Table S1. Comparison of the properties of TanPL1 and other microbial tannases.

Source	Mw (kDa)	Optimal Temperature (°C)	Optimal pH	Temperature-stable Range (°C)	pH-stable Range	Reference
Penicillium longicatenatum SM102	43	55	5.5	20–55	3–8	Present study
Penicillium variable	310	50	5	25–80	3–8	[46]
Aspergillus awamori MTCC9299	101	30	5.5	25–70	5–6	[47]
Aspergillus nomius GWA5	30	50	6	40–70	3–9	[48]
Aspergillus niger NRRL 3536	37–40	45	3.5	≤ 60	N.D.	[24]
Emericella nidulans	302	45	5	22–50	4–5	[26]
Rhodosporidium diobovatum Q95	75.1	40	4.5	25–60	3–8	[49]
Rhodotorula glutinis DB2	73	40	6	0–40	6–7	[50]
Kluyveromyces marxianus NRRL Y-8281	66.62	35	4.5, 8.5	30–70	4–6	[16]
Aureobasidium melanogenum T9	63	60	6	20–55	3.5–7.5	[31]
Bacillus subtilis PAB2	52	40	5	30–70	3–8	[27]
Enterobacter cloacae MTCC 9125	31	50	5.5	40–80	4.5–5.5	[51]
Lachnospiraceae bacterium	68	50	7	30–55	6.5–7.5	[52]
Lactobacillus plantarum ATCC 14917(T)	50	40	8	N.D.	N.D.	[44]
Lactobacillus pentosus QA1-5	50	40	9	30–60	8–10	[53]

"N.D.": no data.

Table S2. Single-point mutations selected for tannase TanPL1 based on ΔΔG values.

Potential Site	Mutation	ΔΔG (kcal/mol)	Decision
Ser123	Ala	–3.3807	Selected
Tyr127	Ala	–3.5933	Selected
Arg130	Asn	–3.2401	Selected
Asp199	Ala	–0.5431	Eliminated
Lys224	Ala	–1.4424	Eliminated
Tyr228	Glu	–5.7502	Selected
Ser334	Pro	–1.1748	Eliminated

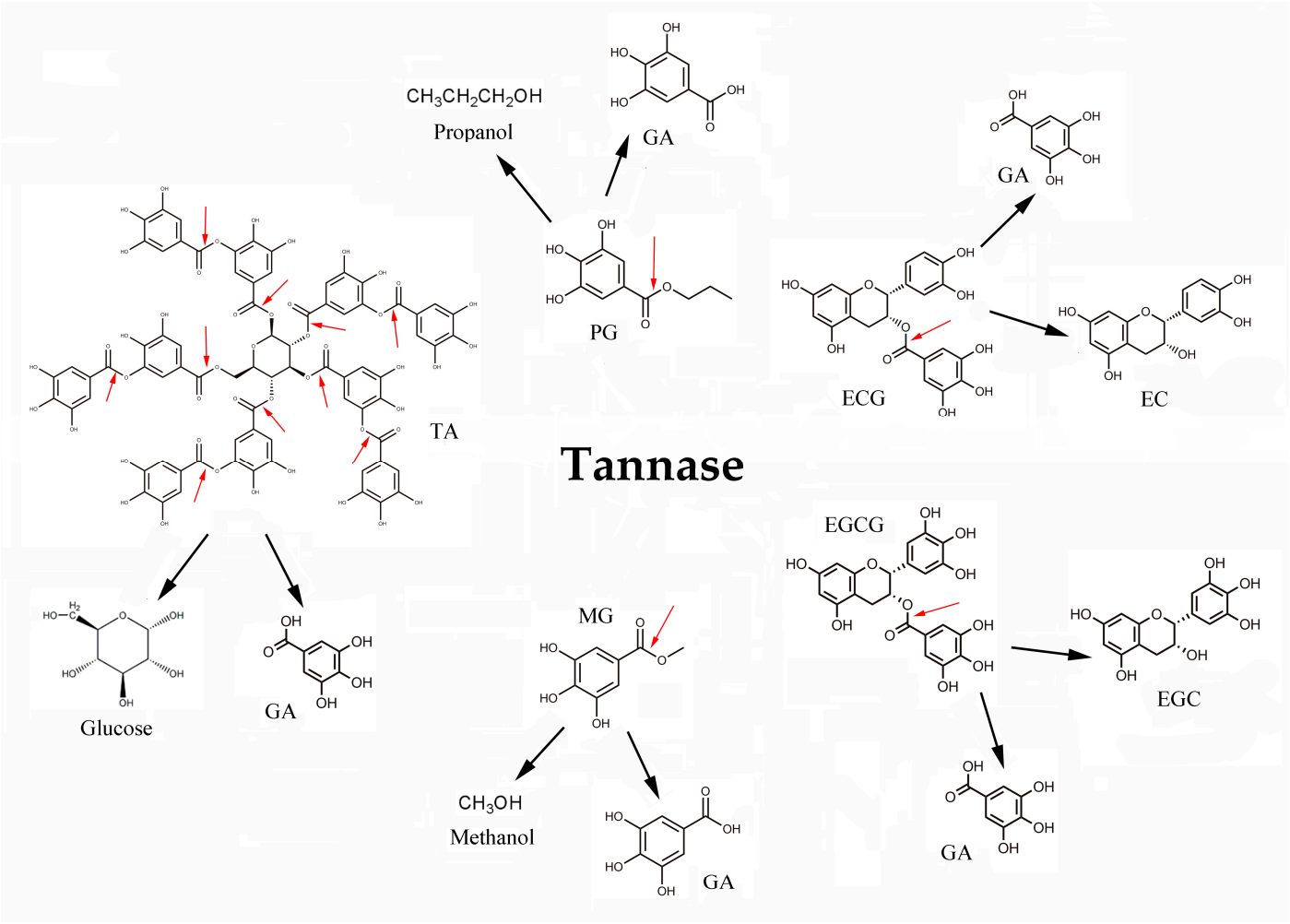

Figure S1. General chemical structures of some tannase substrates and products. The substrates are TA (tannic acid), ECG (epicatechin gallate), EGCG (epigallocatechin gallate), PG (propyl gallate), and MG (methyl gallate); the black arrows indicate the respective hydrolytic products (EC: epicatechin; EGC: epigallocatechin; GA: gallic acid), while the red arrows denote the catalytic cleavage sites of tannase in the substrate molecules.

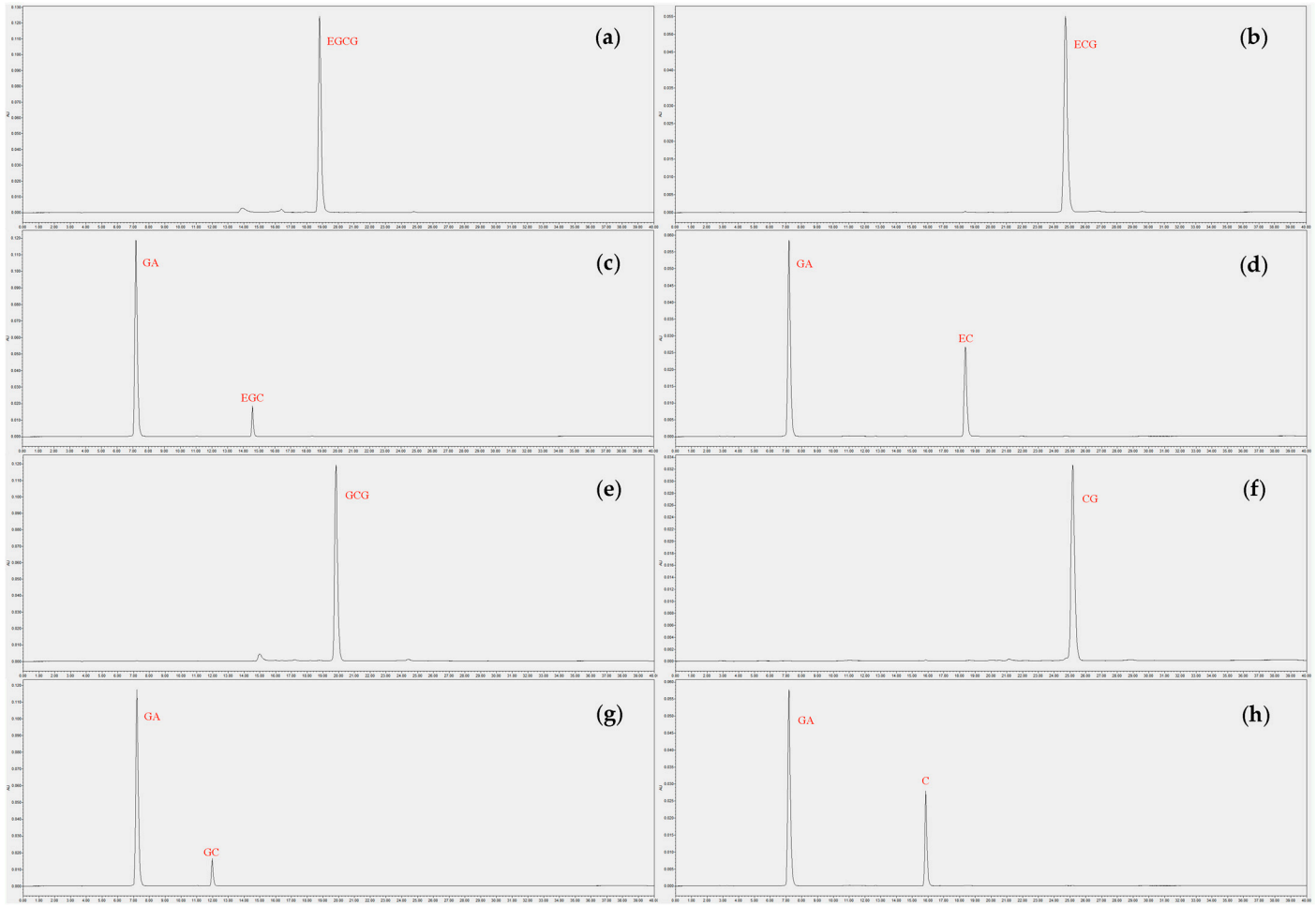

Figure S2. Chromatograms demonstrating catechin biotransformation by tannase TanPL1: (**a**) EGCG, (**b**) ECG, (**e**) GCG, and (**f**) CG; and their respective transformation products (**c**) EGC and GA, (**d**) EC and GA, (**g**) GC and GA, and (**h**) C and GA.

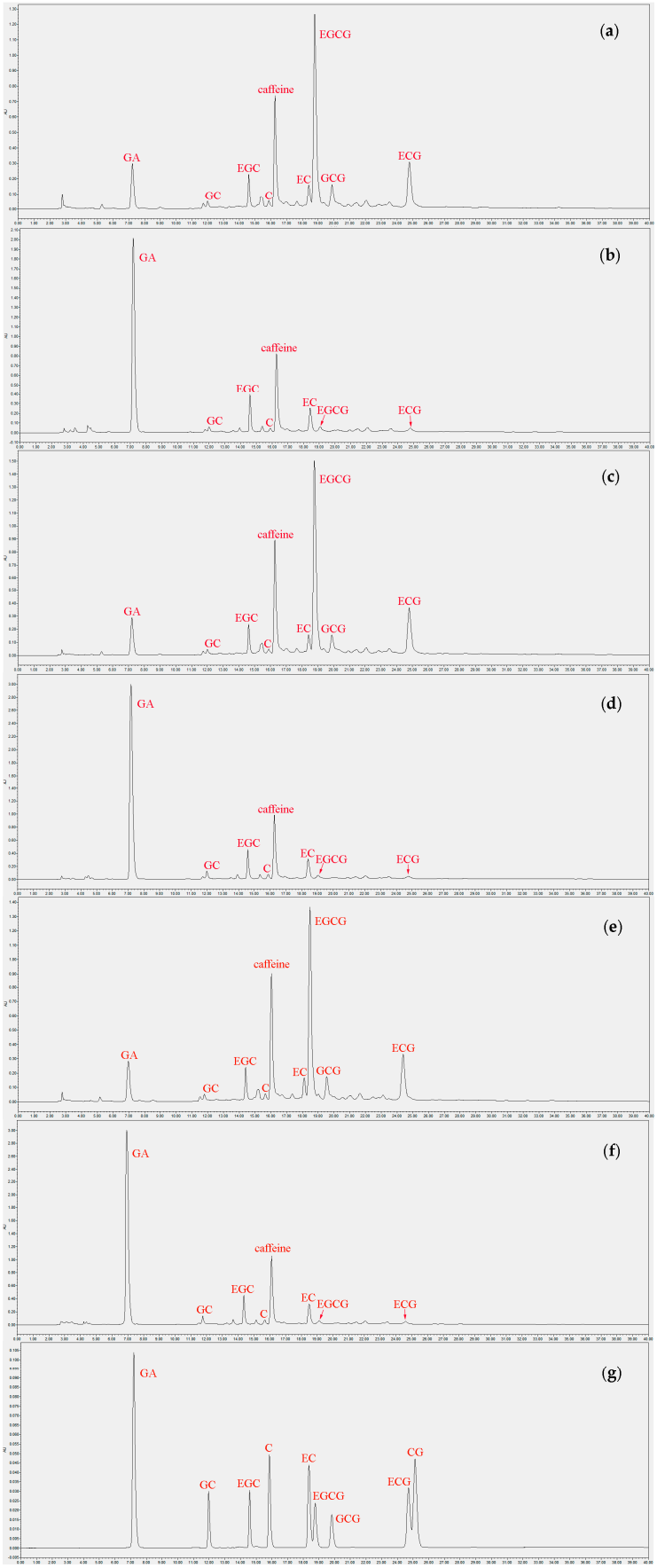

Figure S3. Chromatograms demonstrating the changes in catechins and gallic acid in tea infusions after tannase MuTanPL1 hydrolysis via Method 1 (**b**), Method 2 (**d**), and Method 3 (**f**); the respective controls are shown in (**a**), (**c**), and (**e**). The standards are shown in (**g**).