$MBH^{-1} \cdot min^{-1}$). Peripheral injection of NSD-1015 in a dose range of 100–200 $mg \cdot kg^{-1}$ has also been shown to inhibit 5-HT oxidative-deamination as well as 5-HTP decarboxylation [17–19]. This results in a linear increase in 5-HTP and a linear decrease in 5-HIAA while 5-HT levels remain unchanged (i.e., 'steady-state levels'). Thus, an obvious advantage in using a drug like NSD-1015, which inhibits both 5-HT synthesis and catabolism, to estimate 5-HT turnover rates is the avoidance of possible feedback effects on the rate of 5-HT synthesis.

Our results also demonstrated decreased rates of 5-HT catabolism nocturnally. The rate of decline in 5-HIAA levels following pargyline administration is often used as a measure of 5-HT synthesis[20]. In our study, the estimated rates of 5-HT oxidative-deamination in NSD-1015 and pargyline treated rats were not significantly different either diurnally or nocturnally, suggesting that treatment with NSD-1015 inhibited 5-HT oxidative-deamination to a degree comparable with that due to treatment with pargyline. The discrepancies among regression coefficients obtained from the rise in 5-HTP levels and the decline in 5-HIAA levels after treatment with NSD-1015 could be explained by the existence of multiple pools of 5-HT with different turnover rates[21].

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Thiarubrine A, a bioactive constituent of *Aspilia* (Asteraceae) consumed by wild chimpanzees

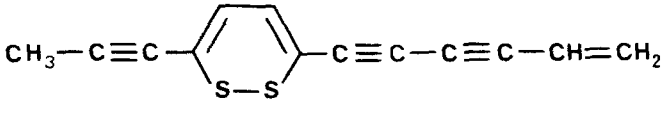
E. Rodriguez, M. Aregullin, T. Nishida, S. Uehara, R. Wrangham, Z. Abramowski, A. Finlayson and G.H.N. Towers

Phytochemical Laboratory, Department of Ecology and Biology, University of California, Irvine (California 92717, USA), Department of Anthropology, University of Tokyo, Tokyo (Japan), Sapporo University (Japan), Department of Anthropology, University of Michigan, Ann Arbor (Michigan 48109, USA), and Department of Botany, University of British Columbia, Vancouver (British Columbia V6T2B1, Canada), 20 September 1984

Summary. Two African species of *Aspilia* (Asteraceae), which are used medicinally by man and which are eaten by wild chimpanzees in an unusual manner, were found to contain the potent antibiotic thiarubrine A as a major leaf phytochemical. Its presence in leaf material strengthens the view that the feeding behavior of wild chimpanzees is related to special physiological or pharmacological effects on the animals.
Key words. Aspilia; chimpanzees, feeding behavior; thiarubrine A.

In various parts of Africa, numerous species of the genus *Aspilia* (Heliantheae, Asteraceae) are used for medicinal purposes[2]. For example, extracts of the root of *A. holstii* are prepared by the Shambala people for the relief of lumbago, sciatica and neuralgia[2]. The leaves of *Aspilia africana* from Nigeria, Cameroon and Ghana are used to clean sores, relieve stomach troubles, as a cough medicine, and in some cases, to remove corneal opacities[3]. More recently, Wrangham and Nishida[4] reported that wild chimpanzees *(Pan troglodytes)* selectively pick and swallow entire leaves of *A. mossambicensis* Oliv., *A. pluriseta* O. Hoffm., and *A. rudis* Oliv. without chewing them. This unusual feeding behavior by chimpanzees suggested to Wrangham and Nishida that the apes consume the leaves for some special pharmacological effects[4]. Janzen[5] has presented circumstantial evidence suggesting that certain mammals eat plants for their medicinal properties instead of for nutritional content. Ent-kaurenic diterpenoid acids have been reported from South American species of *Aspilia*[6] and an acetylenic compound has been identified in *A. montevidensis*[7]. There appear to be no phytochemical reports on African species of *Aspilia.*

Dried leaves of *Aspilia mossambicensis* from Mahale National Park and *A. pluriseta* from Kenya were finely ground and extracted with chloroform and taken to dryness in vacuo. The residue was dissolved in methanol and chromatographed in a Sephadex LH-20 column. Mass spectral analysis of a red oil



THIARUBRINE-A

obtained in one fraction exhibited a mol.wt of 228 with an m/e at 119 for $H_2O{=}CH{-}(C{\equiv}C)_2{-}C^{\oplus}{-}S$. NMR and IR spectral analysis and comparison with an authentic sample of thiarubrine-A established the structure of the oil as 1-(2-methyleth-1-yn)-4-(hex-1,3-diyn-4-ene)-2,3-dithiacyclohex-1,3 diene (I)[8,9], previously isolated and identified from *Iva*[7], *Ambrosia*[7], *Schkuhria*[7], *Palafoxia*[7], *Eriophyllum*[9] and *Chaenactis*[9]. Although many species of the Asteraceae are used for a variety of medicinal purposes, the Okanagan-Colville Indians of British Columbia, Canada and Washington, USA, used *Chaenactis douglassi* var. *achilleaefolia* which contain thiarubrine A to treat wound infections and sores and as an eyewash[10].

Thiarubrine A has been found to be as effective as the strong photosensitizer, α-terthienyl[11] against *Candida albicans, Staphylococcus albus, Mycobacterium phlei, Bacillus subtilis, Streptococcus faecalis* and *E. coli* either in UV-A or in light in the range of 0.1–1.0 ppm[8]. It is as effective against *Candida albicans* as fungizone at a concentration of 1 ppm in dark or 0.1 ppm in light. At 10 ppm it causes 100% mortality in the free living nematode *Coenorhabtidis elegans*. It is also toxic to Chinese hamster ovary cells at 4 ppm in dark and phototoxic at 0.25 ppm[11]. It is therefore a potent biocidal agent. A rough estimate of the amount in a single leaf would be 5 mg, which would be the amount ingested by a chimpanzee per diem. The compound is unstable under acidic conditions, being converted to the corresponding thiophene[9]. Its metabolic fate in the GI tract of the chimpanzee is therefore of interest.

The medicinal use of species of *Aspilia* by Africans to cure sores and other skin infections would appear to make sense since thiarubrine A is such a strong antibiotic. *Aspilia mossambicensis* has been used in east Africa for the treatment of abdominal pains and intestinal worms, including hookworm[12]. Wild chimpanzees harbor many of the nematodes, trematodes and protozoans common to man[13,14]. Whether thiarubrine A is an effective oral antibiotic or anthelmintic awaits further investigation.

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Chemical attraction of the eastern yellowjacket, *Vespula maculifrons* (Hymenoptera: Vespidae)[1]

J.R. Aldrich, J.P. Kochansky and J.D. Sexton

USDA-ARS, Insect Physiology Laboratory, Building.467, BARC-East, Beltsville (Maryland 20705, USA), 27 March 1984

Summary. Workers and queens of the eastern yellowjacket, *Vespula maculifrons*, are attracted to the artificial long-range attractant pheromone of the predaceous pentatomid, *Podisus maculiventris*. A 1:1 mixture of linalool or α-terpineol and *(E)*-2-hexenal is as attractive to *V. maculifrons* workers as the pheromone.
Key words. Yellowjacket, eastern; *Vespula maculifrons;* attraction, chemical; pheromone, attractant; *Podisus maculiventris.*

Heptyl butyrate, 2,4-hexadienyl butyrate and a variety of similar esters are potent and specific attractants for *Vespula pensylvanica* and other yellowjackets in the western United States[2,3], but these attractants are ineffective for eastern yellowjackets[4,5]. While field-testing a synthetic aggregation pheromone for the predaceous spined soldier bug, *Podisus maculiventris* (Hemiptera: Pentatomidae), we noticed that pheromone-baited traps caught many more *Vespula* spp. than unbaited traps. Components of the *P. maculiventris* aggregation pheromone[6] were field-tested singly and in pairs to determine which compounds are attractive to yellowjackets.

Methods and materials. Components of the *P. maculiventris* aggregation pheromone (indicated by an asterisk in the table) and the other compounds tested were purchased from Aldrich Chemical Co. (Milwaukee, WI) or Bedoukian Research Inc. (Danbury, CN) except the enantiomers of α-terpineol and *(E)*-2-hexenyl crotonate. (+)-α-Terpineol and (−)-α-terpineol were synthesized from (+)-α-pinene (Aldrich Chem.) and (−)-α-pinene (Tridom Chem., Hauppauge, NY)[7]. *(E)*-2-Hexenyl crotonate was synthesized from *(E)*-2-hexenol and crotonic acid by standard methods.

Field-tests for yellowjacket attraction were conducted in and around deciduous woods at the Agricultural Research Center-East, Beltsville, Maryland, during 1982 and 1983. Sticky wing traps (Zoecon Corp, Palo Alto, CA) were used and baited daily with 10 µl of the neat compound(s) applied to a 5 × 9 rubber septum (Thomas Scientific, Philadelphia, PA) in the bottom of the trap (1982 experiment) or baited every four days with 350 mg of a 20% (W/W) formulation of the compounds in plasticized polyvinyl chloride (PVC) (Tenneco, Piscataway,