zürich where mandibular glands were dissected and sealed either singly or in pairs in small glass capillaries which were taken to Keele for analysis by linked gas chromatography-mass spectrometry, using the conditions described by Keegans *et al.* (1992). Mandibular glands were introduced directly into the gas chromatograph, without intervention of solvent, by the method of Morgan & Wadhams (1972; see also Morgan 1990). Samples were identified only by a code, and the species was only revealed after the work was completed.

For chiral chromatography, mandibular glands of *C. bicolor* were removed from their capillaries and crushed in hexane, and the hexane solution chromatographed under the same conditions as racemic and (R)-2-methyl-1-hexanol.

Enantiomers were separated by gas chromatography on a 25 m fused silica capillary column coated with octakis(6-O-methyl-2,3-di-O-pentyl)- γ -cyclodextrin (König *et al.* 1990) at 75°C with hydrogen as carrier gas at 0.5 bar inlet pressure and using a flame ionization detector.

Racemic 2-methyl-1-hexanol was prepared from allyl alcohol (3.63 g) TMEDA (0.58 g) and butyl lithium (8.0 g) in hexane at 0°C by the method of Crandall and Rojas (1976) to give (\pm)-2-methyl-1-hexanol (bp. 156°C, IR, liquid film, 3350 cm (OH, broad), 1040 cm⁻¹

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