

# Supplementary Materials

**Table S1.** Insecticidal activity of crude tannin extracts of *S. wightii*, *S. polypodioides* and *T. ornata* (0.025, 0.05, 0.1 and 0.2%), standards (gallic acid and tannic acid) (0.025, 0.05, 0.1 and 0.2%) and commercial insecticides (Vijayneem and Monocrotophos-0.03%) on *A. devastans* nymphs and adults (male/female at random) mortality (%) after 96 h exposure on the basis of oral and contact toxicity bioassays (n = 25, x ± SE).

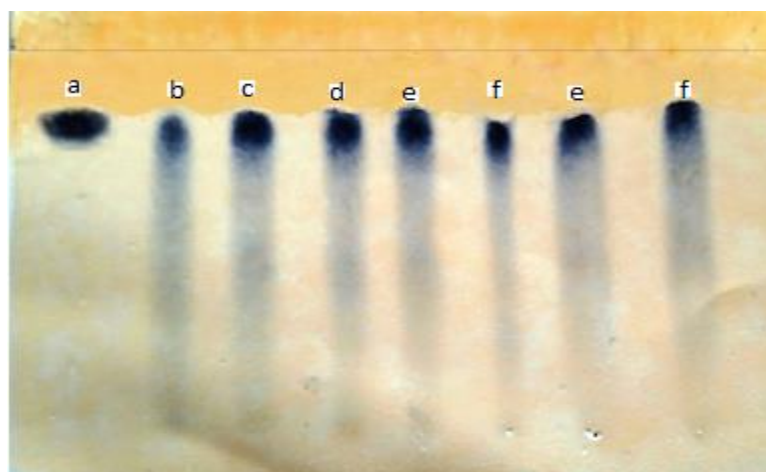
Seaweeds	Concentrations (%)	Adults		Nymphs	
		Oral toxicity	Contact toxicity	Oral toxicity	Contact toxicity
<i>S. wightii</i>	0.025	28.0±4.9 <sup>cB</sup>	32.0±8.0 <sup>cdA</sup>	16.0±4.0 <sup>dB</sup>	20.0±6.3 <sup>dA</sup>
	0.05	44.0±7.5 <sup>bA</sup>	40.0±8.9 <sup>cB</sup>	32.0±10.2 <sup>cB</sup>	44.0±4.0 <sup>cA</sup>
	0.1	64.0±7.5 <sup>aA</sup>	60.0±8.9 <sup>bB</sup>	56.0±7.5 <sup>bA</sup>	56.0±4.0 <sup>bA</sup>
	0.2	64.0±7.5 <sup>aB</sup>	88.0±4.9 <sup>aA</sup>	76.0±4.0 <sup>aAB</sup>	80.0±6.3 <sup>aA</sup>
<i>S. polypodioides</i>	0.025	36.0±7.5 <sup>dB</sup>	40.0±10.9 <sup>cdA</sup>	24.0±9.0 <sup>dA</sup>	16.0±4.9 <sup>daB</sup>
	0.05	56.0±4.0 <sup>cA</sup>	44.0±7.4 <sup>cB</sup>	52.0±10.2 <sup>bcA</sup>	40.0±6.3 <sup>cB</sup>
	0.1	76.0±7.5 <sup>bA</sup>	68.0±4.9 <sup>bB</sup>	56.0±4.0 <sup>bA</sup>	56.0±9.9 <sup>bA</sup>
	0.2	88.0±4.9 <sup>aA</sup>	84.0±7.5 <sup>aAB</sup>	76.0±4.0 <sup>aA</sup>	60.0±14.2 <sup>aB</sup>
<i>T. ornata</i>	0.025	28.0±8.0 <sup>bD</sup>	40.0±0.1 <sup>dA</sup>	36.0±11.7 <sup>dA</sup>	12.0±4.9 <sup>dB</sup>
	0.05	44.0±7.5 <sup>bC</sup>	60.0±0.1 <sup>cA</sup>	56.0±7.5 <sup>cA</sup>	36.0±7.5 <sup>cB</sup>
	0.1	68.0±4.9 <sup>bB</sup>	72.0±10.2 <sup>abA</sup>	60.0±1.2 <sup>bA</sup>	52.0±4.9 <sup>bB</sup>
	0.2	80.0±9.0 <sup>aA</sup>	80.0±6.3 <sup>aA</sup>	72.0±4.0 <sup>aA</sup>	60.0±6.3 <sup>aB</sup>
Gallic acid	0.025	36.0±4.0 <sup>aD</sup>	36.0±3.9 <sup>dA</sup>	32.0±1.8 <sup>dA</sup>	20.0±6.3 <sup>dB</sup>
	0.05	56.0±9.8 <sup>cA</sup>	54.0±7.5 <sup>cAB</sup>	56.0±7.5 <sup>cA</sup>	44.0±4.0 <sup>cB</sup>
	0.1	68.0±4.9 <sup>abA</sup>	64.0±7.5 <sup>bB</sup>	72.0±8.0 <sup>abA</sup>	64.0±7.4 <sup>bB</sup>
	0.2	72.0±2.0 <sup>aB</sup>	84.0±11.7 <sup>aA</sup>	76.0±9.8 <sup>aB</sup>	80.0±6.3 <sup>aA</sup>
Tannic acid	0.025	36.0±7.5 <sup>cdA</sup>	32.0±12.0 <sup>dB</sup>	28.0±4.9 <sup>dA</sup>	28.0±4.9 <sup>dA</sup>
	0.05	44.0±7.5 <sup>cB</sup>	48.0±4.9 <sup>cA</sup>	40.0±2.6 <sup>cB</sup>	48.0±4.9 <sup>cA</sup>
	0.1	60.0±9.0 <sup>bA</sup>	56.0±7.5 <sup>bB</sup>	64.0±3.2 <sup>bA</sup>	56.0±7.5 <sup>bB</sup>
	0.2	76.0±7.5 <sup>aA</sup>	72.0±3.8 <sup>aB</sup>	80.0±0.9 <sup>aA</sup>	76.0±7.5 <sup>aAB</sup>
Vijayneem	0.03	60.0±6.3 <sup>aA</sup>	52.0±4.9 <sup>aB</sup>	52.0±4.9 <sup>aA</sup>	56.0±7.5 <sup>aA</sup>
Monocrotophos	0.03	84.0±4.0 <sup>aA</sup>	72.0±5.7 <sup>bB</sup>	80.0±8.9 <sup>aA</sup>	80.0±6.3 <sup>aA</sup>

The same lowercase letters in a column for each plants and standards separately indicate no significant difference in the Tukey test ( $P < 0.05$ ). The same uppercase letters indicate no significant difference in the Tukey test ( $P < 0.05$ ) between oral and contact toxicity bioassays of adults and nymphs separately.

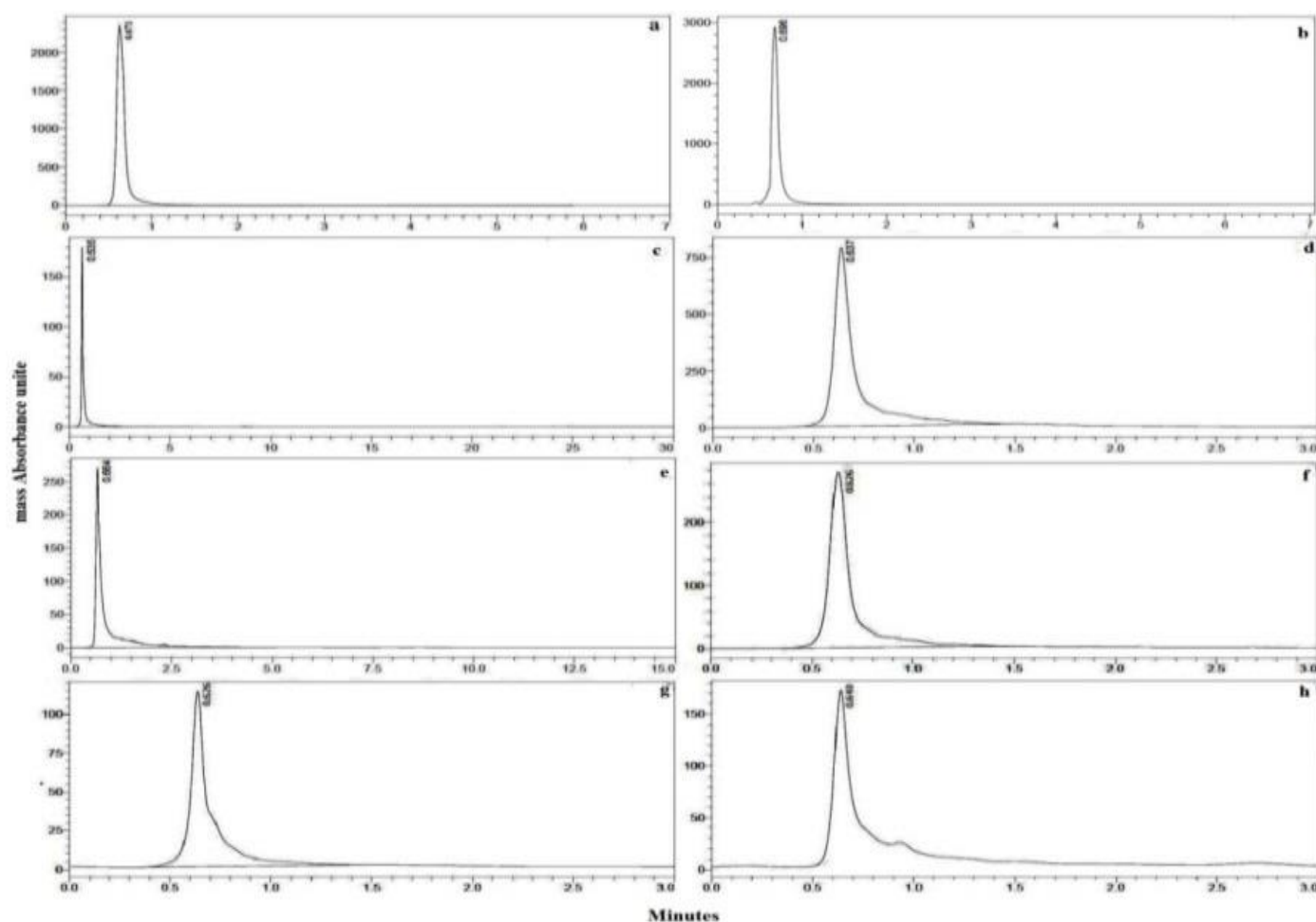
**Table S2.** Impact of tannin fractions (F1 Rf—0.86 and F2 Rf—0.88) of *S. wightii*, *S. polypodioides* and *T. ornata*; standards (gallic acid/tannic acid) (0.0075, 0.015, 0.03, 0.06 and 0.12%) and commercial insecticides (Vijayneem/Monocrotophos-0.03%) on *A. devastans* adult (male/female at random) mortality (%) after 96 h exposure during oral and contact toxicity bioassays (n = 30, x ± SE).

Seaweeds extract /tannin standards	Concentrations	Oral toxicity—adult		Contact toxicity—adult	
		Fraction 1	Fraction 2	Fraction 1	Fraction 2
<i>S. wightii</i>	0.0075	46.7±4.1 <sup>dA</sup>	30.0±8.6 <sup>eB</sup>	33.3±12.3 <sup>eB</sup>	40.0±10.3 <sup>deA</sup>
	0.015	70.0±6.8 <sup>cA</sup>	46.7±9.9 <sup>dB</sup>	40.0±7.3 <sup>dB</sup>	43.3±8.0 <sup>dA</sup>
	0.03	76.7±8.0 <sup>bcA</sup>	63.3±14. <sup>bcB</sup>	60.0±5.2 <sup>bcA</sup>	60.0±8.9 <sup>bcA</sup>
	0.06	76.7±6.1 <sup>bcA</sup>	66.7±6.7 <sup>bB</sup>	63.3±6.1 <sup>bA</sup>	63.3±6.2 <sup>bA</sup>
	0.12	83.3±6.1 <sup>aB</sup>	90.0±4.5 <sup>aA</sup>	73.3±8.4 <sup>aB</sup>	76.7±10.8 <sup>aA</sup>
<i>S. polypodioides</i>	0.0075	30.0±8.7 <sup>eB</sup>	36.7±3.3 <sup>eA</sup>	23.3±8.0 <sup>eB</sup>	36.7±8.0 <sup>deA</sup>
	0.015	60.0±5.2 <sup>cdA</sup>	43.3±6.1 <sup>dB</sup>	40.0±7.3 <sup>dB</sup>	43.3±6.1 <sup>dA</sup>
	0.03	63.3±9.5 <sup>bcA</sup>	60.0±7.3 <sup>cB</sup>	53.3±6.7 <sup>bcB</sup>	60.0±5.2 <sup>bcA</sup>
	0.06	66.7±2.3 <sup>bB</sup>	76.7±8.0 <sup>bA</sup>	56.7±3.3 <sup>bB</sup>	63.3±8.0 <sup>abA</sup>
	0.12	83.3±8.0 <sup>aB</sup>	86.7±5.3 <sup>aA</sup>	66.7±6.7 <sup>aB</sup>	70.0±6.8 <sup>aA</sup>
<i>T. ornata</i>	0.0075	40.0±5.2 <sup>dB</sup>	43.3±8.0 <sup>dA</sup>	30.0±8.6 <sup>dB</sup>	46.7±4.2 <sup>dA</sup>
	0.015	40.0±5.7 <sup>dB</sup>	50.0±12.4 <sup>cdA</sup>	43.3±8.0 <sup>cB</sup>	50.0±4.5 <sup>cA</sup>
	0.03	60.0±7.3 <sup>cA</sup>	53.3±6.7 <sup>cB</sup>	50.0±8.6 <sup>bB</sup>	53.3±6.7 <sup>cA</sup>
	0.06	76.7±6.1 <sup>bA</sup>	60.0±5.2 <sup>bB</sup>	50.0±10.0 <sup>bB</sup>	63.3±8.0 <sup>bA</sup>
	0.12	80.0±7.3 <sup>aA</sup>	83.3±6.1 <sup>aA</sup>	63.3±8.0 <sup>aB</sup>	70.0±10.0 <sup>aA</sup>
Gallic acid	0.0075	30.0±8.6 <sup>e</sup>		43.3±8.0 <sup>de</sup>	
	0.015	43.3±1.8 <sup>cd</sup>		46.7±6.7 <sup>d</sup>	
	0.03	53.3±6.7 <sup>c</sup>		53.3±6.7 <sup>bc</sup>	
	0.06	73.3±6.7 <sup>b</sup>		56.7±14.1 <sup>b</sup>	
	0.12	83.3±6.1 <sup>a</sup>		73.3±8.4 <sup>a</sup>	
Tannic acid	0.0075	26.7±8.4 <sup>d</sup>		40.0±8.9 <sup>cd</sup>	
	0.015	46.4±6.7 <sup>c</sup>		46.7±6.7 <sup>bc</sup>	
	0.03	56.7±6.1 <sup>b</sup>		53.3±4.2 <sup>bc</sup>	
	0.06	73.3±9.9 <sup>a</sup>		56.7±6.1 <sup>b</sup>	
	0.12	73.3±8.4 <sup>a</sup>		66.7±6.7 <sup>a</sup>	
Vijayneem	0.03	60.0±5.2 <sup>a</sup>		56.7±12.0 <sup>a</sup>	
Monocrotophos	0.03	80.0±5.2 <sup>a</sup>		60.0±8.9 <sup>a</sup>	

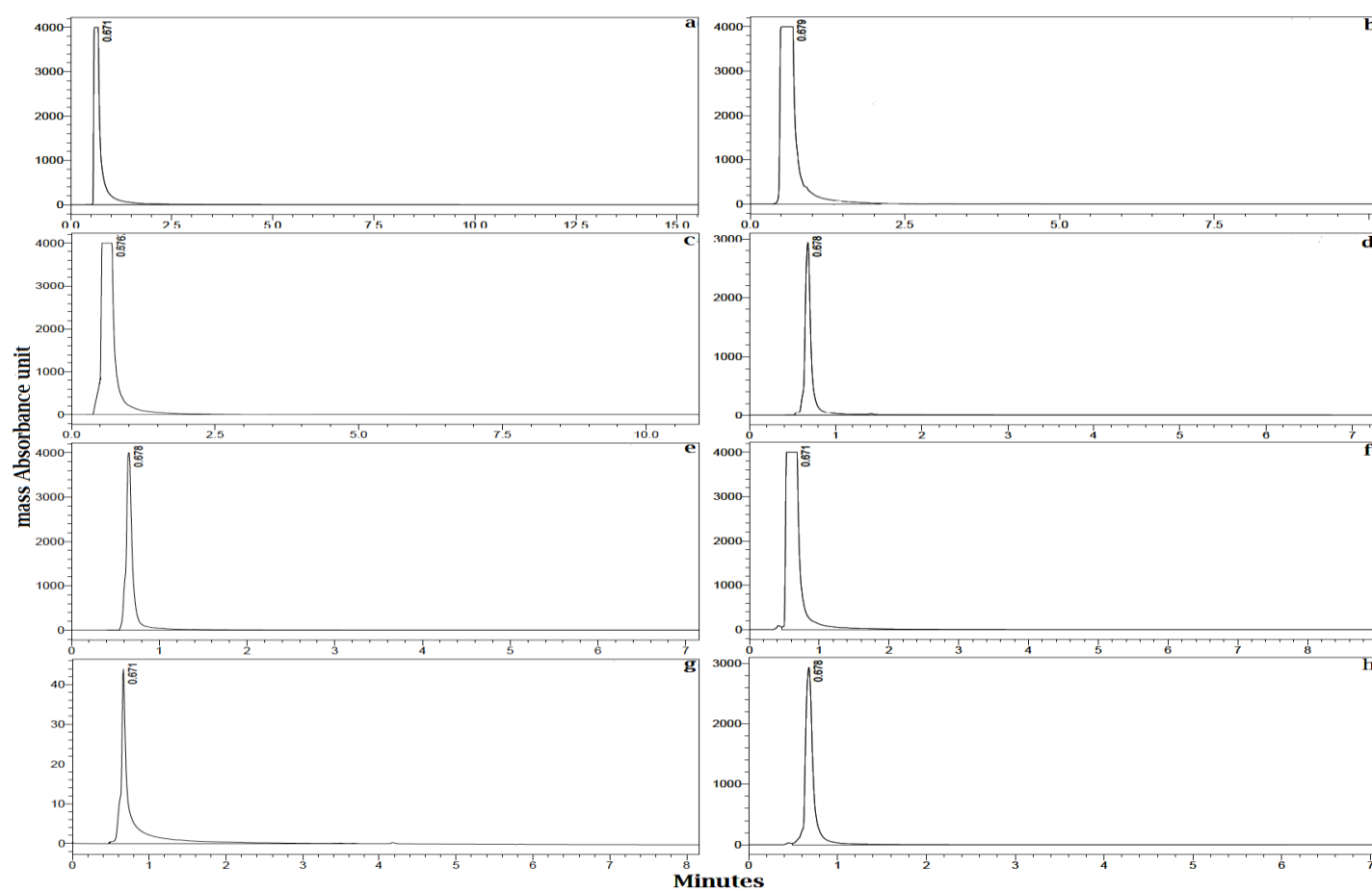
The same lowercase letters in a column for each plants and standards separately indicate no significant difference in the Tukey test ( $P < 0.05$ ). The same uppercase letters indicate no significant difference in the Tukey test ( $P < 0.05$ ) between F1 and F2 of oral and contact toxicity bioassays of adults and nymphs separately.



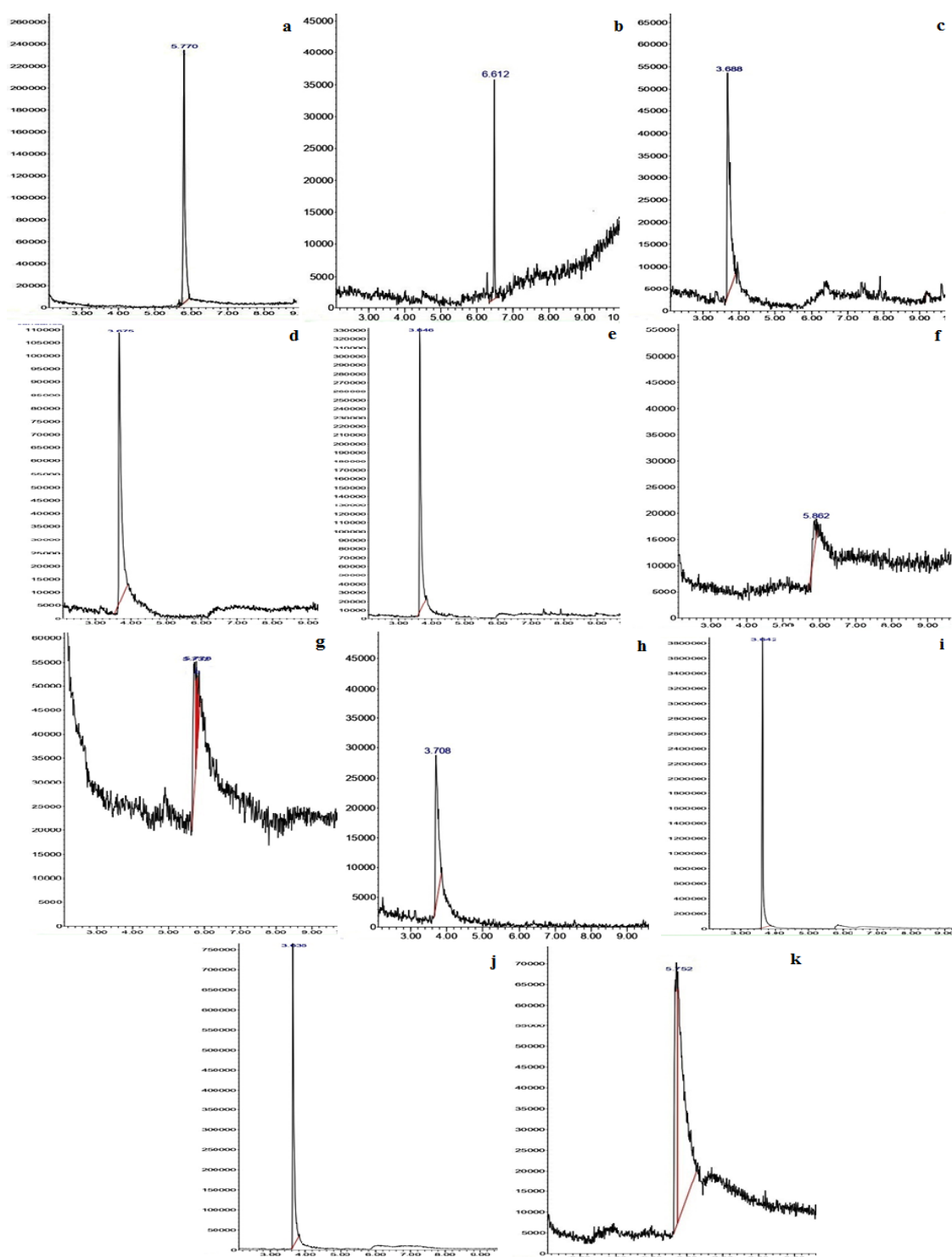
**Figure S1.** Photograph showing the TLC analysis of the standards (a) gallic acid, (b) tannic acid, (c) *S. wightii* F1, (d) *S. polypodioides* F1, (e) *T. ornata* F1, (f) *S. wightii* F2, (g) *S. polypodioides* F2 and (h) *T. ornata* F2. Tannic and gallic acids were processed in TLC 10 times, and samples were processed three times in TLC.



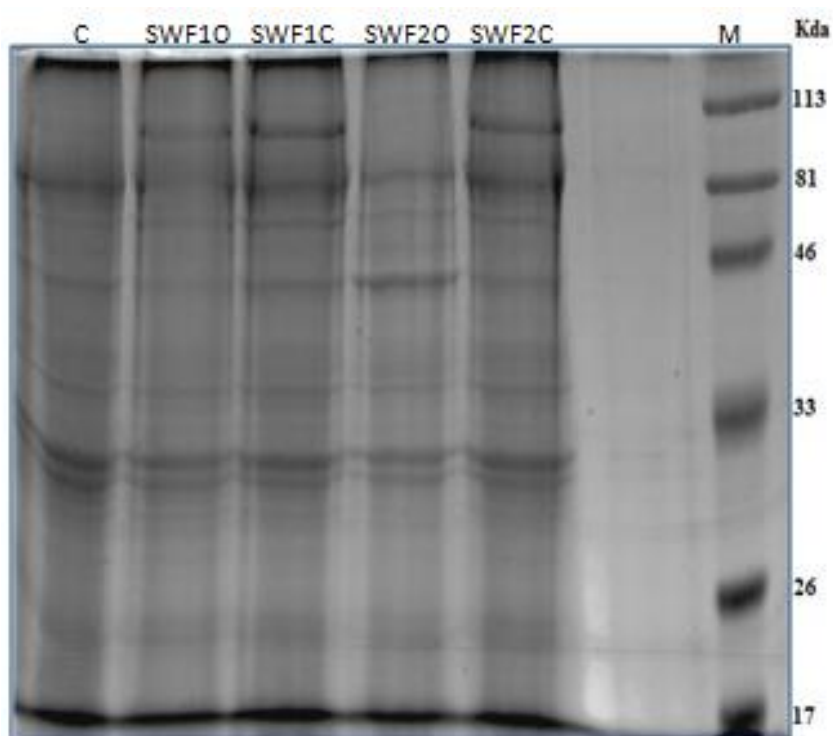
**Figure S2.** HPLC analysis of standard gallic acid (a) and tannic acid (b), and crude tannin extracted from *S. wightii* (c), *S. polypodioides* (d) and *T. ornata* (e) using the Soxhlet method and *S. wightii* (f), *S. polypodioides* (g) and *T. ornata* (h) using the cold percolation method.



**Figure S3.** HPLC analysis of gallic acid (a) and tannic acid (b), and brown algae *S. wightii* F1(c), *S. wightii* F2 (d), *S. polypodioides* F1 (e), *S. polypodioides* F2 (f), *T. ornata* F1 (g) and *T. ornata* F2 (h).



**Figure S4.** GC-MS analysis of gallic acid (a) and tannic acid (b), and drifted brown seaweed tannin crude extracts *S. wightii* (c), *S. polypodioides* (d) and *T. ornata* (e), *S. wightii* F1 (f), *S. polypodioides* F1 (g), *T. ornata* F1 (h), *S. wightii* F2 (i), *S. polypodioides* F2 (j) and *T. ornata* F2 (k).



**Figure S5.** Effects of  $LC_{50}$  concentrations of seaweed tannin fractions on whole-body protein SDS-PAGE of *A. devastans* adults. C—control; SWF1O—*S.wightii* tannin F1 (oral toxicity); SWF2C—*S. wightii* tannin F1 (contact toxicity); SWF2O—*S. wightii* tannin F2 (oral toxicity); SWF2C—*S. wightii* tannin F2 (contact toxicity); and M—marker.