Note

Specificities of Bio-antimutagens
in Plant Kingdom

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Desmutagens are defined as agents that inactivate chemical mutagens by working directly on them.¹⁾ On the other hand, we like to call bio-antimutagens those agents suppressing cellular mutagenesis. Bio-antimutagens of diverse chemical types have been recently isolated from different plants and characterized, for example, proto-anemonin from *Ranunculus*,²⁾ cinnamaldehyde from cinnamon,³⁾ and enmein from *Enmeiso*.⁴⁾ Since these antimutagens were isolated with the criterion of reducing

the frequency of UV-induced mutations of *E. coli* B/r *trp* involving the SOS DNA-repair function, it is interesting to know if antimutagenic factors of similar specificities exist universally in the plant kingdom. The other implication of surveying them in plants relates to their functions. We previously found that a typical bio-antimutagen such as cobaltous chloride working in UV-induced mutations in the above *E. coli* B/r strain also antagonized to a high frequency mutations due to a temperature-sensitive DNA-polymerase III in *B. subtilis*.^{5,6)} Therefore, it is interesting to examine if the UV-induced SOS repair might involve a kind of DNA-replicating polymerase, as suggested by Bridges *et al.*⁷⁾

We checked the bio-antimutagenic capacities of extracts obtained from 303 different plants (Table I) with criteria of suppressing UV-induced mutations in *E. coli* B/r WP2 (*trp*) and the mutator activity in *B. subtilis* NIG1125 (*his met*). The spot tests were carried out using both strains for the experimental procedures which have already been described by Kakinuma *et al.*^{3,4)} For preparation of crude extracts, 3.5 g of plant tissues (mainly leaves and stems) of each plant were immersed in 14 ml of 80% methanol with vigorous stirring. part of the extract (usually 50 μ l) was soaked into a paper disk and placed on the surface of an MB agar plate on which test bacterial cells were spread. Appearance of zones consisting of normally grown bacterial cells without revertant colonies was the criterion of antimutagenicity.

Among 303 kinds of different plant extracts, 18 showed

TABLE I. LIST OF PLANTS FOR ASSAY

Tissues of the plant body used for extraction are indicated as follows.

At, aerial tuber; C, caulis; Fr, fruit; L, leaf; R, root; S, seed; St, stem; T, twig; FL, flower.

1. L, FL: <i>Aconitum chinense</i> (Torikabuto)	24. C: <i>Macleaya cordata</i> (Takenigusa)
2. L: <i>Aquilegia flabellata</i> (Odamaki)	25. L: <i>Macleaya cordata</i> (Takenigusa)
3. L: <i>Coptis japonica forma brachypetala</i> (Seribaôren)	26. S: <i>Chelidonium majus</i> var. <i>asiaticum</i> (Kusanoo)
4. R: <i>Coptis japonica forma brachypetala</i> (Seribaôren)	27. L: <i>Chelidonium majus</i> var. <i>asiaticum</i> (Kusanoo)
5. L: <i>Paeonia suffruticosa</i> (Botan)	28. L, C: <i>Eschscholzia californica</i> (Hanabisiso)
6. L: <i>Ranunculus quelpaertensis</i> (Kitunenobotan)	29. FL, Fr: <i>Corydalis platycarpa</i> (Kikeman)
7. L: <i>Ranunculus japonica</i> (Umanoasigata)	30. L: <i>Corydalis platycarpa</i> (Kikeman)
8. L, St: <i>Ranunculus sceleratus</i> (Tagarasi)	31. FL: <i>Corydalis incisa</i> (Murasakikikeman)
9. L, St: <i>Ranunculus nipponicus</i> var. <i>major</i> (Baikamo)	32. L: <i>Corydalis incisa</i> (Murasakikikeman)
10. FL: <i>Akebia quinata</i> (Akebi)	33. Fr: <i>Elaeocarpus photiniifolius</i> (Simahorutonoki)
11. L: <i>Stauntonia hexaphylla</i> (Mube)	34. S: <i>Gossypium indisum</i> (Watanomi)
12. L: <i>Mahonia japonica</i> (Hiiraginanten)	35. L: <i>Malva sylvestris</i> var. <i>mauritanica</i> (1) (Zeniao)
13. L: <i>Nandina domestica</i> (Nanten)	36. L: <i>Malva sylvestris</i> var. <i>mauritanica</i> (2) (Zeniao)
14. Fr: <i>Nandina domestica</i> (Nanten)	37. L, T: <i>Hibiscus syriacus</i> (Mukuge)
15. L: <i>Lindera glauca</i> (Yamakôbasi)	38. L: <i>Cleyera japonica</i> (Sakaki)
16. T: <i>Lindera glauca</i> (Yamakôbasi)	39. L: <i>Camellia japonica</i> (Tubaki)
17. L: <i>Lindera obtusiloba</i> (Dankôbai)	40. FL: <i>Camellia japonica</i> (Tubaki)
18. L, Fr: <i>Lindera strychnifolia</i> (Tendaiyaku)	41. L: <i>Gracina subelliptica</i> (Fuguki)
19. L: <i>Cinnamomum sieboldii</i> (Nikkei)	42. L: <i>Calophyllum inophyllum</i> (Terihaboku)
20. L: <i>Cinnamomum camphora</i> (Kusunoki)	43. FL: <i>Hypericum patulum</i> (1) (Kinsibai)
21. L: <i>Actinodaphne longifolia</i> (Baribarinoki)	44. L: <i>Hypericum patulum</i> (1) (Kinsibai)
22. L: <i>Parabenzoïn trilobum</i> (Siromoz)	45. L: <i>Hypericum patulum</i> (2) (Kinsibai)
23. L, FL: <i>Papaver rhoeas</i> (Hinages)	46. L: <i>Eucalyptus globulus</i> (Yûkari)

TABLE I (continued).

47. L, Young: <i>Eucalyptus globulus</i> (Yûkari)	104. Fr: <i>Liriope minor</i> (Himeyaburan)
48. Fr: <i>Eucalyptus globulus</i> (Yûkari)	105. L: <i>Rohdea japonica</i> (Omoto)
49. L.: <i>Alangium plantanifolium</i> var. (Urinoki)	106. L: <i>Xanthoxylum pipertum</i> (Sansyo)
50. Fr: <i>Punica granatum</i> (Zakuro)	107. Fr: <i>Geranium nepalense</i> (Gennosyôko)
51. L, C: <i>Bixa orellana</i> (Beninoki)	108. L: <i>Geranium nepalense</i> (Gennosyôko)
52. L: <i>Viola grypceras</i> (Tatitubosumire)	109. L, C: <i>Oxalis martiana</i> (Murasakikatabami)
53. L: <i>Psidium guajava</i> (Banzirô)	110. L, C, F1: <i>Oxalis corniculata</i> (Katabami)
54. Fr: <i>Psidium guajava</i> (Banzirô)	111. Fr: <i>Citrus tamurana</i> (Konatumikan)
55. Fr: <i>Aralia cordata</i> (Udo)	112. Fr: <i>Citrus unshiu</i> (Unsyûmikan)
56. L: <i>Dendropanax trifidus</i> (Kakuremino)	113. L: <i>Skimmia japonica</i> (Miyamasikimi)
57. Fr: <i>Fatsia japonica</i> (Yatude)	114. F1: <i>Skimmia japonica</i> (Miyamasikimi)
58. Fr: <i>Fatsia japonica</i> (Wakayama) (Yatude)	115. Fr: <i>Skimmia japonica</i> (Miyamasikimi)
59. L: <i>Fatsia japonica</i> (Yatude)	116. L: <i>Phellodendron amurense</i> (Kihada)
60. L: <i>Cryptotaenia japonica</i> (Mituba)	117. T: <i>Phellodendron amurense</i> (Kihada)
61. L: <i>Chamaele decumbens</i> (Sentôsô)	118. L, St: <i>Maytenus diversifolia</i> (Hariturumasaki)
62. L: <i>Hydrocotyle sibthorpioides</i> (Tidomegusa)	119. L, C: <i>Polygala japonica</i> (Himehagi)
63. R, L: <i>Panax Schinseng</i> var. <i>japonicas</i> (Totibaninzin)	120. L, T: <i>Canarium album</i> (Kanran)
64. L: <i>Panax Schinseng</i> (Tyosenninzin)	121. L: <i>Picrasma quassoides</i> (Nigaki)
65. R: <i>Daucus carota</i> (Ninzin)	122. Fr: <i>Fortunella japonica</i> (Kinkan)
66. L: <i>Hedera rhombea</i> (Kizuta)	123. L, T: <i>Toona sinensis</i> (Tyantin)
67. Fr: <i>Hedera rhombea</i> (Kizuta)	124. L: <i>Rhododendron pentaphyllum</i> (Akagitutuzi)
68. L, C: <i>Cnidium officinale</i> (Senkyû)	125. L, C: <i>Chrysosplenium grayanum</i> (Yukinosita)
69. R: <i>Cnidium officinale</i> (Senkyû)	126. L: <i>Aleurites cordata</i> (Aburagiri)
70. L, C: <i>Foeniculum vulgare</i> (Uikyô)	127. L, C, F1: <i>Mercurialis leiocarta</i> (Yamaai)
71. L: <i>Helwingia japonica</i> (Hanaikada)	128. L, T: <i>Mallotus japonicus</i> (Akamegasiwa)
72. L: <i>Petroselinum crispum</i> (Paseri)	129. Fr: <i>Ilex crenata</i> (Inutuge)
73. L, F1: <i>Briza maxima</i> (Kobansô)	130. L: <i>Ilex crenata</i> (Inutuge)
74. L, Fr: <i>Hordeum vulgare</i> var. <i>hexastichon</i> (Oomugi)	131. L, T: <i>Rhus orientalis</i> (Tutaurusi)
75. L: <i>Phyllostachys pubescens</i> (Môsôtiku)	132. L: <i>Buxus microphylla</i> var. <i>suffruticosa</i> (Tuge)
76. L, C, F1: <i>Melica nutans</i> (Komegaya)	133. Fr: <i>Buxus microphylla</i> var. <i>suffruticosa</i> (Tuge)
77. L, C: <i>Pinellia ternata</i> (Karasubisyaku)	134. L: <i>Eucommia ulmoides</i> (Totyû)
78. L: <i>Zantedeschia aethiopica</i> (Orandakaiu)	135. L, T: <i>Celastrus orbiculatus</i> (Uruumemodoki)
79. R: <i>Acorus gramineus</i> (Sekisyô)	136. S: <i>Acer</i> sp. (Kaede)
80. L: <i>Acorus gramineus</i> (Sekisyô)	137. S: <i>Litchi chinensis</i> (Reisi)
81. L: <i>Acorus calamus</i> var. <i>asiaticus</i> (Syôbu)	138. L: <i>Litchi chinensis</i> (Reisi)
82. Fr: <i>Annas comosus</i> (Painappuru)	139. L: <i>Litchi chinensis</i> (Kanton) (Reisi)
83. L: <i>Annas comosus</i> (Painappuru)	140. T: <i>Litchi chinensis</i> (Reisi)
84. L: <i>Arisaema monophyllum</i> (Hitotubanantenshô)	141. L: <i>Parthenocissus tricuspidata</i> (Tuta)
85. F1: <i>Arisaema monophyllum</i> (Hitotubanantenshô)	142. L, T: <i>Vitis vinifera</i> (Budô)
86. L: <i>Rhaphidophora pinnata</i> (Habukazura)	143. L: <i>Zizyphus jujuba</i> (Sanebutonatume)
87. L: <i>Tradescantia reflexa</i> (Murasakituyukusa)	144. L: <i>Ajuga decumbens</i> (1) (Kiransô)
88. C: <i>Tradescantia reflexa</i> (Murasakituyukusa)	145. L: <i>Ajuga decumbens</i> (2) (Kiransô)
89. F1: <i>Tradescantia reflexa</i> (Murasakituyukusa)	146. L: <i>Ajuga decumbens</i> (3) (Kiransô)
90. L: <i>Allium tuberosum</i> (Nira)	147. R: <i>Ajuga decumbens</i> var. (Seiyo) (Seiyôkiranso)
91. L, C, F1: <i>Tricyrtis hirta</i> (Hototogisu)	148. L: <i>Vitex rotundifolia</i> (Hamagô)
92. L, C: <i>Asparagus cochinchinensis</i> (Tenmondo)	149. C: <i>Vitex rotundifolia</i> (Hamagô)
93. L: <i>Mallotus japonicus</i> (Akamegasiwa)	150. L: <i>Lantana camara</i> (Rantana)
94. L: <i>Lilium lancifolium</i> (Oniuri)	151. L: <i>Callicarpa japonica</i> (Murasakisikibu)
95. R: <i>Lilium lancifolium</i> (Oniyuri)	152. L: <i>Perilla frutescens</i> (Siso)
96. At: <i>Lilium lancifolium</i> (Oniyuri)	153. F1: <i>Salvia officinalis</i> (Sarubia)
97. L, C: <i>Disporum sessile</i> (Hôtyakusô)	154. L, C: <i>Lamium album</i> var. <i>barbatum</i> (Odorikosô)
98. L: <i>Disporum smilacinum</i> (Tigoyuri)	155. L: <i>Glechoma hederacea</i> (Kakidôsi)
99. R: <i>Disporum smilacinum</i> (Tigoyuri)	156. L, C: <i>Meehania urticifolia</i> (Rasyômonkazura)
100. Fr: <i>Asparagus officinalis</i> (Asuparagasu)	157. L: <i>Rabdosia japonica</i> (Hikiokosi)
101. R: <i>Asparagus cochinchinensis</i> (Tenmondô)	158. L: <i>Solanum lyratum</i> (Hiyodorisyôgo)
102. L: <i>Ophiopogon japonicus</i> (1) (Ryûnohige)	159. L: <i>Hyoscyamus niger</i> (Hiyosu)
103. L: <i>Ophiopogon japonicus</i> (2) (Zyanohige)	160. R: <i>Hyoscyamus niger</i> (Hiyosu)

TABLE I (continued)

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161. C: <i>Scopolia japonica</i> (Hasiridokoro)	217. L: <i>Derris malaccensis</i> (Tatitoba)
162. L: <i>Scopolia japonica</i> (Hasiridokoro)	218. L: <i>Trifolium repens</i> (Sirotumegusa)
163. L: <i>Lycium chinense</i> (Kuko)	219. L: <i>Acacia confusa</i> (Sôsizeyu)
164. F1: <i>Digitalis purpurea</i> (Zikitarisu)	220. T: <i>Sophora</i> sp. (Sidareenzyu)
165. L, C: <i>Veronica persica</i> (Ooinunofuburi)	221. L: <i>Sophora</i> sp. (Sidareenzyu)
166. L, C: <i>Mazus miquelii</i> (Murasakisagiko)	222. L: <i>Pueraria lobata</i> (Kuzu)
167. L, C: <i>Vandellia crustacea</i> (Urikusa)	223. L, C: <i>Vicia satiba</i> (Karasunoendô)
168. F1: <i>Paulownia tomentosa</i> (Kiri)	224. L, C: <i>Vicia hirsuta</i> (Suzumenoendô)
169. L: <i>Paulownia tomentosa</i> (Kiri)	225. L, C: <i>Astragalus sinicus</i> (Renge)
170. L, C: <i>Plantago lanceolata</i> (1) (Heraoobako)	226. L: <i>Phaseolus</i> sp. (Kuzuingen)
171. R: <i>Plantago lanceolata</i> (2) (Heraoobako)	227. F1: <i>Erythrina crista-galli</i> (Amerikadeigo)
172. L, C: <i>Plantago lanceolata</i> (2) (Heraoobako)	228. L: <i>Leguminosa</i> (1) (Mame-ka)
173. L: <i>Digitalis purpurea</i> (Zikitarisu)	229. L: <i>Leguminosa</i> (2) (Mame-ka)
174. L: <i>Gardenia jasminoides</i> (Kutinas)	230. L: <i>Leguminosa</i> (3) (Mame-ka)
175. L: <i>Paederia scandens</i> (Hekusokazura)	231. Fr: <i>Pongamia pinnata</i> (Kuroyona)
176. Fr: <i>Paederia scandens</i> (Hekusokazura)	232. L: <i>Lonicera japonica</i> (Suikazura)
177. Fr: <i>Psychotria rubra</i> (Ryûkyûaoki)	233. F1: <i>Lonicera japonica</i> (Suikazura)
178. L: <i>Psychotria rubra</i> (Ryûkyûaoki)	234. F1: <i>Viburnum sieboldi</i> (Gomagi)
179. L, C: <i>Rubia codifolia</i> L. var. <i>Mungista</i> (Akane)	235. L: <i>Viburnum sieboldi</i> (Gomagi)
180. L: <i>Mitchella undulata</i> (Turuaridôsi)	236. F1: <i>Viburnum wrightii</i> (Miyamagamazumi)
181. L: <i>Galium spurium</i> L. var. <i>echinospermon</i> (Yaemugura)	237. L: <i>Viburnum wrightii</i> (Miyamagamazumi)
182. L: <i>Scaevola frutescens</i> var. <i>sericea</i> (Kusatobera)	238. L: <i>Sambucus sieboldiana</i> (Niwatoko)
183. L, C: <i>Sedum alboroseum</i> (Benkeiso)	239. L: <i>Weigela hortensis</i> (Takoutugi)
184. L: <i>Sedum alboroseum</i> (Benkeiso)	240. F1: <i>Weigela coraeensis</i> (Hakoneutugi)
185. F1: <i>Sedum subtile</i> (Himerenge)	241. L: <i>Weigela coraeensis</i> (Hakoneutugi)
186. F1, C: <i>Sedum japonicum</i> (Menomannengusa)	242. L: <i>Valeriana sambucifolia</i> (Kanokosô)
187. L: <i>Cardamine scutata</i> (Oobatanetukebana)	243. L: <i>Melothria japonica</i> (Okinawa)
188. C: <i>Rorippa indica</i> (Inugasira)	(Okinawasuzumeuri)
189. L: <i>Mitella japonica</i> (Tyarumerusô)	244. Fr: <i>Melothria japonica</i> (Okinawa)
190. F1, C: <i>Mitella japonica</i> (Tyarumerasô)	(Okinawasuzumeuri)
191. L: <i>Chrysosplenium japonicum</i> (Yamanekonomesô)	245. Fr: <i>Melothria japonica</i> (Suzumeuri)
192. L: <i>Chrysosplenium grayanum</i> (Nekonomesô)	246. L: <i>Gnaphalium affine</i> (Hahakogusa)
193. L: <i>Saxifraga stolonifera</i> (Yukinosita)	247. L, C: <i>Erigeron philadelphicus</i> (Haruzyoön)
194. L: <i>Sedum bulbiferum</i> (Komotimannengusa)	248. F1: <i>Erigeron philadelphicus</i> (Haruzyoön)
195. L: <i>Schizophragma hydrangeoides</i> (Iwagarami)	249. L: <i>Erigeron thunbergii</i> (Azumagiku)
196. L: <i>Deutzia gracilis</i> (Himeutugi)	250. F1: <i>Erigeron thunbergii</i> (Azumagiku)
197. L: <i>Philadelphus satsumi</i> (Baikautugi)	251. L: <i>Ligularia tusilaginea</i> (Tuwabuki)
198. F1: <i>Philadelphus satsumi</i> (Baikautugi)	252. F1: <i>Petasites japonicus</i> (Fuki)
199. Fr: <i>Pittosporum tobira</i> (Tobera)	253. L: <i>Petasites japonicus</i> (Fuki)
200. L: <i>Hydrangea macrophylla</i> (Amatya)	254. L, C: <i>Matricaria chamomilla</i> (Kamiture)
201. L, C: <i>Itea japonica</i> (Zuina)	255. L: <i>Chrysanthemum cinerariaefolium</i> (Sirobanamusyokegiku)
202. F1: <i>Itea japonica</i> (Zuina)	256. L: <i>Achillea sibirica</i> (Nokogiriso)
203. Fr: <i>Pyracantha angustifolia</i> (Pirakansasu)	257. L: <i>Oenothera tetraptera</i> (Tukimisô)
204. L: <i>Pyracantha angustifolia</i> (Pirakansasu)	258. L: <i>Oenothera strueta</i> (Matuyoigusa)
205. L: <i>Spiraea cantoniensis</i> (Kodemari)	259. F1: <i>Taraxacum officinale</i> (Seiyôtanpopo)
206. L: <i>Spiraea nipponica</i> (Simotuke)	260. L: <i>Atractylis ovata</i> (Okera)
207. L: <i>Distylium racemosum</i> (Yusunoki)	261. L, C: <i>Calendula officinalis</i> (Kinsenka)
208. Fr: <i>Distylium racemosum</i> (Yusunoki)	262. F1: <i>Calendula officinalis</i> (Kinsenka)
209. L: <i>Rosaceae</i> (Bara)	263. L: <i>Artemisia vulgaris</i> var. <i>indica</i> (Yomogi)
210. L: <i>Rubus parvifolius</i> (Nawasiroitigo)	264. L: <i>Houttuynia cordata</i> (Dokudami)
211. L: <i>Rubus hirsutus</i> (Kusaitigo)	265. L: <i>Saururus chinensis</i> (1) (Hangesyô)
212. L: <i>Crataegus cuneata</i> (Sanzasi)	266. R: <i>Saururus chinensis</i> (2) (Hangesyô)
213. L: <i>Albizia julibrissin</i> (Nemunoki)	267. L: <i>Saururus chinensis</i> (2) (Hangesyô)
214. L, C: <i>Trifolium patens</i> (Himetumegusa)	268. L: <i>Piper kadsura</i> (Fûtôkazura)
215. L: <i>Eriobotrya japonica</i> (Biwa)	269. L: <i>Piper migrum</i> (Kosyô)
216. S: <i>Eriobotrya japonica</i> (Biwa)	270. L: <i>Myrica rubra</i> (Yamamomo)
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TABLE I (continued).

271. L: <i>Salix gracilistyla</i> (Kawayanagi)	288. L: <i>Achyranthes japonica</i> (Inokozuti)
272. L: <i>Chloranthus glaber</i> (Senryô)	289. Fr: <i>Kadsura japonica</i> (Sanekazura)
273. Fr: <i>Chloranthus glaber</i> (Senryô)	290. Fr: <i>Schizandra nigra</i> (Matubusa)
274. L: <i>Ficus carica</i> (Itiziku)	291. Fl: <i>Ficus retusa</i> (Gazyumaru)
275. L: <i>Quercus phillyraeoides</i> (Uamegasi)	292. S: <i>Ficus retusa</i> (Gazyumaru)
276. Fr: <i>Alnus sieboldiana</i> (Oobayasyabusi)	293. L: <i>Ficus retusa</i> (Gazyumaru)
277. L: <i>Alnus sieboldiana</i> (Oobayasyabusi)	294. L: <i>Metasequoia glyptostroboides</i> (Metasekoia)
278. L: <i>Polygonum cuspidatum</i> (Itadori)	295. L: <i>Tripetaleia paniculata</i> (Hotutuzi)
279. Fr: <i>Polygonum filiforme</i> (Mizuhiki)	296. Fr: <i>Aucuba japonica</i> (Aoki)
280. L, C: <i>Persicaria longiseta</i> (Inutade)	297. L: <i>Lygodium japonicum</i> (Kanikusa)
281. L: <i>Nanocnid japonica</i> (Katensô)	298. L: <i>Fagara ailanthoides</i> (Karasunosansyô)
282. Fr: <i>Humulus scandens</i> (Kanamugura)	299. L: <i>Ginkgo biloba</i> (Ityô)
283. L: <i>Humulus scandens</i> (Kanamugura)	300. L: <i>Lysimachia japonicus</i> (Konasubi)
284. L: <i>Sagina japonica</i> (Tumekusa)	301. S: <i>Euphoria longana</i> (Ryûgan)
285. L: <i>Silene gallica</i> (Sirobanamantema)	302. L: <i>Anemone coronaria</i> (Anemone)
286. L: <i>Phytolacca americana</i> (Amerikayamagobô)	303. L: <i>Anemone nikoensis</i> (Itrinsô)
287. C: <i>Phytolacca americana</i> (Amerikayamagobo)	

TABLE II. LIST OF POSITIVE SAMPLES THAT SHOWED ANTIMUTAGENICITIES

The sample numbers	Assay systems	
	<i>E. coli</i> WP2 <i>trp</i>	<i>B. subtilis</i> NIG1125 (<i>his met</i>)
5	+	
6	+	
7	++	
8	+++	
17	+	
18	+	
25		++
53	+	
63	++	+
107		++
108		++
121		++
124	+	++
126	++	++
131		+
164	+	
167		+
180		+
189	++	+
207	++	+++
208	++	+++
276	+	+++
294	+	+
302	++	
303	++	

+: Detection of antimutagenicity zones whose length are 0~5mm by at least two experiments.

++: *Ibid.*, 5~7mm.

+++ : *Ibid.*, more than 7mm.

positive responses to *E. coli* B/r WP2 and 16 to *B. subtilis* 1125 (Table II). Among these positive samples, only 8 responded simultaneously to both strains.

These results indicate that the antimutagenic factors are only detectable in limited species of plants. It is also suggested that no universal bio-antimutagenic ingredient exists in the plant kingdom as measured by the present assay systems. Since no common factor could reduce induced and spontaneous mutabilities of the strains of *E. coli* B/r WP2 and *B. subtilis* 1125, it is difficult to suppose that a certain DNA-polymerase III is involved universally in the UV-induced SOS function. It is noted that the antimutagenicities of certain plant ingredients possessing antioxidant capabilities show quite different spectra from those shown in the present data (M. Namiki and T. Osawa, personal communication).

Chemical isolation studies are under way to elucidate further mechanisms of antimutagenesis involved.

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