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Chemical analysis of secretion from the abdominal scent glands of *Chrysocoris purpureus* (Heteroptera: Pentatomidae)

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Abstract. The chemical analysis of the abdominal scent glands of *Chrysocoris purpureus* Westw. showed the presence of *trans* hex-2-enal, n-dodecane, *trans* hex-2-enyl butyrate and n-octyl acetate. The scent components are metabolically synthesized within the cells of exocrine glands of bugs and are used as defensive in nature. They do not show any correlation with the secondary metabolites of the host plant.

Keywords. Scent glands; *Chrysocoris purpureus*; aliphatic compounds; secondary metabolites; defensive.

1. Introduction

Certain heteropteran bugs on being disturbed, discharge an offensive odour from the scent glands. These glands are situated ventrally in the metathorax of adults and dorsally in the abdomen of nymphs. Morphology and functional anatomy of the scent glands of pentatomid bugs have been studied and the chemical analysis of the secretions of these glands showed saturated and unsaturated compounds (Remold 1963). Many authors have studied the abdominal scent glands of various bugs (Stein 1967; Levinson *et al* 1974; Aldrich *et al* 1972) and their secretions have been identified (Waterhouse and Gilby 1964; Baggini *et al* 1966; Staddon and Olagbemiro 1984; Janaiah *et al* 1979; Leela Kumari *et al* 1984). The chemicals employed by insects to repel predators would be either synthesized by the insects (Meinwald *et al* 1966; Happ *et al* 1966) or sequestered all or half part in host plants (Rothschild 1970; Rothschild *et al* 1970). The present communication deals with the chemical analysis of abdominal scent glands of *Chrysocoris purpureus* and an attempt has been made to correlate the secondary metabolites of the host plant and the components of the scent.

2. Materials and methods

The nymphs of *C. purpureus* Westw. were collected from *Croton sparsiflorus* Morong (Fam. Euphorbiaceae) near the University campus. The nymphs were maintained in the laboratory, on the host plant leaves at room temperature for one or two weeks. The secretion was collected from the abdominal scent glands of 50 bugs inserting microcapillaries against the openings of abdominal glands. The collected scent was injected into gas-liquid chromatography (GLC) and comparison was made with the authentic samples.

2.1 *GLC*

Hewlett Packard 5840-A gas chromatograph was equipped with thermal conducti-

vity detector. Nitrogen as a carrier gas was introduced at 45 ml/min (2·6 kg/ regulator) stationary phase 6 ft × 1/s; packed with 5% silicon (SE)—30 chromosorb P (40–60) mesh at an oven temperature of 100–200°C programming at 5°/min.

The samples (unknown) of 1·5–6 μl were injected at sensitivity 2 and in case of reference (authentic) compounds (ICN K and K Laboratories, New York) 1 μl was injected at sensitivity 16. The scent liquid of *C. purpureus* was dissolved in chloroform and used.

2.2 *Extraction of secondary metabolites from host plant*

The presence of secondary metabolites from leaves and inflorescence of *C. sparsiflorus* were determined by alkaloid test.

The green leaves and inflorescence of *C. sparsiflorus* were collected and dried in the shade and fully dried leaves and inflorescence were powdered. 20 g of the powder was weighed and packed in the filter paper and extracted in a Soxhlet with petroleum-ether (BP 60–80°C), benzene, acetone and alcohol in succession. The extracts were concentrated and the residue dried in a vacuum dessicator.

2.3 *Alkaloid test*

The methanolic solution of the alcohol extract with the help of capillary was applied to the silica gel TLC plate and developed in the chloroform: methnol (9 : 1 v/v) solvent in a chromatographic tank. The plate was allowed to dry and it was sprayed with Dragendorff 's reagent modified according to Munier (1953). Formation of red-magenta coloured spots indicated the presence of a number of alkaloids in the plant extract.

3. Results

The identification of the scent components was mainly by the comparison with the known standard samples on the GLC. Authentic samples were used for comparison. A study of their retention times (R_t) revealed their identity (table 1). A perusal of table 2 and figure 1 showed the following components.

Peak 1. The peak with a R_t 2·25 min corresponded to *trans* hex-2-enal.

Peak 2. The peak which had a R_t 2·50 min corresponded to n-dodecane.

Peak 3. The component with the R_t 6·25 min corresponded to *trans* hex-2-enyl butyrate.

Peak 4. The compound which had a R_t 7·30 min corresponded to n-octyl acetate.

3.1 *Secondary metabolites*

The presence of secondary metabolites from host plant, *C. sparsiflorus* were determined by alkaloid test. A number of alkaloid spots were detected (figure 2) after spraying them with Dragendorff 's reagent.

Table 1. Some authentic samples with retention time on GLC (under standard conditions).

Component	R_t (min)
n-Butyl butyrate	2·0
Hexenal	2·10
n-Hexyl acetate	2·15
Trans hex-2-enal	2·25
n-Dodecane	2·50
n-Hexanol	6·0
Trans hex-2-enyl butyrate	6·25
n-Pentadecane	6·45
Trans hex-2-enyl acetate	7·0
n-Octyl acetate	7·30
Trans oct-2-enal	8·04

Table 2. Composition of scent from the abdominal scent glands of *C. purpureus* (nymph).

Peak number	R_t (min)	Components
1	2·25	*Trans* hex-2-enal
2	2·50	n-Dodecane
3	6·25	*Trans* hex-2-enyl butyrate
4	7·30	n-Octyl acetate

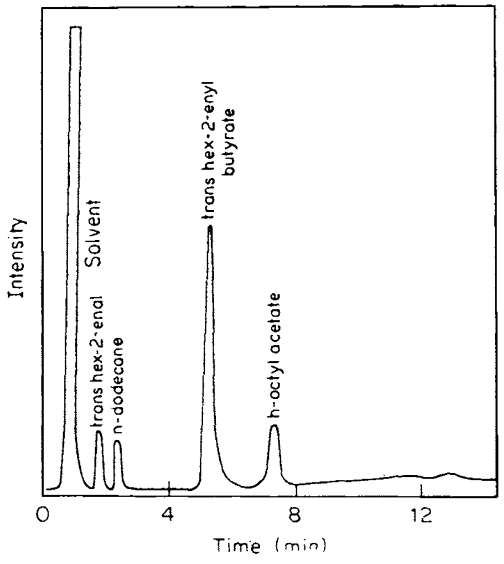

Figure 1. Gas-chromatographic separation of abdominal scent glands secretion of the nymph, *C. purpureus*.

4. Discussion

Table 2 shows the aliphatic compounds from the secretions of the abdominal scent

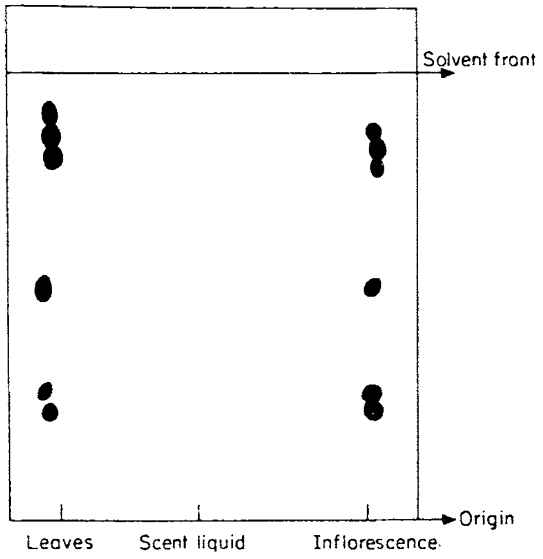

Figure 2. TLC separation of alkaloids from the host plant, *C. sparsiflorus* (chloroform: methanol—9:1—temp. 38°C).

glands of *C. purpureus*. In general, the unsaturated aliphatic aldehydes and some hydrocarbons have been identified from the secretions of dorsal abdominal scent glands of some members of Heteroptera (Baggini *et al* 1966; Games and Staddon 1973; Baker and Jones 1969). The function of the scent in a majority of insects has not been properly investigated. It was observed that the abdominal scent glands of nymphs of *C. purpureus* yielded 4 components. One of them was shown to be *trans* hex-2-enal which was a common occurrence in nymphs and adults and had an alarm effect to both larvae and adults (Calam and Youdeowei 1968) or non-species-specific alarm effect against the larvae of pentatomid (Ishiwatari 1974). *Trans* hex-2-enyl acetate was found in the abdominal scent glands of the male water bug *Belostoma indica* (Butenandt and Tam 1957) and thought to be a sex-attractant. The nymphs of coreid bugs showed n-octyl acetate and n-dodecane (Aldrich *et al* 1976). The scent from the stink glands of adult *C. purpureus* has also got a defensive property in it. When it fell on the skin it formed blisters with itching in addition to paralyzing small insects (Leela Kumari *et al* 1984).

C. purpureus was found on young leaves and inflorescence and drew its sap from the host plant, *C. sparsiflorus*. The secondary metabolites of this host plant showed the presence of 6 alkaloids. Though the insects sucked their sap from this host plant, no alkaloid was detected in the cells of the scent glands. In this respect, *C. purpureus* differs from certain other insect species such as *Dysdercus plexippus* (Brower *et al* 1968; Brower 1969) and *Oncopeltus fasciatus* (Singh and Rastogi 1970) both of which were found to sequester chemicals present in their stink glands from their host plants during feeding.

Thus it is clear that the chemical composition of the scent of *C. purpureus* metabolically synthesized by the exocrine glandular cells is quite different from that of its host plants and the scent liquid is used as a defensive secretion against predators in nature.

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