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Extraction and Identification of the Main Compound Present in *Elaeis Guineensis* Flower Volatiles

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ABSTRAK

*Komponen utama di dalam minyak meruap daripada bunga kelapa sawit telah dikenalpasti sebagai 1-metoksi-4(2-propenyl)benzena atau estragole. Sebatian yang sama telah diekstrak daripada bunga jantan dan betina yang sedang mengalami antesis daripada tumbuhan kelapa sawit (*Elaeis *guineensis). Sebatian ini dipercayai bertanggungjawab menarik kumbang dewasa* Elaeidobius kemerunicus *Faust (Coloeptera: Curculionidae) yang mendebunga kelapa sawit. Penyulingan wap ke atas 1 kg bunga jantan dan bunga betina menghasilkan 0.7g dan 0.2g minyak meruap. Struktur kimia telah pun disahkan dengan analisis spektrometer jisim, resonans magnet nukleus dan spektrum inframerah. Kemungkinan kegunaan sebatian di dalam kajilidikan ekologi kumbang dan industri juga dibincangkan.*

ABSTRACT

The main compound contained in the volatile oils of the oil palm flowers was identified as 1-methoxy-4 (2-propenyl) benzene or estragole. The same compound was extracted from the anthesizing male and female flowers of the oil palm (Elaeis guineensis). *The newly identified compound is believed to bė responsible for attracting the adults of the oil palm pollinating weevil,* Elaeidobius kemerunicus *(Coleoptera: Curculionidae). Steam distillation of 1 kg of fresh male and female flowers yielded 0.7g and 0.2g of volatile oils. The chemical structure and characteristics were confirmed by mass spectromeric analysis, nuclear magnetic resonance (NMR) analysis, and the infrared spectra analysis. The possible usage of the compound in ecological research on the weevil and in the industry are discussed.*

INTRODUCTION

In Malaysia, the oil palm has replaced rubber as the nation's third largest foreign exchange earner (Khor, 1983). One of the factors which contributed significantly to higher crude palm oil production in 1982 was the better pollination and increased fruit set brought by the pollinating weevil, *Elaeidobius kamerunicus* Faust (Coleoptera: Curculionidae). The weevil was imported from Cameroon, Africa and was introduced into oil palm estates in Malaysia in February 1981 (Basri *et al.*, 1983). In order to keep a constant surveilllance and to understand more about its biology and behaviour, survey and research on the insect were initiated and intensified by the various research institutions and universities in the country. It is generally accepted that the weevil's pollination efficiency depends very much on its ability to transfer

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pollens while visiting both the male and female oil palm flowers during anthesis. The anise-like odour emitted by the anthesizing flowers is believed to attract the adult weevils (Syed, 1979). However, the volatile chemical involved in the weevil attraction has not been isolated and identified. This paper reports on the research done on the isolation and characterization of the floral volatile extracted from both male and female oil palm flowers.

MATERIALS AND METHODS

The Plant Material

Anthesizing male and female oil palm inflorescences were obtained from palms (Dura X Pisifera) planted at Universiti Pertanian Malaysia oil plam plantation at Serdang, Selangor. The palms were of 8 – 10 years old. Spikelets of male flowers which were at the 50% anthesis stage were collected and used for the extraction. For the female flowers, spikelets bearing the flowers which were receptive were used in this study. For convenience, flowers were collected in the field and placed in plastic bags between 0900 – 1100 hours.

In the laboratory, pollens were thoroughly shaken off the male spikelets before cutting the spikelets into smaller sections (3 cm long) and used for extraction purposes. For the female flowers, sections of the spikelete bearing 2 or 3 receptive florets were obtained and used directly after collection.

Extraction of Volatile Oils

Oils of the flowers were extracted using a continous steam extraction method with petroleum ether (40 – 60°C) as the solvent. The extraction was carried out for four hours after which the solvent was collected. Upon evaporation of the solvent, a yellowish oil was collected. Chromatographic filteration of the oil (using silica gel as a thin layer, sigma and petroleum ether as solvent) yielded a colourless oil which was later analysed.

Analysis of Volatile Extracts

The volatile extracts obtained were analysed using chromatography Tracor 560 using carbowax SEI capillary column as the stationary and helium as the carrier gas. Clear magnetic resonance (NMR) spectrometric analysis was carried out on the volatile extracts using Varion EM 60L NMR spectrometer. The chemical shifts were recorded in units using tetramethylsilane (0.00 ppm) as internal standard. Carbon tetrachloride (CCl_4) was used as the solvent. The infrared (IR) spectra were recorded on Beckman 4250 using 1601 cm^{-1} band of polystyrene for calibration. Mass spectrometric analysis was done using a AEI-MS12 mass spectrometer. The refractive index was measured on ABBE "60" refractrometer.

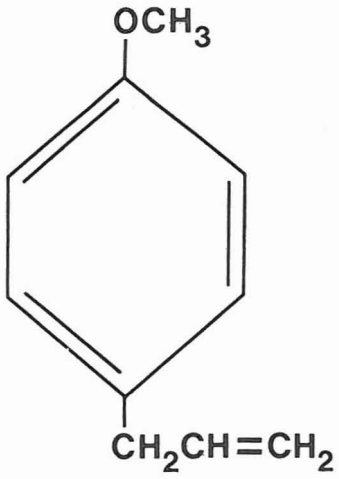
RESULTS

Steam distillation of 1 kg of the male flower yielded 0.7 g of volatile oils and 1 kg of female flowers gave only 0.2 g of volatile oils. The oils from both male and female flowers were collected after filteration of the crude extract through silica gel column. The filtered extracts contained more than 95% of a single component as shown in *Fig. 1.* The compound is a colourless oil which has $n^{27.5} = 1.5164$. Windholtz (1976) recorded $n^{17.5} = 1.5230$ for the same compound. The mass spectrum of this compound showed m/e (%) peaks at 148(100) for M^+, 133(22) for $M^+ - CH_3$ 121(40) for $M^+ - C_2H_3$, 117(34) for $M^+ - OCH_3$, 105(17) for $M^+ - C_3H_7$, 91(27) for $M^+ - (OCH_3 + C_2H_2)$ and 77(22) for $M - C_6H_5$.

The NMR spectrum of the oil have the absorptions at 7.11(2H, d – t, J = 9Hz, 3Hz) and 6.84(2H, d – 6, J = 9Hz, 3Hz) for ortho-para aromatic proton; 6.02(1H, t – t, J = 9Hz, 6Hz) for vinylic proton; 5.5(2H, d – m, J = 8Hz) for terminal vinylic proton; 3.75(3H, s) for methoxy protons and 3.31(br – d, J = 6Hz) for benzylic-allylic protons. NMR spectrum is consistent with the spectrum reported by Pouchert and Campbell (1974).

The infrared spectrum (Nacl, neat) further supports the presence of phenyl ring (3010, 3050, 1600 and 800 cm^{-1}); methyl ether (2910, 2810 and 1245 cm^{-1}) and the carbon-carbon double bond 1650, 985 and 900 cm^{-1}). The IR spectrum is also consistent with that reported by Pouchert (1970).

The data obtained in this study evidently suggests that the compound extracted from both male and female flowers is p-methoxyallyl-benzene (estragole) *Fig. 1)*. The identity of the main compound was further confirmed by comparing our data with those previously reported by others and spectra of authentic samples.



1-methoxy-4-(2-propenyl)benzene

Fig. 1. The structural formula of the main compound in the Volatile oils extracted from the male and female flowers of the oil palm.

DISCUSSION AND CONCLUSION

The main volatile oil (95%) present in the male and female oil palm flowers was 1-methoxy -4-(2-propenyl) benzene (or trivial name : estragole). The fact that the same compound is present in both the male and female flowers may explain why the adult *E. kamerunicus* is attracted to both sexes of flowers during anthesis by the anise-like odour emitted. The identification of the compound in the oil palm flowers made in this study represents the first attempt and report of the findings. The isolation of the attractant compound will open new avenues for future research on much improved methods of trapping and estimating the adult weevil population in oil palm plantations. The development of such methods using the compound as a lure will facilitate studies on the field dispersal and detection of the weevil presence on non-host plants.

Estragole also has a commercial value in that it is a useful ingredient in exalting certain aromatic qualities in perfumes (Arctender, 1969) as well as in the fruit canning industry. Since the percentage composition of the compound is very high, particularly in the male flowers, its extraction would be an attractive possibility for commercial production.

With regards to the weevil's attractancy towards the compound, Teo (1984) has demonstrated in the laboratory that both extracts of the male and female flowers were equally attractive. Research on isolation of volatile oils from the flowers of *Elaeis* X *Oliefera* hybrid oil palms is now underway. A small scale production of attractant is now possible for field testing which will be carried out soon.

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