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STRUCTURE AND ABSOLUTE CONFIGURATION OF TRICHOTOMINE

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As described in the preceeding paper[1], trichotomine was isolated from the deep blue fruits of Clerodendron trichotomum Thunb. We undertook an X-ray structure analysis of N,N'-di-(p-bromobenzoyl)trichotomine dimethyl ester (I) to determine the structure of trichotomine simultaneously with the chemical studies.

N,N'-di-(p-bromobenzoyl)trichotomine dimethyl ester, $C_{46}H_{30}N_4O_8Br_2$ (MW 926.6), m.p. 272-3°, was crystallized from ethyl acetate as deep blue needles, which were shown to be hexagonal with unit cell dimensions of a=17.737, c= 11.365 Å and belong to space group $P6_2$ or $P6_4$. The density measured by the flotation method using a mixture of n-hexane - carbon tetrachloride is 1.50 $g.cm^{-3}$, which agreed with the calculated value of 1.491 $g.cm^{-3}$ based on the presence of three molecules in a unit cell. Accordingly, there is half of a molecule in an asymmetric unit.

Lattice constants and intensities were measured at 5°C on a Hilger & Watts four-circle automatic diffractometer Y 290 with Ni-filtered Cu-Kα radiation. A total of 831 independent intensities more than $3\sigma(F)$ were collected in the range, $\theta<70°$. The crystal structure was solved by the heavy-atom method. Successive use of Fourier and difference Fourier syntheses coupled with least-squares calculations enabled us to assign the location of all the thirty atoms. Refinement of the structure parameters was carried out by the method of block-diagonal least-squares, in which anisotropic thermal parameters were allowed for each atom. The final R value was 7.06%. The absolute configuration of I was determined by the anomalous dispersion method and the R-factor test[2]. Dispersion corrections for the scattering factors of the bromine atom for Cu-Kα radiation were taken as $\Delta f'=-0.9$, $\Delta f''=1.5$. Intensities of 50 random Friedel pairs of reflections were measured on the diffractometer

using Cu-Kα radiation and they were compared with the calculated values. Next, structure factors were calculated after introducing the imaginary part Δf" of the scattering factor of bromine. R increased to 7.13% for Δf"=1.5, and decreased to 6.99% for Δf"=-1.5. These results showed that the correct absolute configuration was given by the atomic coordinates in a left-handed coordinate system.

The molecular structure determined by the present analysis is shown in Fig. 1-a. A ORTEP drawing[3] of the structure is given in Fig. 1-b, which shows the three-dimensional absolute structure of the molecule. The bond lengths and angles are shown in Fig. 2. Therefore, the structure of trichotomine can be shown Fig. 3. The absolute configuration of trichotomine agrees with that of L-tryptophan.

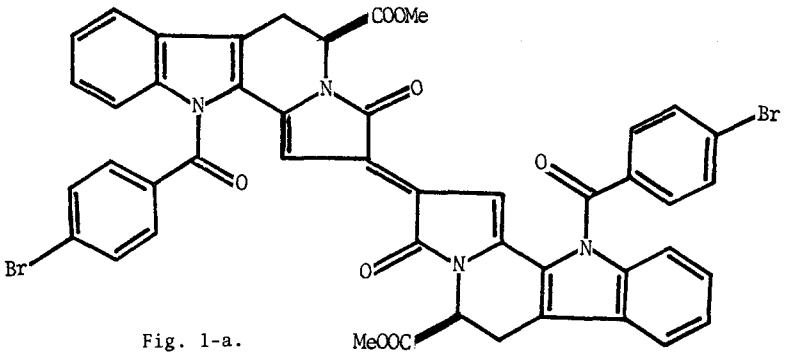

Fig. 1-a.

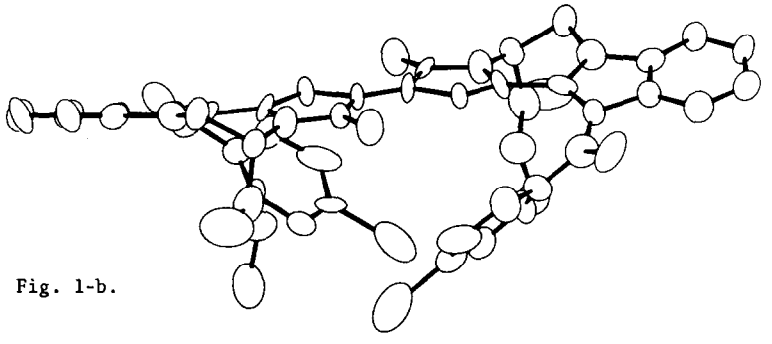

Fig. 1-b.

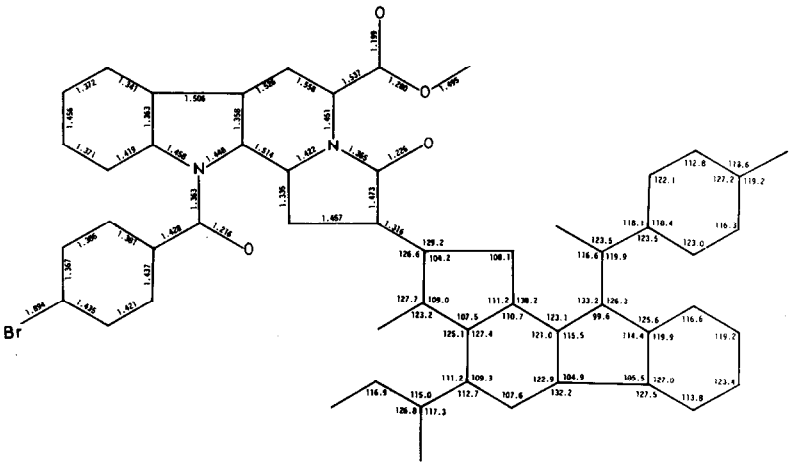

Fig. 2. Bond lengths (Å) and angles (°) of I.

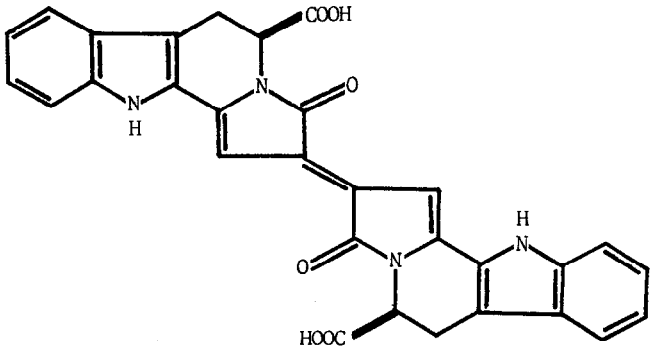

Fig. 3. The structure of trichotomine

The structure of the indole alkaloid derivative (I) is characterized by the conjugation of two indole moieties through three double bonds. The deep blue color of I can be due to this chromophore. However, these two indole moieties are not on a plane and the dihedral angle is 38.6°. On the other hand, the dihedral angle of the planes between an indole and

a benzene of p-bromobenzoyl group is 33.1° (see Fig. 1-b).

Detail of this study and the constitution of I will be given elsewhere. All computation were performed on a FACOM 230-60 at Nagoya University Computation Center using our programs.

REFERENCES

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2) W. C. Hamilton, Acta Cryst. 12, 609 (1959).

3) C. K. Johnson, ORTEP. Report ORNL-3794, Oak Ridge National Laboratory, Oak Ridge, Tennessee.