

	FW	DW	Chl a (A)	Chl b (A)	Total chl (A)	Carotenoid (A)	Chl a (D)	Chl b (D)	Total chl (D)	Carotenoid (D)	Soluble sugar	Proline	MDA	H2O2	DPPH activity	TPC	TFC	SOD	GPX	CAT	PPO	Lupeol	β-sitosterol	a
FW	1.000																							
DW	0.993	1.000																						
Chl a (A)	0.954	0.947	1.000																					
Chl b (A)	0.982	0.986	0.986	1.000																				
Total chl (A)	0.968	0.965	0.998	0.995	1.000																			
Carotenoid (A)	0.953	0.914	0.879	0.892	0.887	1.000																		
Chl a (D)	0.781	0.718	0.865	0.786	0.837	0.839	1.000																	
Chl b (D)	0.699	0.633	0.815	0.719	0.780	0.762	0.992	1.000																
Total chl (D)	0.739	0.674	0.840	0.752	0.808	0.800	0.998	0.998	1.000															
Carotenoid (D)	0.754	0.695	0.862	0.776	0.831	0.797	0.996	0.996	0.998	1.000														
Soluble sugar	0.843	0.785	0.899	0.838	0.878	0.895	0.993	0.970	0.983	0.983	1.000													
Proline	0.851	0.790	0.886	0.832	0.868	0.917	0.986	0.956	0.972	0.969	0.997	1.000												
MDA	-0.962	-0.939	-0.989	-0.970	-0.985	-0.930	-0.911	-0.860	-0.886	-0.900	-0.945	-0.940	1.000											
H2O2	-0.873	-0.820	-0.754	-0.775	-0.765	-0.976	-0.771	-0.689	-0.729	-0.715	-0.830	-0.866	0.831	1.000										
DPPH activity	0.346	0.240	0.428	0.310	0.383	0.545	0.824	0.858	0.843	0.814	0.779	0.783	-0.530	-0.573	1.000									
TPC	0.814	0.752	0.682	0.701	0.692	0.947	0.742	0.663	0.702	0.682	0.798	0.840	-0.773	-0.994	0.606	1.000								
TFC	0.811	0.738	0.801	0.756	0.786	0.928	0.947	0.910	0.929	0.915	0.964	0.980	-0.880	-0.920	0.818	0.913	1.000							
SOD	0.878	0.831	0.743	0.776	0.759	0.971	0.729	0.640	0.684	0.671	0.795	0.834	-0.817	-0.997	0.513	0.989	0.890	1.000						
GPX	0.989	0.995	0.972	0.997	0.985	0.900	0.753	0.678	0.715	0.738	0.812	0.810	-0.957	-0.791	0.270	0.718	0.743	0.797	1.000					
CAT	0.915	0.864	0.912	0.883	0.904	0.968	0.949	0.900	0.925	0.923	0.978	0.987	-0.962	-0.921	0.694	0.891	0.975	0.900	0.872	1.000				
PPO	0.988	0.966	0.920	0.945	0.933	0.987	0.804	0.721	0.761	0.768	0.866	0.883	-0.950	-0.937	0.432	0.893	0.871	0.939	0.955	0.945	1.000			
Lupeol	-0.332	-0.223	-0.252	-0.203	-0.234	-0.600	-0.613	-0.598	-0.606	-0.561	-0.612	-0.654	0.392	0.722	-0.850	-0.787	-0.780	-0.688	-0.201	-0.627	-0.466	1.000		
β-sitosterol	-0.508	-0.424	-0.644	-0.522	-0.598	-0.621	-0.935	-0.968	-0.954	-0.943	-0.891	-0.878	0.707	0.577	-0.945	-0.574	-0.851	-0.517	-0.473	-0.791	-0.550	0.673	1.000	

	FW	DW	Chl a (A)	Chl b (A)	Total chl (A)	Carotenoid (A)	Chl a (D)	Chl b (D)	Total chl (D)	Carotenoid (D)	Soluble sugar	Proline	MDA	H2O2	DPPH activity	TPC	TFC	SOD	GPX	CAT	PPO	Lupeol	β-sitosterol	b
FW	1.000																							
DW	0.738	1.000																						
Chl a (A)	0.689	0.555	1.000																					
Chl b (A)	0.436	0.077	0.870	1.000																				
Total chl (A)	0.590	0.343	0.971	0.962	1.000																			
Carotenoid (A)	0.680	0.625	0.993	0.815	0.941	1.000																		
Chl a (D)	0.712	0.488	0.992	0.907	0.985	0.971	1.000																	
Chl b (D)	0.555	0.726	0.910	0.638	0.810	0.951	0.850	1.000																
Total chl (D)	0.679	0.595	0.997	0.840	0.955	0.999	0.980	0.937	1.000															
Carotenoid (D)	0.834	0.983	0.673	0.235	0.484	0.726	0.622	0.776	0.702	1.000														
Soluble sugar	0.352	0.161	0.900	0.968	0.963	0.869	0.906	0.762	0.885	0.292	1.000													
Proline	0.755	0.727	0.975	0.737	0.893	0.989	0.947	0.953	0.984	0.817	0.789	1.000												
MDA	0.078	0.030	-0.668	-0.772	-0.741	-0.662	-0.640	-0.660	-0.671	-0.040	-0.888	-0.555	1.000											
H2O2	0.053	-0.021	-0.687	-0.764	-0.748	-0.687	-0.654	-0.696	-0.694	-0.087	-0.888	-0.585	0.999	1.000										
DPPH activity	0.953	0.572	0.812	0.679	0.775	0.778	0.853	0.598	0.788	0.708	0.581	0.812	-0.151	-0.165	1.000									
TPC	0.950	0.672	0.875	0.685	0.813	0.857	0.895	0.720	0.862	0.795	0.627	0.894	-0.233	-0.254	0.986	1.000								
TFC	0.728	0.597	0.998	0.845	0.958	0.994	0.989	0.913	0.997	0.712	0.872	0.984	-0.625	-0.646	0.835	0.898	1.000							
SOD	0.996	0.692	0.728	0.511	0.648	0.711	0.757	0.567	0.713	0.801	0.420	0.775	0.016	-0.006	0.976	0.969	0.763	1.000						
GPX	0.767	0.473	0.971	0.901	0.970	0.941	0.992	0.792	0.953	0.617	0.870	0.924	-0.560	-0.571	0.904	0.928	0.972	0.813	1.000					
CAT	0.320	0.327	0.906	0.863	0.916	0.908	0.877	0.885	0.912	0.419	0.960	0.844	-0.915	-0.928	0.498	0.588	0.882	0.370	0.815	1.000				
PPO	0.625	0.200	0.893	0.971	0.961	0.835	0.941	0.631	0.859	0.367	0.903	0.785	-0.610	-0.606	0.830	0.821	0.881	0.691	0.958	0.782	1.000			
Lupeol	0.990	0.663	0.608	0.391	0.524	0.588	0.645	0.438	0.591	0.764	0.277	0.666	0.174	0.155	0.941	0.916	0.648	0.987	0.714	0.215	0.595	1.000		
β-sitosterol	0.331	-0.164	-0.335	-0.231	-0.296	-0.399	-0.236	-0.597	-0.380	-0.114	-0.463	-0.340	0.770	0.790	0.265	0.117	-0.304	0.322	-0.116	-0.654	-0.047	0.457	1.000	

	FW	DW	Chl a (A)	Chl b (A)	Total chl (A)	Carotenoid (A)	Chl a (D)	Chl b (D)	Total chl (D)	Carotenoid (D)	Soluble sugar	Proline	MDA	H2O2	DPPH activity	TPC	TFC	SOD	GPX	CAT	PPO	Lupeol	β-sitosterol	c
FW	1.000																							
DW	0.860	1.000																						
Chl a (A)	0.397	0.790	1.000																					
Chl b (A)	0.153	0.628	0.961	1.000																				
Total chl (A)	0.284	0.720	0.991	0.989	1.000																			
Carotenoid (A)	0.630	0.925	0.962	0.861	0.923	1.000																		
Chl a (D)	0.336	0.751	0.998	0.978	0.998	0.943	1.000																	
Chl b (D)	0.463	0.832	0.997	0.941	0.980	0.980	0.990	1.000																
Total chl (D)	0.387	0.785	1.000	0.965	0.993	0.960	0.998	0.996	1.000															
Carotenoid (D)	0.598	0.865	0.951	0.831	0.903	0.974	0.929	0.965	0.946	1.000														
Soluble sugar	-0.233	0.292	0.788	0.925	0.861	0.603	0.829	0.743	0.796	0.576	1.000													
Proline	0.389	0.804	0.978	0.964	0.981	0.948	0.979	0.976	0.980	0.889	0.803	1.000												
MDA	-0.637	-0.937	-0.896	-0.822	-0.869	-0.954	-0.879	-0.917	-0.896	-0.862	-0.575	-0.944	1.000											
H2O2	-0.359	-0.785	-0.958	-0.960	-0.969	-0.925	-0.963	-0.955	-0.962	-0.850	-0.814	-0.997	0.943	1.000										
DPPH activity	0.939	0.963	0.684	0.468	0.587	0.852	0.633	0.735	0.675	0.837	0.097	0.656	-0.814	-0.620	1.000									
TPC	0.586	0.917	0.939	0.874	0.917	0.974	0.926	0.955	0.940	0.899	0.643	0.972	-0.994	-0.967	0.794	1.000								
TFC	0.251	0.703	0.898	0.942	0.928	0.846	0.911	0.889	0.904	0.743	0.844	0.967	-0.906	-0.984	0.503	0.924	1.000							
SOD	0.894	0.703	0.354	0.083	0.228	0.549	0.291	0.412	0.340	0.622	-0.280	0.253	-0.425	-0.193	0.868	0.410	0.034	1.000						
GPX	0.778	0.938	0.863	0.691	0.789	0.953	0.827	0.895	0.856	0.969	0.371	0.808	-0.862	-0.766	0.946	0.876	0.646	0.773	1.000					
CAT	0.861	0.650	0.311	0.039	0.184	0.501	0.248	0.367	0.297	0.588	-0.313	0.199	-0.361	-0.135	0.830	0.350	-0.029	0.997	0.738	1.000				
PPO	0.988	0.854	0.441	0.186	0.324	0.659	0.379	0.504	0.430	0.661	-0.201	0.402	-0.620	-0.361	0.955	0.583	0.232	0.949	0.826	0.923	1.000			
Lupeol	-0.472	-0.416	0.029	0.060	0.044	-0.140	0.048	-0.013	0.024	0.067	0.201	-0.151	0.410	0.203	-0.308	-0.311	-0.274	-0.042	-0.077	0.018	-0.329	1.000		
β-sitosterol	-0.249	0.279	0.763	0.911	0.841	0.579	0.805	0.718	0.772	0.534	0.996	0.795	-0.576	-0.813	0.069	0.637	0.855	-0.330	0.332	-0.366	-0.230	0.136	1.000	

Supplementary Fig. S1. Correlation analysis values between morph-physio-biochemical parameters and metabolite productions under various nanomaterials treatment: (a) ZnONPs, (b) SiO₂NPs, and (c) MWCNTs.