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ISOBUTYRIC ACID FROM THE BRINDLEY'S GLANDS OF *TRIATOMA LECTICULARIA*

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ABSTRACT. The contents of the Brindley's gland of *Triatoma lecticularia* (Stål) (Heteroptera: Reduviidae: Triatominae) have been identified by gas chromatography–mass spectrometry as isobutyric acid. This compound is found in similar secretions from certain other members of the Triatominae, and is suggested to play a role as a defensive pheromone and for intraspecies communication.

KEY WORDS *Triatoma lecticularia,* Triatominae, Reduviidae, Brindley's glands, isobutyric acid

INTRODUCTION

Almost all Heteroptera are known to possess scent glands (Carayon 1971, Staddon 1986). The most prominent scent glands in members of the order of true bugs include lateral metathoracic glands and ventral abdominal glands (especially in adults) and dorsal abdominal glands (particularly in immatures, but also active in some adults) that produce a wide variety of compounds with allomonal and pheromonal properties (Blum 1981, Pasteels et al. 1983, Staddon 1986, Aldrich 1988). Individuals of *Triatoma lecticularia* (Stål), as well as other triatomine bugs, produce a pronounced rancid odor when disturbed, or when reared in colonies (Zimmerman 1948; Kälin and Barrett 1975; Ryckman, personal communication). The most conspicuous of the scent glands in many Reduviidae (assassin bugs) are Brindley's glands (Brindley 1930, Carayon et al. 1958, Kälin and Barrett 1975, Schofield and Upton 1978, Staddon 1979). Because of the distinctive odor produced by both individuals and colonies of *T. lecticularia,* a species widespread in Texas and the southeastern USA, and the fact that this species sometimes harbors *Trypanosoma cruzii* (Chagas) (Usinger 1944, Lent and Wygodzinsky 1979), the trypanosome responsible for Chagas disease, we investigated the Brindley's gland secretion of this species.

MATERIALS AND METHODS

Specimens of *T. lecticularia* were collected in wood rat (*Neotoma* spp.) nests, 33.5 km northeast of Alpine, Brewster County, TX, on the Strauss Ranch, January 14, 1987, by D. S. Seigler, J. Richerson, and J. Zubia. Adults and various nymphal stages were maintained in cages by feeding once weekly on mice until study was feasible.

Brindley's glands were removed from adult insects by dissection in 0.9% saline solution. The glands were ruptured under a dissecting scope with the needle of a 10-µl syringe and the liberated liquid was taken up and injected directly onto a coupled Hewlett Packard (HP) 5995 gas chromatograph–mass spectrometer (GC-MS) (Hewlett Packard, Rolling Meadows, IL) (electron impact, 70 eV) interfaced with an HP 59970A GC-MS computer system with a National Bureau of Standards mass spectral library containing spectra of more than 38,000 compounds. The column was a fused silica capillary column (10 m × 0.3 mm) with a cross-linked methyl silicone phase (Hewlett Packard) and helium carrier gas. The temperature program was 35°C to 160°C at 10°C/min with a 2-min hold at the starting temperature. The injection port, transfer line, and ion source were set at 230°C, 200°C, and 220°C, respectively. Authentic isobutyric acid was purchased from Aldrich Chemical Co. (Milwaukee, WI) and injected under the same conditions on the GC-MS.

RESULTS AND DISCUSSION

The mass spectrum of the only low molecular weight peak observed in gas chromatographic separations of the gland contents had major ion peaks at the mass-to-charge ratios (*m/e*) 88, 73, 57, 55, 45, 43, 42, 41, and 39, which are consistent with those of isobutyric acid. A standard of this compound exhibited the same retention time, peak shape, and fragmentation pattern. Based on the total ion current chromatogram, isobutyric acid comprises more than 99% of the volatile components of the Brindley's glands.

Isobutyric acid seems to be the typical secretion identified from the Brindley's glands of Triatominae (Schofield and Upton 1978). In addition to *T. lecticularia,* this compound also has been isolated from the Brindley's glands of *Rhodnius prolixus* (Stål) (Pattenden and Staddon 1972, Games et al. 1974), *Panstrongylus megistus* (Burmeister), *Triatoma phyllosoma* (Burmeister) (Games et al. 1974), *T. infestans* (Klug), *T. maculata* (Erichson), *T. brasiliensis* Neiva, and *T. vitticeps* (Stål) (Schofield 1979). Isobutyric acid previously also has been isolated from the secretions of larvae of *Papilio machaon,* the European swallowtail butterfly (Eisner and Meinwald 1965, Seligman and Doy 1973), as well as other swallowtail butterflies (Eis-

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ner et al. 1970), carabid beetles (Schildknecht et al. 1968), and male noctuid moths (Aplin and Birch 1970). Both butyric and isobutyric acids are present in the metathoracic scent of broadheaded bugs (Alydidae) (Aldrich 1988).

This unpleasant-smelling substance probably serves as a predator repellent, but also has intraspecific function. Isobutyric acid is liberated by agitated live adults of *Triatoma infestans,* as well as other species (Lopez et al. 1995). When tested in an olfactometer, bugs avoided the presence of isobutyric acid with a response that involved both klinotactic and orthokinetic components (Ward 1981). However, the avoidance response showed a marked dimunition at high concentrations, suggesting saturation of receptors. Whether isobutyric acid has defensive or pheromonal activity is presently under investigation. The involvement of exocrine secretions in triatomine behavior could play a role in the biological control of this important group of insects.

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