

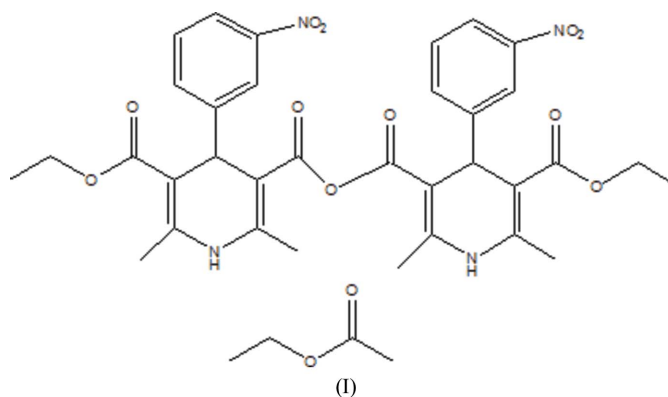
Feng-Xia Sun,<sup>a,b\*</sup> Yi-Feng Yu,<sup>b</sup>  
Xing-Na Guo<sup>b</sup> and Jun-Yong  
Guo<sup>b</sup><sup>a</sup>College of Pharmaceuticals and Biotechnology,  
Tianjin University, Tianjin 300072, People's  
Republic of China, and <sup>b</sup>College of Chemical  
and Pharmaceutical Engineering, Hebei Univer-  
sity of Science and Technology, Shijiazhuang  
050018, People's Republic of China

Correspondence e-mail: fxsun@hebust.edu.cn

## Key indicators

Single-crystal X-ray study  
 $T = 293$  K  
Mean  $\sigma(\text{C}-\text{C}) = 0.005$  Å  
 $R$  factor = 0.065  
 $wR$  factor = 0.206  
Data-to-parameter ratio = 13.8For details of how these key indicators were  
automatically derived from the article, see  
<http://journals.iucr.org/e>.5-Ethoxycarbonyl-2,6-dimethyl-4-(3-nitrophenyl)-  
1,4-dihydropyridine-3-carboxylic anhydride ethyl  
acetate solvateIn the title compound,  $\text{C}_{34}\text{H}_{34}\text{N}_4\text{O}_{11} \cdot \text{C}_4\text{H}_8\text{O}_2$ , the dihydro-  
pyridine rings display envelope configuration. The solvent  
molecule links to the anhydride *via* weak  $\text{C}-\text{H} \cdots \text{O}$  hydrogen  
bonding.Received 11 October 2005  
Accepted 29 November 2005  
Online 7 December 2005

## Comment

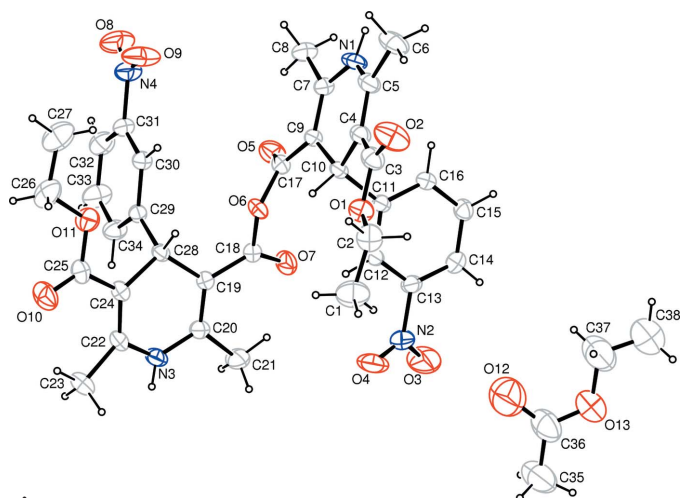
4-Aryl-1,4-dihydropyridine-3,5-dicarboxylic diesters of the  
nefidipine type have become almost indispensable for the  
treatment of cardiovascular diseases since they first appeared  
on the market in 1975 (Yiu & Edward, 1999; Goldmann &  
Stoltefuss, 1991). The title compound, (I), is related to the  
preparation of the above compounds.

The molecular structure of (I) is shown in Fig. 1. Both dihydropyridine rings display an envelope conformation, with atoms C10 and C28 displaced from the mean planes formed by the other atoms in the same ring by 0.287 (1) and 0.217 (1) Å, respectively. The dihedral angle between the C11-containing benzene ring and the N1/C4/C5/C7/C9 plane is 87.42 (5)°, while the dihedral angle between the C29-containing benzene ring and the N3/C19/C20/C22/C24 plane is 85.04 (5)°. This is comparable to the situation found in nefidipine (Hofmann & Cimraglia, 1990; Ramusino & Vari, 1999). The C17–O6 and C18–O6 bond distances (Table 1) are much longer than the C17–O5 and C18–O7 bond distances, respectively, confirming their single bond character.

Both classic  $\text{N}-\text{H} \cdots \text{O}$  and weak  $\text{C}-\text{H} \cdots \text{O}$  hydrogen bonds occur in the crystal structure (Table 2). The solvent molecule links to the anhydride *via* weak  $\text{C}-\text{H} \cdots \text{O}$  hydrogen bonding.

## Experimental

5-Ethoxycarbonyl-2,6-dimethyl-4-(3-nitrophenyl)-1,4-dihydropyridine-3-carboxylic acid (0.45 g, 1 mmol) was dissolved in  $\text{CH}_2\text{Cl}_2$  (30 ml),



**Figure 1**  
The molecular structure of (I), with 30% probability displacement ellipsoids. H atoms are shown as small spheres of arbitrary radii.

and dicyclohexylcarbodiimide (0.21 g, 1 mmol) in  $\text{CH}_2\text{Cl}_2$  (10 ml) was dropped into the above solution at 278 K. The reaction mixture was stirred at 276–279 K for 4 h. The solvent  $\text{CH}_2\text{Cl}_2$  was removed by vacuum evaporation at 293 K. The product was purified by chromatography on a silica gel column (eluted by ethyl acetate and petroleum, 3:7) at room temperature. The product (0.41 g) was obtained in a yield of 94%. Recrystallization from a dichloromethane/ethyl acetate solution gave single crystals of (I).

#### Crystal data

$\text{C}_{34}\text{H}_{34}\text{N}_4\text{O}_{11} \cdot \text{C}_4\text{H}_8\text{O}_2$   
 $M_r = 762.76$   
 Triclinic,  $P\bar{1}$   
 $a = 10.896$  (2) Å  
 $b = 12.017$  (2) Å  
 $c = 16.162$  (3) Å  
 $\alpha = 99.59$  (3)°  
 $\beta = 106.29$  (3)°  
 $\gamma = 105.69$  (3)°  
 $V = 1887.1$  (9) Å<sup>3</sup>

$Z = 2$   
 $D_x = 1.342$  Mg m<sup>-3</sup>  
 Mo  $K\alpha$  radiation  
 Cell parameters from 15558 reflections  
 $\theta = 3.2$ – $25.5$ °  
 $\mu = 0.10$  mm<sup>-1</sup>  
 $T = 293$  (2) K  
 Block, yellow  
 $0.28 \times 0.22 \times 0.10$  mm

#### Data collection

Rigaku R-AXIS RAPID diffractometer  
 $\omega$  scans  
 Absorption correction: none  
 18422 measured reflections  
 6953 independent reflections

4362 reflections with  $I > 2\sigma(I)$   
 $R_{\text{int}} = 0.038$   
 $\theta_{\text{max}} = 25.5$ °  
 $h = -13 \rightarrow 13$   
 $k = -14 \rightarrow 14$   
 $l = -19 \rightarrow 19$

#### Refinement

Refinement on  $F^2$   
 $R[F^2 > 2\sigma(F^2)] = 0.065$   
 $wR(F^2) = 0.206$   
 $S = 1.08$   
 6953 reflections  
 504 parameters

H-atom parameters constrained  
 $w = 1/[\sigma^2(F_o^2) + (0.1184P)^2]$   
 where  $P = (F_o^2 + 2F_c^2)/3$   
 $(\Delta/\sigma)_{\text{max}} = 0.001$   
 $\Delta\rho_{\text{max}} = 0.57$  e Å<sup>-3</sup>  
 $\Delta\rho_{\text{min}} = -0.45$  e Å<sup>-3</sup>

**Table 1**  
Selected bond lengths (Å).

O1—C2	1.453 (4)	O10—C25	1.204 (4)
O1—C3	1.345 (4)	O11—C25	1.347 (3)
O2—C3	1.212 (3)	O11—C26	1.451 (3)
O5—C17	1.199 (3)	O12—C36	1.269 (6)
O6—C17	1.391 (3)	O13—C36	1.256 (6)
O6—C18	1.399 (3)	O13—C37	1.482 (6)
O7—C18	1.203 (3)		

**Table 2**  
Hydrogen-bond geometry (Å, °).

$D-H \cdots A$	$D-H$	$H \cdots A$	$D \cdots A$	$D-H \cdots A$
$\text{N1}-\text{H1D} \cdots \text{O4}^{\text{i}}$	0.86	2.39	3.121 (4)	143
$\text{N3}-\text{H3A} \cdots \text{O9}^{\text{ii}}$	0.86	2.37	3.131 (4)	147
$\text{C6}-\text{H6C} \cdots \text{O12}^{\text{i}}$	0.96	2.36	3.317 (6)	178
$\text{C23}-\text{H23C} \cdots \text{O2}^{\text{iii}}$	0.96	2.44	3.348 (5)	157

Symmetry codes: (i)  $x + 1, y, z$ ; (ii)  $x - 1, y, z$ ; (iii)  $x - 1, y - 1, z$ .

Methyl H atoms were placed in calculated positions with  $\text{C}-\text{H} = 0.96$  Å and  $U_{\text{iso}}(\text{H}) = 1.5U_{\text{eq}}(\text{C})$ ; the torsion angles were refined to fit the electron density. Other H atoms were placed in calculated positions with  $\text{C}-\text{H} = 0.93$ – $0.98$  Å and  $\text{N}-\text{H} = 0.86$  Å, and constrained to ride on their parent atoms with  $U_{\text{iso}}(\text{H}) = 1.2U_{\text{eq}}(\text{carrier})$ .

Data collection: *PROCESS-AUTO* (Rigaku, 1998); cell refinement: *PROCESS-AUTO*; data reduction: *CrystalStructure* (Rigaku/MSK, 2002); program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics: *SHELXTL* (Bruker, 2002); software used to prepare material for publication: *SHELXTL*.

The authors gratefully acknowledge support from Tianjin University and Hebei University of Science and Technology.

#### References

- Bruker (2002). *SHELXTL*. Bruker AXS Inc., Madison, Wisconsin, USA.  
 Goldmann, S. & Stoltefuss, J. (1991). *Angew. Chem. Int. Ed. Engl.* **30**, 1559–1578.  
 Hofmann, H. J. & Cimraglia, R. (1990). *J. Mol. Struct. (THEOCHEM)*, **205**, 1–6.  
 Ramusino, M. C. & Vari, M. R. (1999). *J. Mol. Struct. (THEOCHEM)*, **492**, 257–268.  
 Rigaku (1998). *PROCESS-AUTO*. Rigaku Corporation, Tokyo, Japan.  
 Rigaku/MSK (2002). *CrystalStructure*. Version 3.00. Rigaku/MSK, The Woodlands, TX 77381-5209, USA.  
 Sheldrick, G. M. (1997). *SHELXS97* and *SHELXL97*. University of Göttingen, Germany.  
 Yiu, S.-H. & Edward, E.-K. (1999). *Drug Dev. Res.* **48**, 26–37.