Mechanistic insights and antifungal assessment of (3+2) cycloaddition products of 2-diazopropane and 5-hydroxy-3-methyl-1,5-dihydropyrrol-2-one derivatives

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Table. 1S. ELF valence basin populations for reactants DAP, HMHP1, and HMHP2 in electrons e, calculated at thewB97XD/6-311++G(d,p)level of theory.

Basins	DAP	HMHP1	HMHP2
V(N1)	1.99	---	---
V'(N1)	2.00	---	---
V(N1,N2)	1.77	---	---
V'(N1,N2)	1.73	---	---
V(N2,C3)	1.65	---	---
V'(N2,C3)	1.65	---	---
V(C3)	0.47	---	---
V'(C3)	0.47	---	---
V(C4,C5)	---	1.72	---
V'(C4,C5)	---	1.73	---
V(C4',C5')	---	---	1.70
V'(C4',C5')	---	---	1.75

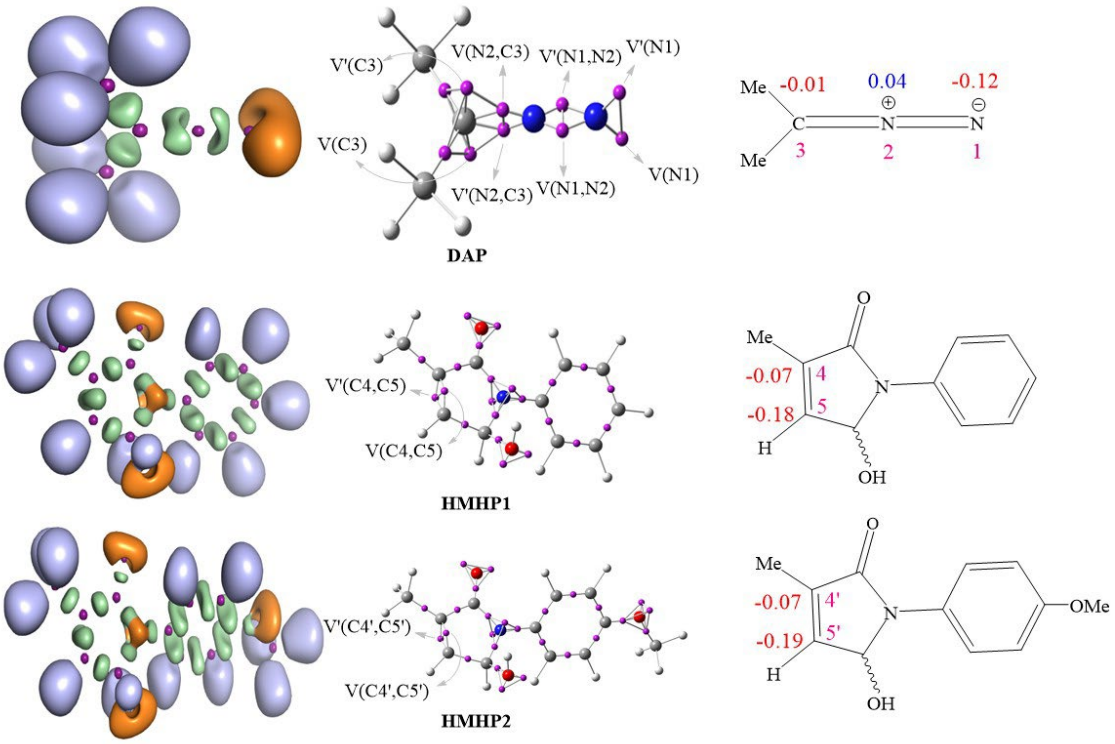

Figure 1S. (Left) ELF localization domains of the reactants plotted at an isosurface value of 0.8. Protonated basins are shown in light purple, monosynaptic basins are colored orange, disynaptic basins are colored green, and core basins are colored purple. (Centre) ELF basin attractor positions and population values for the most relevant sites. (Right) Lewis-like structures of reactants and natural atomic charge on reaction sites

Table. 2S. Relative energies ΔE (kcal.mol^{-1}), Gibbs free energies ΔG (kcal.mol^{-1}), relative enthalpies ΔH (kcal.mol^{-1}), and entropies ΔS (cal.mol^{-1}.K^{-1}) of the TSs and products involved in the 32CA reaction of DAP with HMHP1 in gas phase and in Et_2O solvent at 273.15 K.

	P/TS	ΔE (kcal.mol^{-1})	ΔG (kcal.mol^{-1})	ΔH (kcal.mol^{-1})	ΔS (cal.K^{-1}.mol^{-1})
Gas phase	P1a	-39.22	-21.07	-36.29	-55.71
	P1s	-33.61	-14.15	-30.42	-59.58
	P2a	-39.57	-20.66	-36.40	-57.62
	P2s	-37.57	-17.53	-34.14	-60.81
	TS1a	10.91	25.54	11.47	-51.52
	TS1s	14.13	29.37	14.80	-53.36
	TS2a	8.64	24.56	9.51	-55.11
	TS2s	10.34	26.92	11.42	-60.81
Et_2O solvent	P1a	-40.38	-21.51	-37.08	-57.02
	P1s	-33.63	-13.29	-30.19	-61.86
	P2a	-39.54	-19.89	-36.28	-60.02
	P2s	-36.86	-16.56	-33.49	-61.97
	TS1a	10.06	25.28	10.72	-53.27
	TS1s	13.43	29.21	14.20	-54.96
	TS2a	10.75	27.04	11.67	-56.25
	TS2s	12.25	28.48	13.12	-56.25

Table. 3S. Relative energies ΔE (kcal.mol^{-1}), Gibbs free energies ΔG (kcal.mol^{-1}), relative enthalpies ΔH (kcal.mol^{-1}), and entropies ΔS (cal.K^{-1}.mol^{-1}) of the TSs and products involved in the 32CA reaction of DAP with HMHP2 in gas phase and in Et_2O solvent at 273.15 K.

	P/TS	ΔE (kcal.mol^{-1})	ΔG (kcal.mol^{-1})	ΔH (kcal.mol^{-1})	ΔS (cal.K^{-1}.mol^{-1})
Gas phase	P3a	-40.19	-22.35	-37.54	-55.61
	P3s	-34.07	-14.70	-30.99	-59.65
	P4a	-40.39	-21.99	-37.50	-56.81
	P4s	-38.14	-19.35	-35.18	-57.95
	TS3a	10.92	24.77	11.17	-49.82
	TS3s	14.08	28.18	14.34	-50.65
	TS4a	9.81	24.61	10.19	-52.81
	TS4s	10.40	26.09	10.99	-55.30
Et_2O solvent	P3a	-41.15	-22.05	-37.84	-57.80
	P3s	-33.82	-13.79	-30.37	-60.69
	P4a	-40.12	-20.80	-36.78	-58.51
	P4s	-37.53	-18.36	-34.26	-58.24
	TS3a	9.91	23.81	10.42	-49.05
	TS3s	13.68	28.79	14.25	-53.22
	TS4a	10.63	26.35	11.47	-54.49
	TS4s	11.38	27.64	12.35	-55.98

Table. 4S. Calculated bond lengths (Å) and *l* index of bond formation for the reactions of DAP with HMHP1, and HMHP2.

Structure	r (Å)	*l*	r (Å)	*l*	Structure	r (Å)	*l*	r (Å)	*l*
	N1-C4		**C3-C5**			**N1-C4'**		**C3-C5'**	
P1a	1.4926	0.4202	1.5499	0.5768	**P3a**	1.4926	0.4220	1.5498	0.5725
TS1a	2.3580		2.2058		**TS3a**	2.3552		2.2123	
P1s	1.5003	0..4719	1.5406	0.5625	**P3s**	1.4999	0.4757	1.5407	0.5585
TS1s	2.2926		2.2145		**TS3s**	2.2863		2.2209	
	N1-C5		**C3-C4**			**N1-C5'**		**C3-C4'**	
P2a	1.4820	0.5769	1.5620	0.4847	**P4a**	1.4820	0.5746	1.5608	0.4846
TS2a	2.1091		2.3669		**TS4a**	2.1124		2.3652	
P2s	1.4741	0.5390	1.5670	0.5184	**P4s**	1.4743	0.5451	1.5669	0.5154
TS2s	2.1537		2.3216		**TS4s**	2.1450		2.3262	

Table. 5S. The most significant ELF valence basin populations at the TSs have been obtained at the wB97XD/6-311++G(d,p) level of theory.

Basins	TS1a	TS1s	TS2a	TS2s
V(N1)	3.69	3.67	3.74	3.76
V(N1,N2)	1.67	1.67	1.47	1.48
V'(N1,N2)	1.43	1.40	1.51	1.48
V(N2)	1.84	1.92	1.99	2.00
V(N2,C3)	1.96	1.92	1.98	1.96
V(C3)	0.91	0.95	0.84	0.84
V(C4,C5)	3.34	3.04	3.35	3.06
V(C4)	---	---	---	0.30
V(C5)	---	0.31	---	---

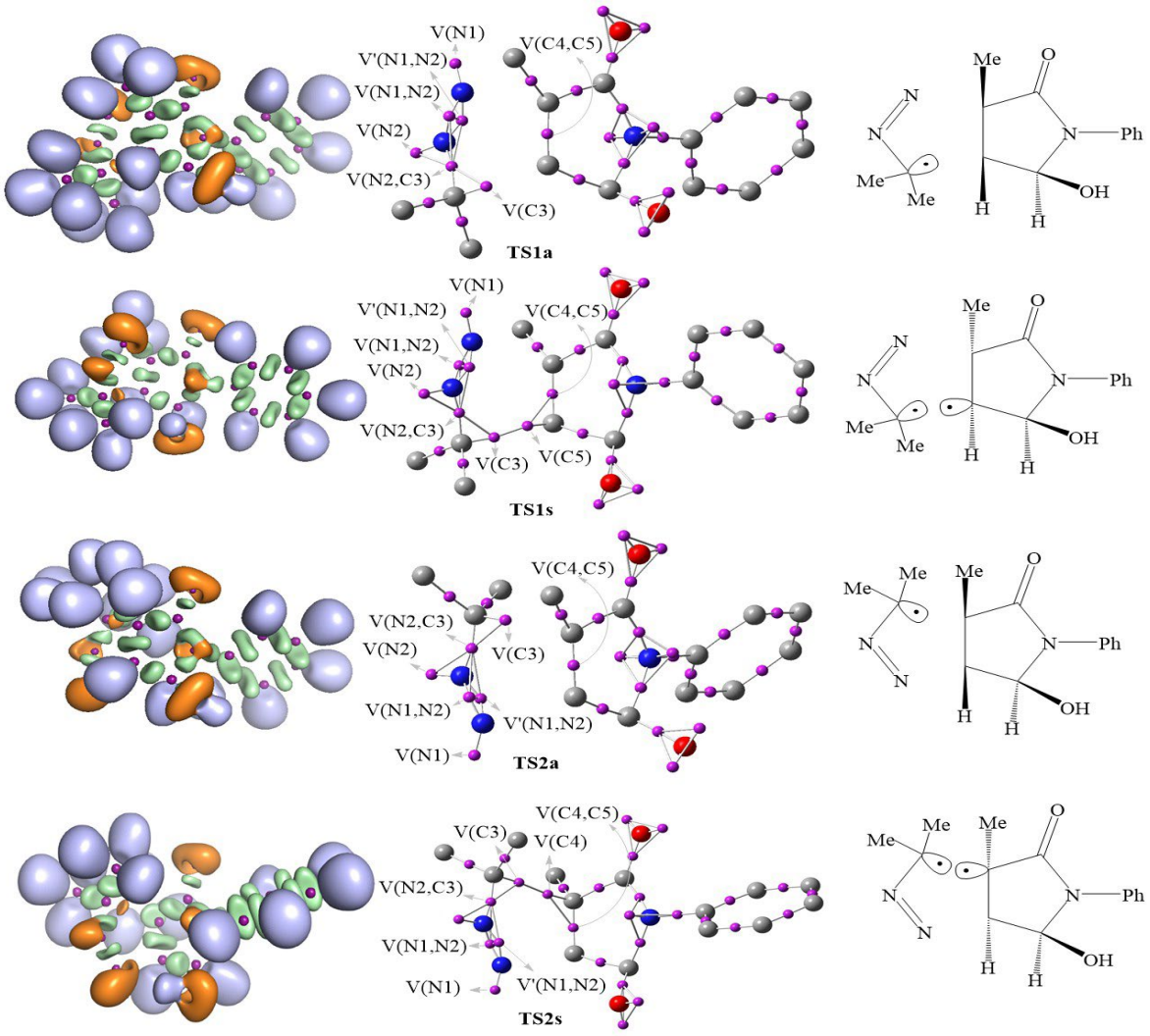

Figure 2S. (Left) ELF localization domains of the TSs of the reaction of DAP with HMHP1 plotted at an isosurface value of 0.8. Protonated basins are shown in light blue, monosynaptic basins in orange, disynaptic basins in green, and core basins in purple. (Centre) ELF basin attractor positions and population values for the important sites. (Right) Lewis-like structures of TSs

Table. 6S. The most significant ELF valence basin populations at the TSs have been obtained at the wB97XD/6-311++G(d,p) level of theory.

Basins	TS3a	TS3s	TS4a	TS4s
V(N1)	3.69	3.68	3.73	3.75
V(N1,N2)	1.42	1.67	1.50	1.51
V'(N1,N2)	1.69	1.39	1.48	1.45
V(N2)	1.84	1.92	1.99	2.01
V(N2,C3)	1.96	1.92	1.97	1.96
V(C3)	0.91	0.96	0.84	0.85
V(C4',C5')	3.35	3.04	3.36	3.07
V(C4')	---	---	---	0.29
V(C5')	---	0.32	---	---

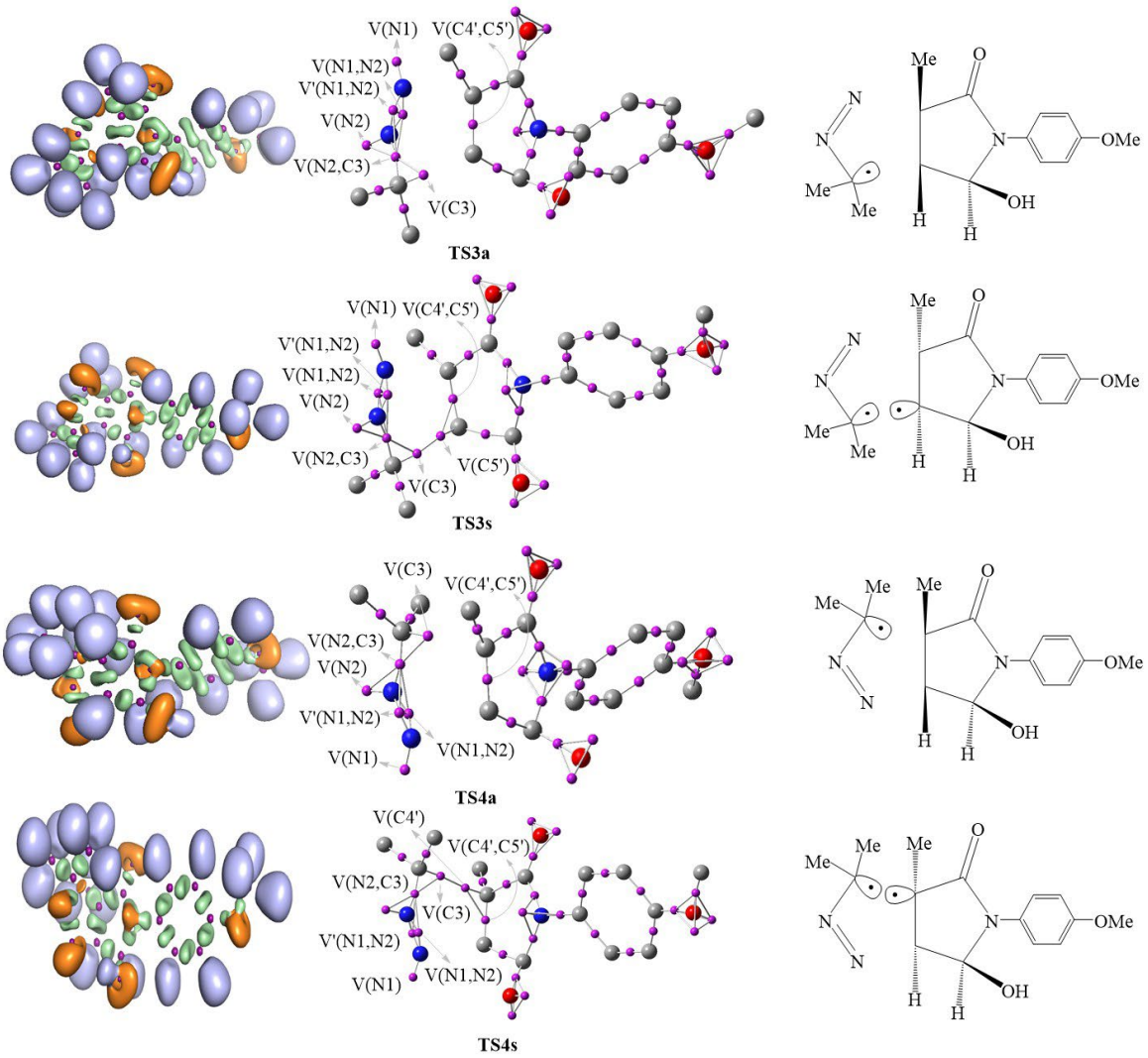

Figure 3S. (Left) ELF localization domains of the TSs of the reaction of DAP with HMHP2plotted at an isosurface value of 0.8. Protonated basins are shown in light blue, monosynaptic basins in orange, disynaptic basins in green, and core basins in purple. (Centre) ELF basin attractor positions and population values for the important sites. (Right) Lewis-like structures of TSs

Table. 7S. wB97XD/6-311++G(d,p) calculated most significant electronic localization function valence basin populations, global electron density transfer, forming bond distances and of the relevant IRC points along the 32CA reaction between DAP and the HMHP1.

Phases	I	II	III	IV	V	VI	
Points	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**
d(N1,C4)	3.07	2.56	2.36	2.26	2.03	1.94	1.49
d(C3,C5)	3.12	2.48	2.21	2.06	1.80	1.73	1.55
GEDT	0.03	0.13	0.20	0.19	0.09	0.04	-0.10
V(N1,N2)	1.76	1.80	1.67	1.58	2.77	2.73	2.54
V'(N1,N2)	1.79	1.62	1.43	1.41	---	---	---
V(N1)	1.90	3.81	3.69	3.65	3.68	2.92	2.72
V'(N1)	2.05	---	---	---	---	0.80	---
V(N2,C3)	1.60	3.46	1.96	1.87	1.81	1.81	1.83
V'(N2,C3)	1.68	---	---	---	---	---	---
V(C3)	0.53	0.76	0.91	0.97	---	---	---
V(C4,C5)	1.69	1.60	3.34	2.90	2.22	2.15	1.96
V'(C4,C5)	1.73	1.76	---	---	---	---	---
V(C4)	---	---	---	---	0.46	0.49	---
V(C5)	---	---	---	0.46	---	---	---
V(N2)	---	---	1.84	2.10	2.46	2.52	2.68
V(N1,C4)	---	---	---	---	---	---	1.80
V(C3,C5)	---	---	---	---	1.73	1.80	1.96

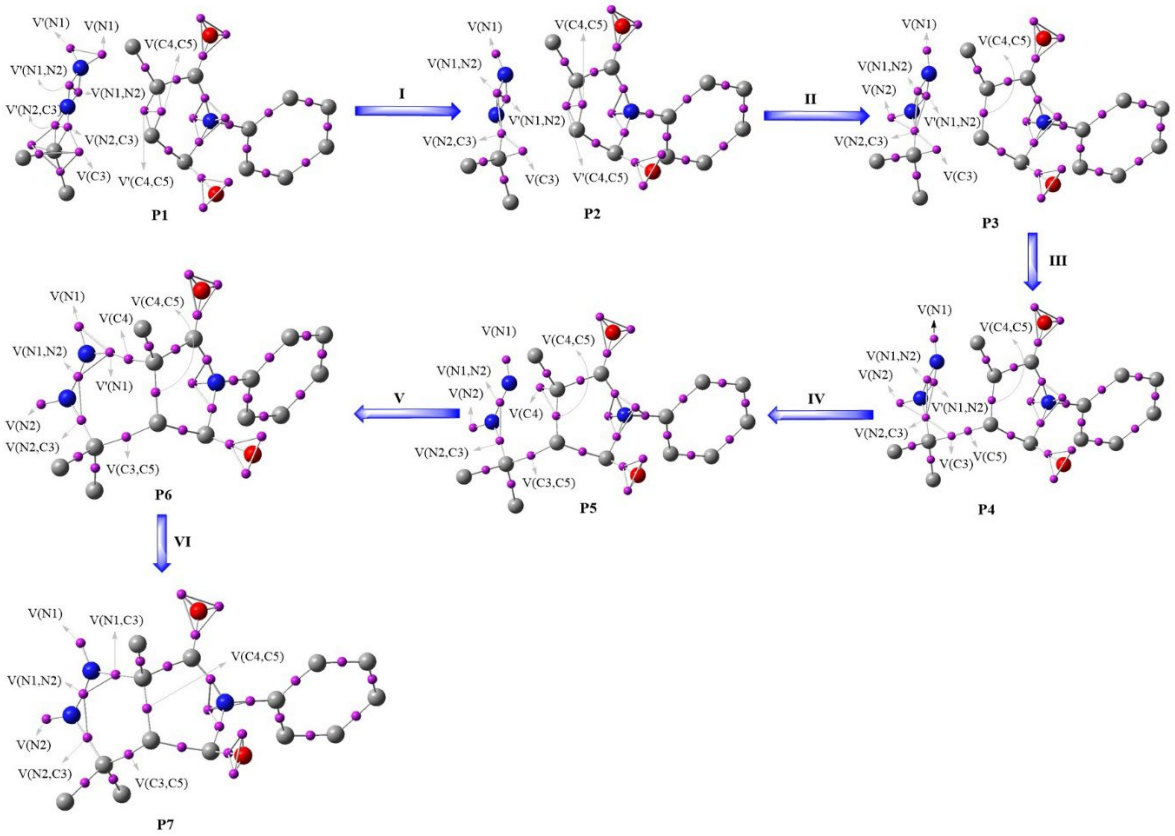

Figure 4S. ELF basin attractor positions of the IRC points P1-P7 of the 32CA reaction of DAP with HMHP1

Table. 8S. QTAIM parameters (in a.u.) of the (3,-1) BCPs at the TSs corresponding to the 32CA reactions of DAP with HMHP1and HMHP2.

	CP1		**CP2**	
	ρ	**∇2ρ(r)**	**ρ**	**∇2ρ(r)**
	(N1-C4)		**(C3-C5)**	
TS1a	0.0408	0.0800	0.0626	0.0368
TS1s	0.0461	0.0841	0.06201	0.0358
	(N1-C5)		**(C3-C4)**	
TS2a	0.0669	0.0891	0.04786	0.0411
TS2s	0.0620	0.0867	0.05162	0.03897
	(N1-C4')		**(C3-C5')**	
TS3a	0.0410	0.0800	0.0618	0.0375
TS3s	0.0467	0.0844	0.0613	0.0361
	(N1-C5')		**(C3-C4')**	
TS4a	0.06642	0.0891	0.0480	0.0408
TS4s	0.06282	0.0876	0.0513	0.0391