

Table 2 Systematic List of the Hoki Species

GYMNOSPERMAE	1	2	3
Pinaceae			
<i>Abies</i> sp.	—	×	—
<i>Larix onbaraensis</i> sp. nov.	—	×	—
<i>Picea Kaneharai</i> sp. nov.	×	—	—
<i>Pseudolarix japonica</i> sp. nov.	—	×	—
<i>Pinus palaeopenataphylla</i> sp. nov.	×	×	—
Taxodiaceae			
<i>Taiwania japonica</i> sp. nov.	—	—	×
<i>Cunninghamia protokonishii</i> sp. nov.	—	×	—
Cupressaceae			
<i>Juniperus honshuensis</i> sp. nov.	—	—	×
<i>Thuja nipponica</i> sp. nov.	×	×	—
ANGIOSPERMAE			
Salicaceae			
<i>Populus aizuana</i> HUZIOKA et SUZUKI	—	×	×
Juglandaceae			
<i>Juglans</i> sp.	×	×	×
<i>Pterocarya nipponica</i> sp. nov.	×	—	×
<i>Carya miocathayensis</i> HU et CHANEY	—	—	×
Betulaceae			
<i>Alnus protohirsuta</i> ENDO	—	×	—
<i>A. miojaponica</i> TANAI	—	×	—
<i>Betula protoermanii</i> ENDO	—	×	×
<i>B. protoglobispica</i> sp. nov.	—	×	×
<i>B. onbaraensis</i> sp. nov.	—	×	—
<i>Carpinus subyedoensis</i> KONNO	—	×	×
<i>C. nipponica</i> ENDO	×	×	×
<i>C. miocenica</i> TANAI	×	×	—
<i>C. subcordata</i> NATHORST	—	×	—
<i>C. subcarpinoides</i> sp. nov.	×	×	—
Fagaceae			
<i>Castanea miocrenata</i> sp. nov.	×	×	×
<i>Fagus palaeocrenata</i> OKUTSU	×	×	×
<i>F. palaeojaponica</i> sp. nov.	×	×	—
<i>Quercus miocrispula</i> HUZIOKA	×	×	×
<i>Q. protodentata</i> sp. nov.	×	×	×
<i>Q. protoserrata</i> sp. nov.	×	×	×
<i>Q.</i> sp.	—	×	—
Ulmaceae			
<i>Celtis Nathorstii</i> sp. nov.	×	—	—
<i>C. Nordenskiöldii</i> NATHORST	×	—	×
<i>Ulmus protolaciniata</i> sp. nov.	—	×	×
<i>U. protojaponica</i> sp. nov.	—	—	×
<i>Zelkova Ungeri</i> (ETTINGS.) KOVATS	×	×	×
Moraceae			
<i>Ficus</i> sp.	—	—	×
Magnoliaceae			
<i>Liriodendron honshuensis</i> ENDO	—	—	×
<i>Magnolia elliptica</i> sp. nov.	—	—	×
Lauraceae			
<i>Sassafras subtriloba</i> (KONNO) new comb.	—	×	×
Saxifragaceae			
<i>Schizophragma mitokuensis</i> sp. nov.	—	—	×
Hamamelidaceae			
<i>Hamamelis</i> sp.	—	×	—
<i>Liquidambar mioformosana</i> TANAI	—	—	×
Rosaceae			
<i>Sorbus nipponica</i> sp. nov.	—	—	×
<i>Prunus protossiori</i> sp. nov.	×	—	—
Leguminosae			
<i>Wistaria fallax</i> (NATHORST) new comb.	×	×	×
Buxaceae			
<i>Buxus protojaponica</i> sp. nov.	—	×	—
Aquifoliaceae			
<i>Ilex</i> sp.	—	×	—
Celastraceae			
<i>Euonymus palaeosieboldianus</i> sp. nov.	—	×	—
Aceraceae			
<i>Acer Nordenskiöldi</i> NATHORST	—	—	×
<i>A. palaeodiabolicum</i> ENDO	—	×	×
<i>A. palaeorufinerve</i> sp. nov.	—	—	×
<i>A. protosieboldianum</i> sp. nov.	×	—	—
<i>A. submayrii</i> sp. nov.	—	—	×
<i>A. subpictum</i> SAPORTA	×	×	×
<i>Acer</i> cfr. <i>pseudocarpinifolium</i> ENDO	—	—	×
Rhamnaceae			
<i>Paliurus nipponicus</i> MIKI	—	×	—
Tiliaceae			
<i>Tilia miohenryana</i> HU et CHANEY	—	—	×
Theaceae			
<i>Stewartia submonadelpha</i> sp. nov.	—	—	×
Cornaceae			
<i>Cornus megaphylla</i> HU et CHANEY	—	—	×
<i>C. subkousa</i> sp. nov.	×	—	×
Clethraceae			
<i>Clethra</i> sp.	—	—	×
Ericaceae			
<i>Rhododendron protodilatatum</i> sp. nov.	—	—	×
<i>Tripetaleia pseudopaniculata</i> sp. nov.	—	×	—
Symplocaceae			
<i>Symplocos</i> sp.	×	—	—
Styracaceae			
<i>Styrax protoobassia</i> sp. nov.	×	—	—
Oleaceae			
<i>Fraxinus honshuensis</i> sp. nov.	×	—	—
Caprifoliaceae			
<i>Lonicera protojaponica</i> sp. nov.	—	×	—

Table 6 Nearest Equivalents of the Hoki Species and Their Modern Distribution in East Asia

Fossil Species	Equivalent Modern Species	Present Distribution of Their Modern Species															
		Sagh. Kuril. ①	Japan						Form. ⑦	Korea ⑧	China				Manch. ⑬	N. Amer. ⑭	Others ⑮
			Hokk. ②	Honshu			Kyus. Shik. ⑥	Nor. ⑨			Cent. ⑩	SE. ⑪	SW. ⑫				
				③	④	⑤											
<i>Abies</i> sp.	<i>A. firma</i>		×	×	×	×											
<i>Larix onbaraensis</i>	<i>L. Kaempferi</i>			×	×	×											
<i>Picea kaneharui</i>	<i>P. polita</i>			×	×	×											
<i>Pseudolarix japonica</i>	<i>P. Kaempferi</i>									×	×						
<i>Pinus palaeopentaphylla</i>	<i>P. pentaphylla</i>		×	×	×												
<i>Taiwania japonica</i>	<i>T. cryptomeroides</i>							×			×	×					
<i>Cunninghamia protokonishii</i>	<i>C. Konishii</i>							×									
<i>Thuja nipponica</i>	<i>T. standishii</i>			×	×				×								
<i>Juniperus honshuensis</i>	<i>J. chinensis</i>			×	×	×	×										
<i>Populus aizuwana</i>	<i>P. alba</i> ; <i>P. Fremonti</i>																×
<i>Juglans</i> sp.	<i>J. ailanthifolia</i>	×	×	×	×	×	×										
<i>Pterocarya nipponica</i>	<i>P. rhoifolia</i>		×	×	×	×	×			×							
<i>Carya miocathayensis</i>	<i>C. cathayensis</i>									×	×						
<i>Alnus protohirsuta</i>	<i>A. hirsuta</i>	×	×	×	×	×	×										×
<i>A. miojaponica</i>	<i>A. japonica</i>		×	×	×	×	×					×					×
<i>Betula protoermani</i>	<i>B. Ermani</i>	×	×	×	×				×								
<i>B. protoglobispica</i>	<i>B. globispica</i>				×												
<i>B. onbaraensis</i>	<i>B. grossa</i> var. <i>ulmifolia</i>			×	×	×	×										
<i>Carpinus subyedoensis</i>	<i>C. Tschonoskii</i>			×	×	×	×		×								
<i>C. nipponica</i>	<i>C. lanceolata</i>									×	×						
<i>C. miocenic</i>	<i>C. laxiflora</i>		×	×	×	×	×		×								
<i>C. subcordata</i>	<i>C. cordata</i>		×	×	×	×	×		×	×	×						×
<i>C. subcarpinoides</i>	<i>C. japonica</i>			×	×	×	×										
<i>Castanea miocrenata</i>	<i>C. crenata</i>		×	×	×	×	×										
<i>Fagus palaeocrenata</i>	<i>F. crenata</i>		×	×	×	×	×										
<i>F. palaeojaponica</i>	<i>F. japonica</i>			×	×	×	×										
<i>Quercus miocrispula</i>	<i>Q. mongolica</i> var. <i>grosserrata</i>	×	×	×	×	×	×			×	×						×
<i>Q. protodentata</i>	<i>Q. dentata</i>	×	×	×	×	×	×		×	×	×		×	×			×
<i>Q. protoserrata</i>	<i>Q. serrata</i>		×	×	×	×	×		×	×	×		×	×			
<i>Quercus</i> sp.	<i>Q. acutissima</i>		×	×	×	×	×		×	×	×		×	×			
<i>Celtis Nathorstii</i>	<i>C. jessoensis</i>		×	×	×	×	×		×								
<i>C. Nordenskiöldii</i>	<i>C. occidentalis</i>																×
<i>Ulmus protolaciniata</i>	<i>U. laciniata</i>	×	×	×	×	×	×		×	×							×
<i>U. protojaponica</i>	<i>U. Davidiana</i> var. <i>japonica</i>	×	×	×	×	×	×		×	×							×
<i>Zelkova Ungeri</i>	<i>Z. serrata</i>			×	×	×	×		×		×	×					
<i>Ficus</i> sp.	<i>F. erect</i>				×	×	×					×					
<i>Liriodendron honshuensis</i>	<i>L. tulipifera</i> ; ( <i>L. chinense</i> )										(×)	(×)					×
<i>Magnolia elliptica</i>	<i>M. Kobus</i>		×	×	×	×	×		×								×
<i>Sassafras subtriloba</i>	<i>S. Sassafras</i> ; ( <i>S. tsumu</i> )										(×)	(×)					×
<i>Schizophragma mitokuensis</i>	<i>S. hydrangeoides</i>		×	×	×	×	×		×		×						
<i>Hamamelis</i> sp.	<i>H. japonica</i>		×	×	×	×	×										
<i>Liquidambar mioformosana</i>	<i>L. formosana</i>							×			×	×	×				
<i>Sorbus nipponica</i>	<i>S. comixta</i> var. <i>rufo-ferruginea</i>			×	×	×	×										
<i>Prunus protossiori</i>	<i>P. Ssiori</i>	×	×	×	×	×	×										×
<i>Wistaria fallax</i>	<i>W. floribunda</i>			×	×	×	×										
<i>Buxus protojaponica</i>	<i>B. macrophylla</i> var. <i>japonica</i>				×	×	×										
<i>Ilex</i> sp.	<i>I. latifolia</i>					×	×				×	×					
<i>Euonymus palaeosieboldianus</i>	<i>E. sieboldianus</i>		×	×	×	×	×										
<i>Acer Nordenskiöldii</i>	<i>A. palmatum</i>			×	×	×	×				×	×					
<i>A. palaeodiabolicum</i>	<i>A. diabolicum</i>			×	×	×	×										
<i>A. palaeorufinerve</i>	<i>A. rufinerve</i>			×	×	×	×										
<i>A. protosieboldianum</i>	<i>A. Sieboldianum</i>		×	×	×	×	×										
<i>A. submayrii</i>	<i>A. Mono</i> var. <i>Mayrii</i>		×	×													
<i>A. subpictum</i>	<i>A. mono</i>	×	×	×	×	×	×		×	×			×	×			
<i>Acer</i> cfr. <i>pseudocarpinifolium</i>	<i>A. carpinifolium</i>			×	×	×	×										
<i>Paliurus nipponicus</i>	<i>P. Spina-christii</i>																×
<i>Tilia miohenryana</i>	<i>T. henryana</i> ; ( <i>T. Miyabei</i> )		(×)	(×)	(×)						×	×					
<i>Stewartia submonadelpha</i>	<i>S. monadelpha</i>				×	×	×										
<i>Cornus megaphylla</i>	<i>C. macrophylla</i>									×	×						
<i>C. subkousa</i>	<i>C. Kousa</i>			×	×	×	×		×		×		×				
<i>Clethra</i> sp.	<i>C. barbinervis</i>		×	×	×	×	×		×								
<i>Rhododendron protodilatatum</i>	<i>R. dilatatum</i>			×	×	×	×										
<i>Tripetaleia pseudopaniculata</i>	<i>T. paniculata</i>		×	×	×	×	×										
<i>Symplocos</i> sp.	<i>S. crataegoides</i>		×	×	×	×	×		×								
<i>Styrax protoobassia</i>	<i>S. obassia</i>		×	×	×	×	×		×	×							×
<i>Fraxinus honshuensis</i>	<i>F. japonica</i>			×	×												
<i>Lonicera protojaponica</i>	<i>L. japonica</i>		×	×	×	×	×		×	×	×	×	×	×			
Mitoku florule		7	16	27	29	26	23	2	11	8	15	11	6	5	3	0	
Onbara florule		7	18	28	31	27	26	1	11	8	12	8	5	8	2	1	
Ningyo-toge florule		5	14	21	22	19	19	0	9	6	7	4	4	5	1	0	

## Modern Distribution

- |                              |                      |                          |                         |
|------------------------------|----------------------|--------------------------|-------------------------|
| 1 Saghalien and Kurile Isl.  | 2 Hokkaido           | 3 Northern Honshu, Japan | 4 Central Honshu, Japan |
| 5 Southwestern Honshu, Japan | 6 Kyushu and Shikoku | 7 Formosa                | 8 Korea                 |
| 9 North China                | 10 Central China     | 11 Southeast China       | 12 Southwest China      |
| 13 Manchuria                 | 14 North America     | 15 Other areas           |                         |

Table 11 Correlation of the Hoki Species with Other Neogene Floras in Japan

	1	2	3	4	5	6	7	8	9	10	11
<i>Abies</i> sp.	○									○	
<i>Larix onbaraensis</i>											
<i>Picea Kaneharai</i>										○	
<i>Pseudolarix japonica</i>											
<i>Pinus palaeopentaphylla</i>											
<i>Taiwania japonica</i>											
<i>Cunninghamia protokonishii</i>									×		
<i>Thuja nipponica</i>					×	×				○	
<i>Juniperus honshuensis</i>											
<i>Populus aizuwana</i>			×	×							
<i>Juglans</i> sp.	○										
<i>Pterocarya nipponica</i>	×	×				○	○				
<i>Carya miocathayensis</i>									×		
<i>Alnus protohirsuta</i>		×	×	×		×					
<i>A. miojaponica</i>		×	×	×					×		
<i>Betula protoermanni</i>	×		×	×		×					×
<i>B. protoglobispica</i>	×					×					
<i>B. onbaraensis</i>						○					
<i>Carpinus subyedoensis</i>					×	×	×				×
<i>C. nipponica</i>						○				○	
<i>C. miocenica</i>	×						×		×		
<i>C. subcordata</i>	×	×	×	×		×	×	×	×		×
<i>C. subcarpinoides</i>		×			×	×	×				
<i>Castanea miocrenata</i>	×	×				○	○				
<i>Fagus palaeocrenata</i>	×	×	×	×	×	×	×			○	×
<i>F. palaeojaponica</i>	×	×					×				
<i>Quercus miocrispula</i>				×		×	×				×
<i>Q. protodentata</i>						○	○				×
<i>Q. protoserrata</i>		×				×	×				×
<i>Quercus</i> sp.									○		
<i>Celtis Nathorstii</i>						○			○		
<i>C. Nordenskiöldii</i>				○			○				
<i>Ulmus protolaciniata</i>						×					
<i>U. protojaponica</i>		×					×				
<i>Zelkova Ungerii</i>		×	×	×	×	×	×	×	×	×	×
<i>Ficus</i> sp.											
<i>Liriodendron honshuensis</i>	×					×	×				
<i>Magnolia elliptica</i>	○				○					○	
<i>Sassafras subtriloba</i>	○			○		×					×
<i>Schizophragma mitokuensis</i>											
<i>Hamamelis</i> sp.	○										
<i>Liquidambar mioformosana</i>				×	×				×		×
<i>Sorbus nipponica</i>	×			○							
<i>Punus protossiori</i>	×					×					
<i>Wistaria fallax</i>			×		○			×		×	×
<i>Buxus protojaponica</i>					×					×	
<i>Ilex</i> sp.											
<i>Euonymus palaeosieboldianus</i>											
<i>Acer Nordenskiöldii</i>	○		○	×	×	×				×	×
<i>A. palaeodiabolicum</i>	×		×	×	×	×	×	×		×	×
<i>A. palaeorufinerve</i>	×					×	×			×	×
<i>A. protosieboldianum</i>								○			
<i>A. submayrii</i>						×		○			
<i>A. subpictum</i>	×				×	×	×	×	×		×
<i>Acer</i> cfr. <i>pseudocarpinifolium</i>	×										
<i>Paliurus nipponicus</i>					×					×	
<i>Tilia miohenryana</i>	○	○									○
<i>Stewartia submonadelpha</i>	×				×					×	×
<i>Cornus megaphylla</i>											
<i>C. subkousa</i>											
<i>Clethra</i> sp.						○					
<i>Rhododendron protodilatatum</i>											
<i>Tripetaleia pseudopaniculata</i>		○									
<i>Symplocos</i> sp.										○	
<i>Styrax protoobassia</i>				×		×				×	×
<i>Fraxinus honshuensis</i>											
<i>Lonicera protojaponica</i>											
Mitoku	12	6	5	7	8	15	10	4	4	5	15
	5	1	2	3	1	6	5	1	2	2	1
Onbara	9	9	8	9	9	15	11	5	6	4	12
	4	1	1	1	1	5	3	0	3	3	0
Ningyo-toge	7	7	2	4	5	9	8	3	3	3	8
	1	0	1	0	0	6	3	0	3	4	0

1 Goshō (MURAI, 1957) 2 Okitama (TOKUNAGA & TANAI, 1954) 3 Shiotsubo (HUZIOKA & SUZUKI, 1954) 4 Fujitoge (SUZUKI, 1951) 5 Oya (TAKAHASHI, 1954) 6 Lower Shirasawa (OKUTSU, 1955) 7 Upper Shirasawa (OKUTSU, 1955) 8 Shichiku (TANAI & ONOE, 1958) 9 Kamigo (TANAI, MS) 10 Akashi (MIKI, 1937) 11 Omi (KONNO, 1931)

× identical species ○ closely similar species