ARBORINE AND METHAQUALONE ARE NOT SEDATIVE IN THE WOLF SPIDER *LYCOSA CERATIOLA* GERTSCH AND WALLACE

Glomerin and homoglomerin, two quinazolinone alkaloids in the defensive secretion of the pill milliped, *Glomeris marginata,* produce delayed sedation of prolonged duration in wolf spiders (*Lycosa* spp.). The compounds are sedative at small doses (1-7 μg per spider), representing but a fraction of the total secretory output of a medium sized milliped (Carrel and Eisner 1984). Glomerin and homoglomerin are structurally related to arborine, a plant natural product, and to methaqualone, a synthetic drug. Both arborine and methaqualone are sedative to vertebrates (Dey and Chatterjee 1967, Inaba et al. 1973), which suggests that they might also be sedative to spiders. We here present evidence indicating that this hypothesis is incorrect, since neither arborine nor methaqualone given in large doses produced sedation (= hypnosis) in the wolf spider, *Lycosa ceratiola* Gertsch and Wallace.

Arborine, also known as glycosine, was synthesized using the procedure described by Kametani et al. (1977). Chromatography of the reactant residue on a silica gel column eluted with ethylacetate-ethanol (4:1, v/v) yielded pure arborine, whose melting point and UV, IR, NMR, and mass spectral data were identical with published values (Chakravarti et al. 1961, Kametani et al. 1977). Methaqualone hydrochloride (Parest-200®, Parke-Davis and Co., Detroit, Michigan) was locally purchased. Dosages of methaqualone were calculated as the HCl-free base (0.875 times the weight of the methaqualone-HCl).

Lycosa ceratiola, stemming from the same population at the Archbold Biological Station near Lake Placid, Florida, as those used to test glomerin and homoglomerin, were maintained as described by Carrel and Eisner (1984). As before, spiders were of relatively uniform body size ($\bar{x} \pm$ S.E.M.; body mass = 344 ± 13 mg).

The sedative potencies of arborine and methaqualone in spiders were measured by injection. In these tests (N = 140, including 20 controls), essentially the same as in those for glomerin and homoglomerin (Carrel and Eisner 1984), injection (5 μl) was accomplished with a micrometer-activated syringe into the abdomen of the spider. Arborine and methaqualone as sonified suspensions were injected at six dosages (N = 10 spiders per dosage) in the range of 1-50 μg per spider. Spider saline (Rathmayer 1965) containing 1% (w/v) methylcellulose was used as sample carrier and was itself tested as the control. Spiders were checked for sedation at 4, 12, 24, and 48 hours after injection. The criterion for sedation, as in earlier tests, was the spider's inability to right itself promptly when flipped on its back with a curved glass rod.

None of the *L. ceratiola* became sedated and none died within 48 hours after injection of 1-50 μg of arborine or methaqualone. Control spiders also showed no behavioral abnormalities. Maximum doses of either compound used in our study ($\sim$ 150 mg/kg spider body weight) were large compared with doses of these compounds that are sedative/ hypnotic in humans, mice, and rats (Gujral et al. 1955, Swift et al. 1960, Wheeler 1963, Dey and Chatterjee 1967, Mukherjee and Dey 1970, Hardtmann et al. 1971, Ochiai et al. 1972, American Medical Association 1980). Hence, the absence of sedation in wolf spiders treated with arborine or methaqualone definitely did not result from using dosages of the compounds below their established pharmacological ranges.

Our findings cannot be explained by a general insensitivity of spiders to sedative drugs. Phenobarbital (Luminal) and diazepam (Valium), two sedatives commonly used by humans, each in low doses (10-100 mg/kg) cause the cross-spider, *Araneus diadematus,* to curtail construction of its orb web (Reed and Witt 1968). Both phenobarbital and diazepam bear little structural resemblance to the quinazolinones we tested and preliminary evidence indicates that, at least in mammals, they act *via* different neurobiochemical mechanisms to depress the central nervous system (Mukherjee and Dey 1970, Smith 1977, Martin 1982). We think the ineffectiveness of some, but not all sedative drugs in spiders likely is explained by basic and as yet undescribed neurophysiological differences between spiders and mammals more than it is by the vagaries of various drug bioassays.

Our study confirms the long standing view of pharmacologists (Witt 1968, 1971) that spiders are imperfect substitutes for humans for the characterization of psychoactive drugs. Our findings also illustrate how little is known about the short and long term responses of spiders to pure substances, especially natural products contained in their prey. We suspect that many dietary chemicals may alter a spider's physiological state, causing changes—ranging from profound to subtle ones—in feeding, reproduction, or maintenance activities. The chemical ecology of spiders, an emerging field of study, is bound to be diverse and complex, perhaps rivaling that of herbivorous insects, about which so much has recently been written (Rosenthal and Janzen 1979, Harborne 1982).

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