2,3-PENTANEDIONE AS AN ATTRACTANT FOR *HIPPELATES* (DIPTERA:CHLOROPIDAE)[1]

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The use of various complex proteinaceous materials as attractants for *Hippelates* species has been well documented over the past 35 years by Parman (1932), Burgess (1935, 1951), Dow (1959), Mulla *et al.* (1960a, 1960b), Dorner and Mulla (1962), and Axtell (1967, pers. comm.). However, little information is available on the actual attractant principals which are involved. The advantage of a unimolecular chemical attractant for members of this group is obvious. A specific attractant may be formulated with an insecticide or chemosterilant and be utilized in both a control program and to determine the presence or population density of the species of *Hippelates* concerned.

Decaying proteinaceous baits are normally difficult to standardize, unsavory to work with and leave much to be desired when mixed with insecticides or chemosterilants. According to Hall *et al.* (1957), there are commonly two approaches employed in searching for an insect attractant: the empirical approach, whereby a large number of chemicals are screened to obtain a clue as to a possible attractant or the classical approach which involves the isolation, identification, and synthesis of the natural occurring attractant compounds. Research described in the present study represents a modification of the former or empirical approach.

Studies were made of various feeding niches and the attractants associated with the niches of adult *Hippelates* in Georgia during the 1967 gnat season. These studies indicated that some attractants are commonly shared by many species while other attractants are relatively species specific. For example, collections of gnats from cattle revealed that natural secretions from their eyes and nasal areas commonly attracted large numbers of *H. pusio* Lw. whereas the blood and various exudates from flesh wounds were especially attractive to *H. pallipes* (Lw.) and two undescribed *Hippelates* species.

Large numbers of two pestiferous species (*H. pusio* and *H. pallipes*) and a species not considered pestiferous (*H. bishoppi* Sabr.) were attracted to decaying proteinaceous materials such as liver, fish, and eggs. Droplets of milk on cow teats and adjacent body areas were attractive to *H. bishoppi* and *H. dissidens* (Tuck.), two species normally not considered pestiferous or commonly associated with mammals. Saunders (1940) observed the attractiveness of fresh milk to *Hippelates* and implicated these gnats in the transmission of pathogenic microorganisms responsible for mastitis in cattle. Since there is no apparent proteinaceous decay in fresh milk, it would appear that other types of compounds in milk may be attractive to the gnats. Studies by Forss *et al.* (1960) indicated cream contains many volatile carbonyl compounds.

From these observations it is obvious that some species have rather selective feeding niches while the niches of others are rather broad. With this evidence of the diversity of feeding niches, a search was initiated in order to determine if a specific unimolecular chemical compound may be present in the various attractant media frequented by *Hippelates*.

Because of the fact that fresh milk, a source of many volatile carbonyl compounds, (Forss *et al,* 1960) is attractive to many species of *Hippelates,* a series of

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purified carbonyl compounds was evaluated as potential attractants for gnats. Sixty aldehydes and ketones were selected for studies on their attractiveness to members of the genus *Hippelates*. Compounds were selected with particular emphasis on those with low boiling points, relatively low molecular weights and containing unsaturation. Each compound was dispensed by dipping a sterile Q-tip cotton swab in the candidate material and placing it in the prospective trap. The cotton tips retained about 0.2 ml each of the compound being tested.

Of the carbonyl compounds tested, only 2,3-pentanedione[2] was attractive to members of the genus *Hippelates*. This is the first known report of a specific unimolecular attractant compound for members of this genus. To prevent contamination of the collection containers, a disposable trap was designed (Fig. 1) utilizing 6 oz. paper cups. The bottom was removed from each cup and a 3″ x 5″ index card stapled inside. A 3″ x 3″ area of the card was coated with Stickem.

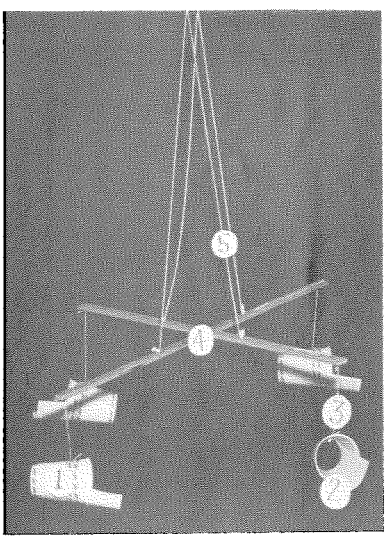

FIG. 1.—(1) 6 oz. No. 67 Dixie Cup; (2) 3″ x 5″ index cord; (3) 6 ply cotton cord [4″]; (4) cross-piece of pine strips [24″ x ¼″ x ¾″]; (5) 12 ply cotton cord [24″].

All attractant tests were conducted in open uncultivated land near Griffin, Georgia. In 28 tests, 0.2 ml of 2,3-pentanedione exposed for 48 hours caught a maximum of 442 *Hippelates* per cup (Table 1). Subsequent tests utilizing square foot sections of brown cardboard coated with Stickem and baited with two quantities of 2,3-pentanedione on 1 cm lengths of cotton dental roll, caught a maximum of 21,004 *Hippelates* per ft² panel (Table 2).

2,3-Pentanedione is apparently more attractive to *H. dissidens* than to other species, as random samples of trapped specimens revealed over 95 percent were *H. dissidens* while less than 5 percent were other species, primarily *H. bishoppi, H. pusio* and *H. pallipes*. This compound is assumed to be an assembly or feeding attractant since the sex ratio of trapped specimens of *H. dissidens* was approximately 60 percent female and 40 percent male. Although *H. dissidens* is not considered pestiferous, the discovery of an attractant for this species could lead to the isolation of specific attractants for closely related or pestiferous species. The apparent cross-attractiveness of this compound for other members of the genus is not a unique phenomenon. The cross-attractancy of compounds to closely related species is well-known, e.g., Howlett (1915) found the fruit fly *Dacus dorsalis* was strongly attracted to both methyl eugenol and iso-eugenol while *D. zonatus* was attracted to methyl eugenol and *D. diversus* was more strongly attracted to iso-eugenol.

The attractiveness to *Hippelates* species of compounds structurally related to 2,3-pentanedione is now being investigated.

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[2] Gas chromatographic analysis demonstrated that the purity of the 2,3-pentanedione exceeded 95 percent.

TABLE 1.—Number of *Hippelates* taken per cup baited with 0.2 ml of 2,3-pentanedione.

Date	Number of cups	Number of gnats caught		
		Check	Average	Range
October 12–14	4	0	203	135–253
October 16–18	6	0	100	42–184
October 23–25	18	0	88	34–442

TABLE 2.—Number of *Hippelates* taken October 26–28 on ft^2 panels baited with 2,3-pentanedione.

Quantity of attractant	No. ft^2 panels	Number of gnats caught	
		Average	Range
0.0 ml	4	17	13–23
0.2 ml	4	1,973	1,930–2,543
1.0 ml	4	12,158	2,149–21,004

of the attractant and for many helpful suggestions.

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