Acta Crystallographica Section E
**Structure Reports**
**Online**
ISSN 1600-5368

# 2,3-Dimethyl 5-isopropyl 1-ethoxymethyl-6-methyl-4-(3-nitrophenyl)-1,4-dihydropyridine-2,3,5-tricarboxylate

**Victor Vrabel,[a]* Drahomír Oktavec[a] and Štefan Marchalín[b]**

[a]Department of Analytical Chemistry, Faculty of Chemical Technology, Slovak Technical University, Radlinskeho 9, Bratislava 81237, Slovak Republic, and [b]Department of Organic Chemistry, Faculty of Chemical Technology, Slovak Technical University, Radlinskeho 9, Bratislava 81237, Slovak Republic

Correspondence e-mail: vrabel@cvt.stuba.sk

**Key indicators**

Single-crystal X-ray study
$T$ = 293 K
Mean $\sigma$(C–C) = 0.004 Å
$R$ factor = 0.059
$wR$ factor = 0.083
Data-to-parameter ratio = 17.6

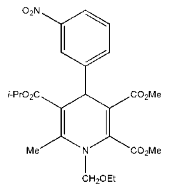
For details of how these key indicators were automatically derived from the article, see http://journals.iucr.org/e.

Received 30 January 2003
Accepted 6 February 2003
Online 14 February 2003

In the title compound, $C_{23}H_{28}N_2O_9$, the substituted 1,4-dihydropyridine ring has a flat-boat conformation. The dihedral angle between the mean planes of the 1,4-dihydropyridine and substituted phenyl rings is 88.10 (9)°. The 3-nitro substituent on the phenyl ring is rotated from coplanarity with the ring by only 3.2 (2)°.

## Comment

A number of 4-aryl-1,4-dihydropyridine derivatives have been prepared and tested for cardiovascular activity. Some have been found to possess potent vasodilating activity due to their calcium-blocking effect and are now undergoing clinical trials or therapeutic use for the treatment of cardiovascular diseases (Triggle *et al.*, 1980; Natale *et al.*, 1990; Goldmann *et al.*, 1990; Alajarin *et al.*, 1995).



(I)

X-ray studies on 1,4-dihydropyridines (1,4-DHPs) have shown a great dependence of the geometry of the skeleton on the attached substituents, especially those in the 4 position. An unsymmetrically substituted phenyldihydropyridine may be oriented in either of two minimum-energy conformations, with the substituent on the phenyl ring positioned either toward the C3 H atom (synperiplanar, *sp*) (Fossheim, 1985) or away from the C3 H atom (antiperiplanar, *ap*) (Rovnyak *et al.*, 1988). We have studied the crystal structure of 2,3-dimethyl 5-isopropyl 1-ethoxymethyl-6-methyl-4(3-nitrophenyl)-1,4-dihydropyridine-2,3,5-tricarboxylate, (I), and present its structure here.

The structure of (I) (Fig. 1) consists of discrete molecules. The shortest intermolecular contact is $N2\cdots O8^{i}$ of 3.111 (3) Å [symmetry code: (i) $-x+1$, $-y$, $-z+1$]. The 1,4-DHP ring has a flat-boat conformation with atoms N1 and C3 displaced by 0.157 (2) and 0.343 (2) Å, respectively, from the base of the boat. The sustituted phenyl ring is nearly planar and is approximately perpendicular to the least-squares plane of the 1,4-DHP ring. The ester groups, at positions 3 and 5, are twisted in the same direction, both having *cis,cis* geometry with respect to the ring double bonds. Both carbonyl groups are slightly rotated out of the plane defined by C1, C2, C3, C4, C5 [torsion angles: C1—C2—C11—O4 = −13.8 (4)° and C5—C4—C19—O8 = −5.0 (4)°].

DOI: 10.1107/S1600536803003015

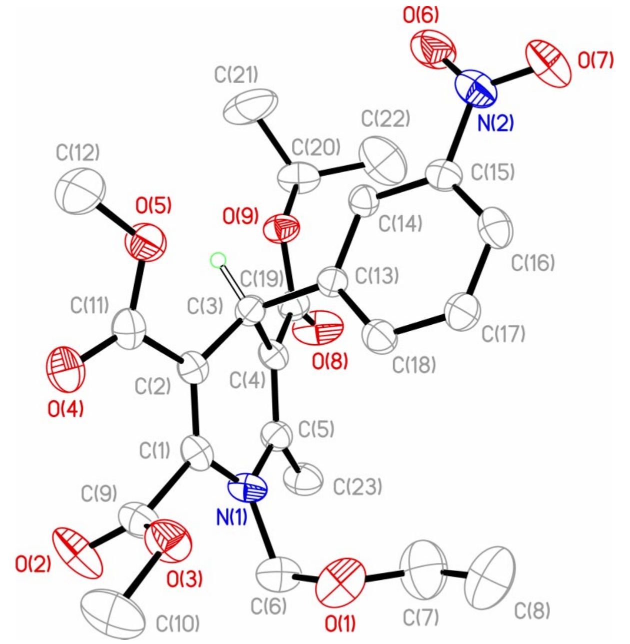


**Figure 1**
A view of (I), with the atomic numbering scheme. Displacement ellipsoids are drawn at the 30% probability level. H atoms are omitted.

## Experimental

The title compound was prepared according to known synthetic methods (Hantzsch, 1882) and recrystallized from ethanol solution. Slow evaporation of an ethanol solution yielded yellow block-shaped crystals.

*Crystal data*

$C_{23}H_{28}N_2O_9$
$M_r = 476.47$
Monoclinic, $P2_1/c$
$a = 9.291$ (4) Å
$b = 9.589$ (3) Å
$c = 27.175$ (13) Å
$\beta = 99.53$ (3)°
$V = 2387.6$ (17) Å$^3$
$Z = 4$
$D_x = 1.325$ Mg m$^{-3}$
$D_m = 1.33$ (1) Mg m$^{-3}$
$D_m$ measured by flotation in bromoform–hexane
Mo $K\alpha$ radiation
Cell parameters from 25 reflections
$\theta = 6.9$–18.7°
$\mu = 0.10$ mm$^{-1}$
$T = 293$ (2) K
Block, yellow
0.4 × 0.3 × 0.3 mm

*Data collection*

Syntex $P2_1$ diffractometer
$\theta/2\theta$ scans
Absorption correction: none
5519 measured reflections
5519 independent reflections
1503 reflections with $I > 2\sigma(I)$
$\theta_{\max} = 27.6°$
$h = 0 \rightarrow 12$
$k = 0 \rightarrow 12$
$l = -35 \rightarrow 34$
2 standard reflections
frequency: 100 min
intensity decay: none

*Refinement*

Refinement on $F^2$
$R[F^2 > 2\sigma(F^2)] = 0.059$
$wR(F^2) = 0.083$
$S = 0.93$
5519 reflections
313 parameters
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.0187P)^2]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{\max} = 0.004$
$\Delta\rho_{\max} = 0.21$ e Å$^{-3}$
$\Delta\rho_{\min} = -0.16$ e Å$^{-3}$
Extinction correction: *SHELXL*
Extinction coefficient: 0.0027 (2)

**Table 1**
Selected geometric parameters (Å, °).

| | | | |
|---|---|---|---|
| O1—C7 | 1.350 (3) | N1—C5 | 1.408 (3) |
| O1—C6 | 1.391 (3) | N2—C15 | 1.474 (3) |
| O5—C11 | 1.321 (3) | C1—C2 | 1.320 (3) |
| O9—C19 | 1.331 (3) | C2—C3 | 1.487 (3) |
| O9—C20 | 1.450 (2) | C3—C4 | 1.523 (3) |
| N1—C1 | 1.380 (3) | C4—C5 | 1.339 (3) |
| | | | |
| C7—O1—C6 | 116.7 (3) | C4—C3—C13 | 109.53 (17) |
| C1—N1—C5 | 118.8 (2) | C5—C4—C19 | 121.1 (3) |
| O6—N2—O7 | 124.2 (3) | C19—C4—C3 | 117.7 (2) |
| C2—C3—C4 | 109.0 (2) | C14—C13—C3 | 120.1 (2) |
| | | | |
| C5—N1—C1—C2 | −15.6 (3) | C4—C3—C13—C14 | 94.1 (3) |
| C1—C2—C3—C4 | 26.8 (3) | C4—C3—C13—C18 | −84.9 (2) |
| C2—C3—C4—C5 | −27.8 (3) | C3—C13—C18—C17 | 176.5 (2) |
| C1—N1—C5—C4 | 14.2 (3) | C5—C4—C19—O8 | −5.0 (4) |
| C1—C2—C11—O4 | −13.8 (4) | C5—C4—C19—O9 | 175.5 (2) |

Although most of the H atoms were located in a difference Fourier map, all H-atom positions were calculated geometrically and these atoms were treated as riding atoms (C—H = 0.93–0.98 Å), with $U_{\rm iso}$ set at $1.2U_{\rm eq}$ ($1.5U_{\rm eq}$ for methyl) of the parent atom. From repeated crystallizations, we were unable to select a crystal of better quality than the one used for this determination. The percentage of observed data, collected by our diffractometer, was only 27% of the unique data available to a $\theta_{\max}$ of 27.6°. Inclusion of such a high percentage of essentially unobserved data into the structure refinement restricts the precision of the results.

Data collection: *Diffractometer Control Software* (Syntex, 1973); cell refinement: *Diffractometer Control Software*; data reduction: *XP*21 (Pavelčík, 1987); program(s) used to solve structure: *SHELXS*97 (Sheldrick, 1990); program(s) used to refine structure: *SHELXL*97 (Sheldrick, 1997); molecular graphics: *ORTEP*II (Johnson, 1976); software used to prepare material for publication: *SHELXL*97.

This work wos supported by the Grant Agency of the Slovak Republic (grant Nos. 1/9249/02 and 1/9255/02).

## References

Alajarin, R., Vaguero, J. J., Alvarez-Builla, J., Pastor, M., Sunkel, C., Fau de Casa-Juana, M., Priego, J., Statkow P. R., Sanz-Aparicio, J. & Fonseca, I. (1995). *J. Med. Chem.* **38**, 2830–2841.
Fossheim, R. (1985). *Acta Chem. Scand.* **39**, 785–790.
Goldmann, S., Born, L., Kazda, S., Pittel B. & Schramm, M. (1990). *J. Med. Chem.* **33**, 1413–1418.
Hantzsch, A. (1882). *Justus Liebigs Ann. Chem.* **215**, 1–82.
Johnson, C. K. (1976). *ORTEP*II. Report ORNL-5138. Oak Ridge National Laboratory, Tennessee, USA.
Natale, N. R., Triggle, D. J., Palmer, R. B., Lefler, B. J. & Edwards, W. D. (1990). *J. Med. Chem.* **33**, 2255–2259.
Pavelčík, F. (1987). *XP*21. Comenius University, Bratislava, Slovakia.
Rovnyak, G., Andersen, N., Gougoutas, J., Hedberg, A., Kimball, S. D., Malley, M., Moreland, S., Porubcan, M. & Podzianowski, A. (1988). *J. Med. Chem.* **31**, 936–944.
Sheldrick, G. M. (1990). *Acta Cryst.* A**46**, 467–473.
Sheldrick, G. M. (1997). *SHELXL*97. University of Göttingen, Germany.
Syntex (1973). *Syntex P*2$_1$ *Diffractometer Control Software*. Syntex Analytical Instruments, Cupertino, California, USA.
Triggle, A. M., Shefter, E. & Triggle, D. J. (1980). *J. Chem. Med.* **23**, 1442–1445.