

謝辞

本論文を作成するにあたり、東京大学大学院農学生命科学研究科、生圏システム学専攻、森圏管理学研究室の井出雄二教授には、初稿から手を加えていただき、終始ご指導とご鞭撻を賜った。

東京大学大学院農学生命科学研究科、森林科学専攻、造林学研究室の八木久義教授、同森林植物学研究室の鈴木和夫教授、附属科学の森教育研究センター（演習林）の丹下 健教授、森林総合研究所集団遺伝研究室長（生圏システム学専攻連携併任教授）吉丸博志博士には、本論文のご校閲とご指導を賜った。

九州大学農学部の白石 進教授には、本研究に対して常に適切なご助言をご指導を頂いた。森林総合研究所の津村義彦博士には、遺伝分析に関する最新の情報を提供して頂き、適切なご助言を頂いた。九州大学農学部の渡辺敦史博士には、DNA 実験に対して技術的なご指導を頂き、また本研究に対して適切なご意見を頂いた。福岡県森林林業技術センターの池田浩一氏には、論文作成に対するご指導と本研究に対する適切なご助言を頂いた。福岡県森林林業技術センターの宮原文彦氏、熊本県菊池農林事務所の家入龍二氏、鹿児島県大隅農林事務所の川内博文氏には、共同研究者として調査や実験にご協力頂き、また議論に参加して頂いた。森林総合研究所の岩田洋佳博士、北海道立林業試験場の錦織正智氏には、データ処理に関する貴重なご意見とご協力を頂いた。森林総合研究所の金谷整一博士には、議論に付き合っていただくとともに、本研究に対する貴重なご意見を頂いた。林木育種センター九州育種場の戸田忠雄氏には、マツノザイセンチュウ抵抗性クロマツ採種園に関する貴重な情報を頂いた。宮崎県林業総合センターの三樹陽一郎氏には、人工交配苗の針葉サンプルを提供して頂いた。東京大学大学院の大給敬子氏、新潟大学大学院の森口喜成氏、九州大学農学部の村上春樹氏には、引用文献の収集に多大なご協力を頂いた。

前職場である福岡県森林林業技術センターの皆様には、採種園や苗畑における調査研究に対して様々なご協力を頂き、また本研究に対する貴重なご意見を頂いた。江藤たまきさん、草場律子さんの両氏には、DNA 実験に関して多大なご協力を頂いた。東京大学大学院農学生命科学研究科附属演習林および森圏管理学研究室の皆様には、本研究に対する貴重なご意見を頂いた。現職場である東京大学大学院北海道演習林の皆様には、本論文を書き進めるに当たり様々な便宜を図っていただいた。

これらの方々に厚くお礼を申し上げます。

引用文献

- Adams, W.T. (1983) Application of isozymes in tree breeding. *In* Isozymes in plant genetics and breeding, Part A. Tanksley, S.D. and Orton, T.J. (eds.), Elsevier Science Publishers, B.V., Amsterdam, 381-400.
- Adams, W.T., Hipkins, V.D., Burczyk, J. and Randall, W.K. (1997) Pollen contamination trends in a maturing Douglas-fir seed orchard. *Can. J. For. Res.* 27: 131-134.
- Adams, W.T. and Joly, R.J. (1980) Allozyme studies in loblolly pine seed orchards: clonal variation and frequency of progeny due to self-fertilization. *Silvae Genet.* 29: 1-4.
- Åkerman, S., Tammisola, J., Lapinjoki, S.P., Söderlund, H., Kauppinen, V., Viherä-Aarnio, A., Regina, M. and Hagqvist, R. (1995) RAPD markers in parentage confirmation of a valuable breeding progeny of European white birch. *Can. J. For. Res.* 25: 1070-1076.
- Apsit, V.J., Nakamura, R.R. and Wheeler, N.C. (1989) Differential male reproductive success in Douglas fir. *Thoe. Appl. Genet.* 77: 681-684.
- Askew, G.R. (1992) Potential genetic improvement due to supplemental mass pollination management in conifer seed orchards. *For. Ecol. Manage.* 47: 135-147.
- Bailey, D.C. (1983) Isozyme variation and plant breeders' rights. *In* Isozymes in plant genetics and breeding, part A. Tanksley, S.D. and Orton, T.J. (eds.), Elsevier Science Publishers, Amsterdam, 425-441.
- Barber, J.C. and Dorman, K.W. (1964) Clonal or seedling seed orchards? *Silvae Genet.* 13: 11-17.
- Barrett, J.W., Knowles, P. and Cheliak, W.M. (1987) The mating system in a black spruce clonal seed orchard. *Can. J. For. Res.* 17: 379-382.
- Bartels, H. (1971) Genetic control of multiple esterases from needles and megagametophytes of *Picea abies*. *Planta* 99: 283-289.
- Bates, C.G. (1928) Tree "Seed farms". *Jour. Forestry* 26: 969-976.
- Bonnet-Masimbert, M. (1982) Effect of growth regulators, girdling and mulching on flowering of young European and Japanese larches under field conditions. *Can. J. For. Res.* 12: 270-279.
- Bonnet-Masimbert, M. (1987) Floral induction in conifers: a review of available techniques.

- For. Ecol. Manage. 19: 135-146.
- Bramlett, D.L. (1987) Protection of pine seed orchards in the southeastern United States.
For. Ecol. Manage. 19: 199-208.
- Carlson, J.E., Tulsieram, L.K., Glaubitz, J.C., Luk, V.W.K., Kauffeldt, C. and Rutledge, R.
(1991) Segregation of random amplified DNA markers in F₁ progeny of conifers.
Theor. Appl. Genet. 83: 194-200.
- Castiglione, S., Wang, G., Damiani, G., Bandi, C., Bisoffi, S. and Sala, F. (1993) RAPD
fingerprints for identification and for taxonomic studies of elite poplar
(*Populus* spp.) clones. Theor. Appl. Genet. 87: 54-59.
- Cato, S.A. and Richardson, T.E. (1996) Inter- and intraspecific polymorphism at chloroplast
SSR loci and the inheritance of plastids in *Pinus radiata* D. Don.
Theor. Appl. Genet. 93: 587-592.
- Cecich, R.A. (1981) Applied gibberellin A_{4/7} increases ovulate strobili production in
accelerated growth jack pine seedlings. Can. J. For. Res. 11: 580-585.
- Chalupka, W. (1980) Regulation of flowering in Scots pine (*Pinus sylvestris* L.) grafts by
gibberellins. Silvae Genet. 29: 118-121.
- Daniels, J.D. (1978) Efficacy of supplemental mass-pollination in a Douglas-fir seed orchard.
Silvae. Genet 27: 52-58.
- Denison, N.P. and Franklin, E.C. (1975) Pollen management. In Seed Orchards. Faulkner, R.
(eds.), 149pp, Forestry Commission Bulletin 54, London, 92-100.
- Di-Giovanni, F. and Kevan, P.G. (1991) Factors affecting pollen dynamics and its importance
to pollen contamination. : a review. Can. J. For. Res. 21: 1155-1170.
- Dinus, R.J. and Yates III, H.O. (1975) Protection of seed orchards. In Seed Orchards.
Faulkner, R.(eds.), 149pp, Forestry Commission Bulletin 54, London, 58-71.
- Echt, C.S., DeVerno, L.L., Anzidei, M. and Vendramin, G.G. (1998) Chloroplast microsatellites
reveal population genetic diversity in red pine, *Pinus resinosa* Ait.
Mol. Ecol. 7: 307-316.
- El-Kassaby, Y.A., Barnes, S., Cook, C., and MacLeod, D.A. (1993) Supplemental mass
pollination success rate in a mature Douglas-fir seed orchard.
Can. J. For. Res. 23: 1096-1099.

- El-Kassaby, Y.A., Edwards, D.G.W. and Cook, C. (1990) Impact of crop management practices on seed yield in a Douglas-fir seed orchard. *Silvae Genet.* 39: 226-230.
- El-Kassaby, Y.A., Fashler, A.M.K. and Sziklai, O. (1984) Reproductive phenology and its impact on genetically improved seed production in a Douglas-fir seed orchard. *Silvae Genet.* 33: 120-125.
- El-Kassaby, Y.A. and Ritland, K. (1986a) Low levels of pollen contamination in a Douglas-fir seed orchard as detected by allozyme markers. *Silvae Genet.* 35: 224-229.
- El-Kassaby, Y.A. and Ritland, K. (1986b) The relation of outcrossing and contamination to reproductive phenology and supplemental mass pollination in a Douglas-fir seed orchard. *Silvae Genet.* 35: 240-244.
- El-Kassaby, Y.A., Ritland, K., Fashler, A.M.K. and Devitt, W.J.B. (1988) The role of reproductive phenology upon the mating system of a Douglas-fir seed orchard. *Silvae. Genet* 37: 76-82.
- El-Kassaby, Y.A., Rudin, D. and Yazdani, R. (1989) Levels of outcrossing and contamination in two *Pinus sylvestris* L. seed orchards in Northern Sweden. *Scand J For Res* 4: 41-49.
- Ellsworth, D.L., Rittenhouse, K.D. and Honeycutt, R.L. (1993) Artifactual variation in randomly amplified polymorphic DNA banding patterns. *Bio/Techniques* 14: 214-217.
- Enescu, V. (1987) Climate and the choice of seed orchard sites. *For. Ecol. Manage.* 19: 257-265
- 榎本善夫 (1969) スギのつぎき親和性. *林木の育種* 54: 7-8.
- Erickson, V.J. and Adams, W.T. (1989) Mating success in a coastal Douglas-fir seed orchard as affected by distance and floral phenology. *Can. J. For. Res.* 19: 1248-1255.
- Eriksson, G., Jonsson, A. and Lindgren, D. (1973) Flowering in a clone trial of *Picea abies* Karst. *Studia Forestalia Suecica* 110: 1-45.
- Falkenhagen, E.R. (1985) Isozyme studies in provenance research of forest trees. *Theor. Appl. Genet.* 69: 335-347.
- Fashler, A.M.K. and El-Kassaby, Y.A. (1987) The effect of water spray cooling treatment on reproductive phenology in a Douglas-fir seed orchard. *Silvae. Genet* 36: 245-249.
- Fast, W., Dancik, B.P. and Bower, R.C. (1986) Mating system and pollen contamination in a Douglas-fir clone bank. *Can. J. For. Res.* 16: 1314-1319.
- Feilberg, L. and Sørengaard, B. (1975) Historical review of seed orchards. *In* Seed Orchards.

- pp1-8. Faulkner, R.(eds) Forestry Commission Bulltein 54, London
- Feret, P.P. and Bergmann, F. (1976) Gel electrophoresis of proteins and enzymes. *In* Modern methods in forest genetics. Miksche, J.P.(eds.), Springer Verlag, Hamburg, 49-77.
- Freeman, G.H. (1967) The use of cyclic balanced incomplete block designs for directional seed orchards. *Biometrics* 23:761-778.
- Freeman, G.H. (1969) The use of cyclic balanced incomplete block designs for non-directional seed orchards. *Biometrics* 25:561-571.
- Friedman, S.T. and Adams, W.T. (1985) Estimation of gene flow into two seed orchards of loblolly pine (*Pinus taeda* L.). *Theor. Appl. Genet.* 69: 609-615.
- 藤本吉幸・戸田忠雄・西村慶二・山手廣太 (1989) マツノザイセンチュウ抵抗性育種事業－技術開発と事業実施 10 年の成果－. 林育研報 7: 1-84.
- 福原梢勝・荒井国幸 (1979) 林木のツギキ不親和性. 林木の育種 113: 2-6.
- 古越隆信 (1978) スギ採種園の花粉管理に関する基礎的研究. 林試研報 300: 41-120.
- 古越隆信 (1979) スギ採種園における 2, 3 の受粉管理問題. 林木の育種 112: 5-10.
- 古越隆信・谷口純平 (1982) 林木の育種. 223pp, 農林出版, 東京.
- Giertych, M.M. (1965) Systematic lay-outs for seed orchards. *Silvae Genet.* 14: 91-94.
- Giertych, M.M. (1975) Seed orchard designs. *In* Seed Orchards. Faulkner, R.(eds.), 149pp, Forestry Commission Bulltein 54, London, 25-37.
- 後藤 晋(1999) クロマツの挿し木増殖における発根条件の検討. 日林九支研論 52: 57-58.
- 後藤 晋(2000) アカマツとクロマツの組織培養. (組織培養法を用いた優良樹木苗の生産－森林の多様性保全と遺伝資源の保存のために－. 石井克明編, 104pp, 林業科学技術振興所, 東京), 27-35.
- 後藤 晋・家入龍二・宮原文彦(1999) 福岡県におけるスギさし木品種と精英樹の RAPD 分析. 日林誌 81: 187-193.
- 後藤 晋・宮原文彦 (1997) 抵抗性クロマツの組織培養 (I)－発根条件の検討－. 日林九支研論 50: 57-58.
- 後藤 晋・宮原文彦 (2000) 抵抗性クロマツ「田辺ーク 54 号」を母樹とする自然交雑実生苗の初期成長とマツノザイセンチュウ抵抗性. 日林九支研論 53: 69-70.
- 後藤 晋・宮原文彦・家入龍二・川内博文 (2000) RAPD 分析によるスギ挿し木品種の識別とその利用. 林木の育種 197: 6-8.

- Goto, S. and Sasaki, S. (1998) Micropropagation and development of early examination system *in vitro* for nematode-reisistance in Japanese black pine. *In* Proceedings of International Symposium on Sustainability of pine forests in relation to pine wilt and decline. Suzuki, K.(eds.), 336pp, Shokado, Tokyo, 178-180.
- 後藤 晋・渡辺敦史・池田浩一 (1997) RAPD マーカーによるハゼノキの品種識別. 日林誌 79: 229-233.
- Griffin, A.R. (1982) Clonal variation in Radiata pine seed orchards. I . Some flowering, cone and seed production traits. *Aust. For. Res.* 12: 295-302.
- Hadders, G. and Koski, V. (1975) Probability of inbreeding in seed orchards. *In* Seed Orchards. pp108-130. Faulkner, R.(eds) Forestry Commission Bulltein 54, London.
- Harju, A. and Muona, O. (1989) Background pollination in *Pinus sylvestris* seed orchards. *Scand. J. For. Res.* 4: 513-520.
- 橋詰隼人 (1959) スギの花芽分化におよぼすジベレリンの影響. 日林誌 41: 375-381
- 橋詰隼人 (1968) 針葉樹の花芽分化の化学調節. 日林誌 50: 14-16.
- 畑野健一・佐々木恵彦 (1987) 樹木の生長と環境. 383pp, 養賢堂, 東京.
- Hattemer, H.H., Andersson, E. and Tamm, C.O. (1977) Effects of spacing and fertilization on four grafted clones of Scots pine. *Studia Forestlia Suecica* 141: 1-31.
- Hedrick, P. (1992) Shooting the RAPDs. *Nature* 355: 679-680.
- Heun, M. and Helentjaris, T. (1993) Inheritance of RAPDs in F₁ hybrids of corn. *Theor. Appl. Genet.* 85: 961-968 .
- 樋口真一 (1967) 八女林業のあゆみとさしすぎ品種 (八女地方) について. 福岡県林業試験場 時報 19: 1-52.
- Hong, S.O.(1975) Vegetative propagation of plant material for seed orchards with special reference to graft-incompatibility problems. *In* Seed Orchards. pp38-57. Faulkner, R. (eds.) Forestry Commission Bulltein 54, London.
- 井出雄二 (1984) パーソナルコンピューター・プログラミング報告 (I) 採種園設計プログラム (ASOR). 静岡県林試研報 12: 27-43.
- 家入龍二・宮島淳二 (2000) RAPD マーカーによるヒノキさし木品種ナンゴウヒのクローン識別. 日林誌 82: 98-100.
- 石井克明 (1993) ヒノキとクロマツの組織培養条件の検索. 森林総研研報 365: 131-167.

- 石井克明・栗延 晋・古越隆信（1983）クロマツ×タイワンアカマツ雑種 F₁, F₂ 及び B₁ 等のマツノザイセンチュウ抵抗性. 第 94 回日林講: 245-247.
- 石松 誠（1998）マツノザイセンチュウ抵抗性クロマツの挿し木による増殖.
日林九支研論 51: 47-48.
- 石崎厚美（1965）九州におけるおもなスギさしき品種の形態, 生理, 造林上の特性.
林試研報 180 : 1-303.
- 金川 侃（1979）ジベレリン（GA₄+GA₇）によるクロマツの着花促進効果.
林木の育種特別号: 48-49.
- Kanekawa, T. and Katsuta, M. (1982) Promotion of strobilus production in *Pinus thunbergii* Parl. and *P. densiflora* STEB. et ZUCC. by Gibberellins. J. Jap. For. Soc. 64: 101-106.
- 金川 侃・北川紀彦（1987）ヒノキ採種園の着花促進について. 林木の育種 143: 28-33.
- 金川 侃・桑原正明（1984）スギ採種園における花粉管理に関する研究.
林木の育種 133: 3-7.
- 加藤善忠（1959）ジベレリンによるスギの花芽分化の促進（第 2 報）. 日林誌 41: 138-141
- 加藤善忠・福原植勝・小林玲爾（1959）ジベレリンによる針葉樹の花芽分化の促進（第 1 報）. 日林誌 41: 309-311.
- 加藤善忠・三宅 勇・石川広隆（1958）ジベレリンによるスギ花芽分化の促進.
日林誌 40: 35-36.
- 勝田 柁（1964）クロマツとアカマツの自家受精. 東大演習林 15: 23-35.
- 勝田 柁（1982）坂下ヒノキ採種園における種子生産実績と今後の技術的対応.
林木の育種 124: 13-18.
- 川尻秀樹・大橋章博・和田 清（1992）ヒノキ採種園におけるカメムシ被害防除. 岐阜県林業センター研究報告 20: 1-14.
- 川内博文（2000）マツノザイセンチュウ抵抗性クロマツの諸特性－鹿児島県マツノザイセンチュウ抵抗性クロマツ採種園の種子生産性と家系特性－.
林木の育種特別号 : 30-33.
- Keil, M. and Griffin, A.R. (1994) Use of random-amplified polymorphic DNA (RAPD) markers in the discrimination and verification of genotypes in *Eucalyptus*.
Theor. Appl. Genet. 89: 442-450.
- Kernodle, S.P., Cannon, R.E. and Scandalios, J.G. (1993) Concentration of primer and template

- qualitatively affects products in random amplified polymorphic DNA PCR.
 Bio/Techniques 14: 362-364.
- 岸 洋一 (1995) マツ材線虫－松くい虫－精説. 291pp, トーマスカンパニー, 東京.
- 清原友也・徳重陽山 (1971) マツ生立木に対する線虫 *Bursaphelenchus sp.* の接種試験.
 日林誌 53: 210-218.
- 小林一三・横山敏孝 (1984) カメムシ類の加害によるスギ種子の発芽率低下.
 林木の育種 133: 16-19.
- 小島耕一郎・王鷲幸一 (1987) 長野県における松くい虫被害とその防除対策.
 森林防疫 36: 199-203.
- Koller, B., Lehmann, A., McDermott, J.M. and Gessler, C. (1993) Identification of apple
 cultivars using RAPD markers. Theor. Appl. Genet. 85: 901-904.
- Koski, V. (1987) Long geographic transfers, a possible way of eliminating pollen
 contamination in advanced-generation seed orchards of *Pinus sylvestris*.
 For. Ecol. Manage. 19: 267-271.
- 栗延 晋・藤沢義武 (1988) クロマツ母樹が異なる和華松及び戻し交雑種のマツノザイ
 センチュウによる被害度の変異. 第 99 回日林論: 253-254.
- 九州地区林業試験研究機関連絡協議会育種部会 (1999) ヒノキ精英樹・抵抗性マツ
 特性表: 35-58.
- Langner, W. and Stern, K. (1955) Versuchstechnische probleme bei der anlage von
 klonplantagen. Z. Forstgenet. ForstpfZucht 4: 81-88.
- Larsen, C.S. (1956) Genetics in silviculture. Oliver&Boyd, Edinburgh, U.K., 224pp
- Lindquist, B. (1948) Genetics in Swedish forestry practice.
 The Chronica Botanica Co, Waltham, Mass., USA, 172pp
- Longman, K.A. (1982) Effect of giberellin, clone and environment on cone initiation,
 shoot growth and branching in *Pinus contorta*. Ann. Bot. 50: 247-257.
- Lu, M.-Z., Szmidt, A.E. and Wang, X.-R. (1995) Inheritance of RAPD fragments in haploid
 and diploid tissues of *Pinus sylvestris* (L.). Heredity 74: 582-589.
- Michelmore, R.W., Paran, I. and Kesseli, R.V. (1991) Identification of markers linked to
 disease-resistance genes by bulked segregant analysis: A rapid method to detect markers
 in specific genomic regions by using segregating populations.

Proc. Natl. Acad. Sci. USA 88: 9828-9832.

右田一雄 (1960) 土壤水分がスギ苗の花芽着生に及ぼす影響. 日林誌 42: 441-444.

三樹陽一郎 (1998) 組織培養によるクロマツの2針葉からの植物体再生.

日林九支研論 51: 43-44.

宮原文彦 (1989) ヒノキ採種園におけるカメムシ防除 (I). 日林九支研論 42: 65-66.

宮原文彦 (1997) スーパーまつ生産技術の民間移転. 現代林業 9月号,
(社) 全国林業改良普及協会, 東京: 53

宮原文彦・前田 一・白石 進 (1998) マツノザイセンチュウ抵抗性クロマツ採種園構成
クローンとしての小浜ーク 24号の評価. 日林誌 80: 233-235.

宮原文彦・佐々木重行・小河誠司 (1994) 採種園産抵抗性クロマツの自然交雑実生苗の
ザイセンチュウ抵抗性. 日林九支研論 47: 125-126.

宮島 寛 (1989) 九州のスギとヒノキ. 275pp, 九州大学出版会, 福岡.

百瀬行男 (1969) 採種・採穂園の管理とスギのさしき. 163pp, 農林出版, 東京.

百瀬行男 (1971) スギのつぎき親和性. 林木の育種 70: 8-9.

Moran, G.F., Bell, J.C. and Matheson, A.C. (1980) The genetic structure and levels of
inbreeding in a *Pinus radiata* D. Don seed orchard. *Silvae. Genet* 29: 190-193.

Moran, G.F. and Griffin, A.R. (1985) Non-random contribution of pollen in polycrosses of
Pinus radiata D. Don. *Silvae. Genet* 34: 117-121.

森本 桂・岩崎 厚 (1972) マツノザイセンチュウ伝播者としてのマツノマダラカミキリの
役割. 日林誌 54: 177-183.

Morris, R.W. and Spieth, P.T. (1978) Sampling strategies for using female gametophytes to
estimate heterozygosity in conifers. *Theor. Appl. Genet.* 51: 217-222.

Müller-Starck, G. (1982) Reproductive systems in conifer seed orchards. I. Mating probabilities
in a seed orchard of *Pinus sylvestris* L. *Silvae Genet.* 31: 188-197.

長尾精文・佐々木恵彦 (1985) ヒノキの花芽反応に及ぼす光処理の効果.
林試研報 332: 39-60.

Nagasaka, K. and Szmidt, A.E. (1985) Multilocus analysis of external pollen contamination of
a Scots pine (*Pinus sylvestris* L.) seed orchard. *Lecture Notes in Biomathematics* 60:
134-138.

中平幸助・染郷正孝 (1973) 造園木の手引き／つぎ木・とり木の実際. 246pp,

- 地球社, 東京, 159-168.
- 中井 勇・藤本博次・稲森幸雄・伊佐義朗・佐野宗一 (1967) マツ類の交雑育種に関する研究 (I) -クロマツの種内交雑ならびに他のマツ類数種との種間交雑の可能性- . 京大演報 39: 125-143.
- Nakamura, R.R. and Wheeler, N.C. (1992) Pollen competition and paternal success in Douglas-fir. *Evolution* 46: 846-851.
- 中野伸二 (1995) マツノザイセンチュウ抵抗性家系の特性について.
日林九支研論 48: 63-64.
- Neale, D.B. and Sederoff, R.R. (1989) Paternal inheritance of chloroplast DNA and maternal inheritance of mitochondrial DNA in loblolly pine. *Theor. Appl. Genet.* 77: 212-216.
- Nelson, C.D., Nance, W.L. and Doudrick, R.L. (1993) A partial genetic linkage map of slash pine (*Pinus elliotti* Engelm. var. *elliotti*) based on random amplified polymorphic DNAs. *Theor. Appl. Genet.* 87: 145-151.
- 西村慶二 (1991) マツノザイセンチュウ抵抗性クローンの諸特性 (V)
-クロマツの分類・同定-. 日林九支研論 44: 37-38.
- 小笠原隆三 (1962) クロマツのさし木に関する基礎的研究 (第 I 報) 発根が困難である原因について. 日林誌 44: 276-281.
- Okuizumi, H (1993) Clone analysis of collected Sugi-cutting cultivars of the Kyushu region by the multilocus genotype of twelve isozyme loci. *J. Jpn. For. Soc.* 75: 293-302.
- 大庭喜八郎 (1972) 黄金スギ花粉を指標とした選択受精. 日林講 83: 204-206.
- 大庭喜八郎 (1979) マツノザイセンチュウ抵抗性育種の概要 (九州・関西地区).
林木の育種 112: 45-48.
- 大庭喜八郎・勝田 榎 (1991) 林木育種学. 337pp, 文永堂出版, 東京.
- 大山浪雄・豊島昭和 (1965) マツ属のさし木の発根能力とその増進法. 林試研報 179: 99-125
- O'reilly, C., Parker, W.H. and Barker, J.E. (1982) Effect of pollination period and strobili number on random mating in a clonal seed orchard of *Picea mariana*. *Silvae Genet.* 31: 90-94.
- Penner, G.A., Bush, A., Wise, R., Kim, W., Domier, L., Kasha, K., Laroche, A., Scoles, G.,
Molnar, S.J. and Fedak, G. (1993) Reproducibility of random amplified polymorphic DNA (RAPD) analysis among laboratories. *PCR Method Appl.* 2: 341-345.
- Pharis, R.P. and Kuo, C.G. (1977) Physiology of gibberellins in conifers.

- Can. J. For. Res. 7: 299-325.
- Pharis, R.P., Webber, J.E. and Ross, S.D. (1987) The promotion of flowering in forest trees by gibberellin A_{4/7} and cultural treatments: a review of the possible mechanisms. For. Ecol. Manage. 19: 65-84.
- Powell, W., Morgante, M., McDevitt, R., Vendramin, G.G. and Rafalski, J.A. (1995) Polymorphic simple sequence repeat regions in chloroplast genomes: Applications to the population genetics of pines. Proc. Natl. Acad. Sci. USA 92: 7759-7763.
- Prat, D. (1995) Mating system in a clonal Douglas fir (*Pseudotsuga menziesii* (Mirb) Franco) seed orchard. II. Effective pollen dispersal. Ann. Sci. For. 52: 213-222.
- Puritch, G.A., McMullen, E.E., Simmons, C.S. and Meagher, M. D. (1979) Hormonal enhancement of cone production in Douglas-fir grafts and seedlings. Can. J. For. Res. 9: 193-200.
- 林木育種センター (1999) 林木育種事業統計 (平成9年度) 123pp,
林野庁林木育種センター, 茨城, 20-21.
- 林野庁森林保護対策室 (1996) 松くい虫被害の推移. 森林防疫 45: 183.
- Ritland, K. and El-Kassaby, Y.A. (1985) The nature of inbreeding in a seed orchard of Douglas fir as shown by an efficient multilocus model. Theor. Appl. Genet. 71: 375-384.
- Roy, A., Frascaria, N., MacKay, J. and Bousquet, J. (1992) Segregating random amplified polymorphic DNAs (RAPDs) in *Betula alleghaniensis*. Theor. Appl. Genet. 85: 173-180.
- Rudin, D. and Lindgren, D. (1977) Isozyme studies in seed orchards. Studia Forestalia Suecica 139: 1-23.
- Rudin, D., Muona, O. and Yazdani, R. (1986) Comparison of the mating system of *Pinus sylvestris* in natural stands and seed orchards. Hereditas 104: 15-19.
- 佐野信幸 (1997) カメムシ類によるヒノキ種子被害の年次変動. 日林誌 79: 131-136.
- 佐藤平典 (1990) 岩手県におけるマツ材線虫病対策—県単独事業を中心にして—. 森林防疫 39: 151-154.
- Scheepers, D., Eloy, M.-C. and Briquet, M. (1997) Use of RAPD patterns for clone verification and in studying provenance relationships in Norway spruce (*Picea abies*). Theor. Appl. Genet. 94: 480-485.

- Schierwater, B. and Ender, A. (1993) Different thermostable DNA polymerases may amplify different RAPD products. Nucl. Acids. Res. 21: 4647-4648.
- Schmidtling, R.C. (1984) Planting south of origin increases flowering in shortleaf (*Pinus echinata* Mill.) and virginia pines (*P. virginiana* Mill.). Silvae Genet. 33: 140-144.
- Schmidtling, R.C. (1987) Locating pine seed orchards in warmer climates: benefits and risks. For. Ecol. Manage. 19: 273-283.
- Schoen DJ, Denti D, and Stewart SC (1986) Strobilus production in a clonal white spruce seed orchard: Evidence for unbalanced mating. Silvae Genet 35: 201-205.
- Schoen, D.J. and Stewart, S.C. (1986) Variation in male reproductive investment and male reproductive success in white spruce. Evolution 40: 1109-1120.
- Scott, M.P., Haymes, K.M. and Williams, S.M. (1992) Parentage analysis using RAPD PCR. Nucleic Acids. Res. 20: 5493.
- 清藤城宏・前田 一・村上春樹・井田和彦・白石 進 (2000a) 山梨県ヒノキ採種園における鯉沢5号の花粉親としての寄与. 日林誌 82: 105-108.
- 清藤城宏・山岸一雄・井田和彦・村上春樹・白石 進 (2000b) 葉緑体 DNA マーカーを用いたヒノキにおける選択受精の検討. 日林誌 82: 380-383.
- Shaw, D.V. and Allard, R.W. (1982) Estimation of outcrossing rates in Douglas-fir using isozyme markers. Theor. Appl. Genet. 62: 113-120.
- Shen, H.-H., Rudin, D. and Lindgren, D. (1981) Study on the pollination pattern in a Scots pine seed orchard by means of isozyme analysis. Silvae. Genet 30: 7-15.
- Shiraishi, S. (1988) Inheritance of isozyme variations in Japanese black pine, *Pinus thunbergii* Parl. Silvae Genet. 37: 93-100.
- 白石 進・前田 徹 (1994) RAPD マーカーを用いた交配家系のバルク分析. 第105回日林要旨集: 700.
- 白石 進・磯田圭哉・渡辺敦史・河崎久男 (1996) 蔵王山系馬ノ神岳に生存するカラマツのDNA分類学的解析. 日林誌 78: 175-182.
- 白石 進・渡辺敦史 (1995) *rbcL* 遺伝子多型を利用したアカマツとクロマツの葉緑体ゲノム識別. 日林誌 77: 429-436.
- Silen, R.R. (1962) Pollen dispersal considerations for Douglas-fir. Jour. Forestry 60: 790-795.

- Skroch, P. and Nienhuis, J. (1995) Impact of scoring error and reproducibility of RAPD data on RAPD based estimates of genetic distance. *Theor. Appl. Genet.* 91: 1086-1091.
- Slee, M.U. and Spidy, T. (1970) The incidence of graft incompatibility with related stock in *P. caribaea* Mor. var. *hondurensis* B. et G. *Silvae Genet.* 19: 184-187.
- Squillace, A.E. (1967) Effectiveness of 400-foot isolation around a slash pine seed orchard. *Jour. Forestry* 65: 823-824.
- Steinbrenner, E.C., Duffield, J.W. and Campbell, R.K. (1960) Increased cone production of young Douglas-fir following nitrogen and phosphorus fertilization. *Jour. Forestry* 58: 105-110.
- Stoehr, M.U., Orvar, B.L., Vo, T.M., Gawley, J.R., Webber, J.E. and Newton, C.H. (1998) Application of a chloroplast DNA marker in seed orchard management evaluations of Douglas-fir. *Can. J. For. Res.* 28: 187-195.
- Strand, L. (1957) Pollen dispersal. *Silvae Genet.* 6: 129-136.
- Sweet, G.B. (1975) Flowering and seed production. *In* Seed Orchards. pp72-82. Faulkner, R. (eds) Forestry Commission Bulltein 54, London
- Sweet, G.B., Dickson, R.L., Donaldson, B.D. and Litchwark, H. (1992) Controlled pollination without isolation - a new approach to the management of Radiata pine seed orchards. *Silvae. Genet* 41: 95-99.
- Szmidt, A.E. (1987) Genetic composition of seed orchard crops. *For. Ecol. Manage.* 19: 227-232.
- 田畑勝洋 (1997) 被害の推移と行政の対応。(松くい虫 (マツ材線虫病) - 沿革と最近の研究 -。pp274, 全国森林病虫獣害防除協会, 東京). 1-17.
- 高山芳之助 (1967) アカマツの採種園に関する研究 (II) アカマツツギキクロンで観察した肥培の影響。 *日林誌* 49: 192-197.
- 鳥羽瀬正志・中村健作・宮島淳二・戸田忠雄 (1993) マツノザイセンチュウ抵抗性種苗の生産 (I) - 天草森林組合におけるスーパーマツの生産 -。 *日林九支研論* 46: 81-82.
- 戸田良吉 (1953) マツ類のサンキについて - 総合抄録 -。 *林試研報* 65: 61-85.
- Toda, R. (1964) A brief review and conclusions of the discussion on seed orchards. *Silvae. Genet* 13: 1-4.
- 戸田忠雄 (1997) マツノザイセンチュウ抵抗性マツの育成。(松くい虫 (マツ材線虫病) - 沿革と最近の研究 -。pp274, 全国森林病虫獣害防除協会, 東京). 168-257.

- 戸田忠雄・千吉良治・宮田増男（1997a）クロマツ×アカマツ交雑種のマツノザイセンチュウ抵抗性の向上の事例．日林九支研論 50: 41-42.
- 戸田忠雄・藤本吉幸・西村慶二（1990）アイノコマツのマツノザイセンチュウ抵抗性（Ⅲ）－クロマツ×アカマツの人工交雑種の抵抗性－．日林九支研論 43: 43-44.
- 戸田忠雄・西村慶二・田島正啓（1994a）マツノザイセンチュウ抵抗性クローンの諸特性（Ⅸ）－抵抗性クローンの開花時期－．日林九支研論 47: 53-54.
- 戸田忠雄・田島正啓・西村慶二・竹内寛興（1993）九州におけるマツノザイセンチュウ抵抗性育種－抵抗性クローンの選抜後の研究経過－．林育研報 11: 37-88.
- 戸田忠雄・竹内寛興・千吉良治・山野邊太郎・栗延 晋・宮田増男（1999）クロマツ実生家系からのマツノザイセンチュウ抵抗性個体の選抜（Ⅱ）－クロマツ実生家系の一次検定及び二次検定－．日林九支研論 52: 41-42.
- 戸田忠雄・竹内寛興・宮田増男・園田一夫（1998）クロマツ実生家系からのマツノザイセンチュウ抵抗性個体の選抜（Ⅰ）－球果を採取した母樹の2，3の形質の地域間差－．日林九支研論 51: 49-50.
- 戸田忠雄・竹内寛興・田島正啓（1994b）マツノザイセンチュウ抵抗性クローンの諸特性（Ⅹ）－抵抗性クローンの樹脂道指数から見た雑種性－．日林九支研論 47: 55-56.
- 戸田忠雄・竹内寛興・田村 明・西村慶二（1997b）マツノザイセンチュウ抵抗性クローンの諸特性（ⅩⅢ）－採取年次の異なる種子から育成したアカマツ抵抗性家系の抵抗性変異－．日林九支研論 50: 39-40.
- 戸田忠雄・寺田貴美雄（1997）マツノザイセンチュウ抵抗性育種の現状と展望．
林木の育種 184: 20-26.
- 戸田忠雄・鳥羽瀬正志・永田 勲（1992）検定地間における材線虫接種検定結果の変動．
日林九支研論 45: 45-46.
- Tulsieram, L.K., Glaubitz, J.C., Kiss, G. and Carlson, J.E. (1992) Single tree genetic linkage mapping in conifers using haploid DNA from megagametophytes.
Bio/Technology 10: 686-690.
- Van de Ven, W.T.G. and McNicol, R.J. (1995) The use of RAPD markers for identification of Sitka spruce (*Picea sitchensis*) clones. Heredity 75: 126-132.
- Vendramin, G.G., Anzidei, M., Madaghiele, A. and Bucci, G. (1998) Distribution of genetic diversity in *Pinus pinaster* Ait. as revealed by chloroplast microsatellites.

- Theor. Appl. Genet. 97: 456-463.
- Wagner, D.B. (1992) Nuclear, chloroplast, and mitochondrial DNA polymorphisms as biochemical markers in population genetic analyses of forest trees.
New Forests 6: 373-390.
- Wakushima, S., Yoshioka, H. and Sakurai, N. (1996) Lateral female strobili production in a Japanese red pine (*Pinus densiflora* Sieb. et Zucc.) clone by exogenous cytokinin application. J. For. Res.1: 143-148.
- Wakushima, S., Yoshioka, H. and Sakurai, N. (1997) Promotion of lateral female strobili production in *Pinus densiflora* by cytokinin application at a specific stage.
J. For. Res.2: 51-57.
- Wang, C.-W., Perry, T.O. and Johnson, A.G. (1960) Pollen dispersion of slash pine (*Pinus elliotti* Engelm.) with special reference to seed orchard management.
Silvae. Genet 9: 78-86.
- Wang, X.-R., Lindgren, D., Szmidt, A.E. and Yazdani, R. (1991) Pollen migration into a seed orchard of *Pinus sylvestris* L. and the methods of its estimation using allozyme markers.
Scand. J. For. Res. 6: 379-385.
- 渡辺敦史・前田 一・白石 進 (1997) PCR-SSCP 分析を用いたアカマツとクロマツの葉緑体ゲノム型の簡便判定法. 日林誌 79: 155-156.
- 渡辺敦史・白石 進・川瀬英治・戸田忠雄・那須 孝 (1996) DNA 分子マーカーによるアカクロマツ (*Pinus × densi-thunbergii*) のゲノム解析—その雑種性の検証—. 日林誌 79: 293-300.
- 渡辺 操・岩川 盈夫 (1969) マツ類の人工受粉技術ならびに種間交雑について.
林試研報 224: 125-146.
- Waugh, R. and Powell, W. (1992) Using RAPD markers for crop improvement.
Tibtech10: 186-191
- Welsh, J., Honeycutt, R.J., McClelland, M. and Sobral, B.W.S. (1991) Parentage determination in maize hybrids using the arbitrarily primed polymerase chain reaction (AP-PCR).
Theor. Appl. Genet. 82: 473-476.
- Welsh, J. and McClelland, M. (1990) Fingerprinting genomes using PCR with arbitrary primers.
Nucl. Acids Res. 18: 7213-7218.

- Werner, M. (1975) Location, establishment and management of seed orchards. *In* Seed Orchards. pp49-57. Faulkner, R. (eds) Forestry Commission Bulltein 54, London
- Wheeler, N.C. and Jech, K.S. (1992) The use of electrophoretic markers in seed orchard research. *New Forests* 6: 311-328.
- Williams, J.G.K., Kubelik, A.R., Livak, K.J., Rafalski, J.A., and Tingey, S.V. (1990) DNA polymorphisms amplified by arbitrary primers are useful as genetic markers. *Nucl. Acids Res.* 18: 6531-6535.
- Wright, J.W. (1976) Introduction to forest genetics. 463pp, Academic Press, New York San Fransisco London.
- 柳原利夫・棚秋一延・荒井国幸 (1960) カラマツ結実の豊凶と気象の関係について. *日林誌* 42: 347-351.
- 吉野 豊・田畑勝洋 (1989) ヒノキ採種園におけるチャバネアオカメムシの種子への加害 (I) -加害の時期と発芽率-. *日林誌* 71: 160-163.
- 吉野 豊・谷口真吾 (1991) スギ採種園におけるカメムシ類による種子への加害. *日林誌* 73: 460-465.
- Yu, K. and Pauls, K.P. (1993) Rapid estimation of genetic relatedness among heterogeneous populations of alfalfa by random amplification of bulked genomic DNA samples. *Theor. Appl. Genet.* 86: 788-794.
- Ziegenhagen, B., Scholz, F., Madaghiele, A. and Vendramin, G.G. (1998) Chloroplast microsatellites as markers for paternity analysis in *Abies alba*. *Can. J. For. Res.* 28: 317-321.
- Zobel, B.J., Barber, J., Brown, C.L. and Perry, T.O. (1958) Seed orchard -Their concept and management. *Jour. Forestry* 56: 815-825.
- Zobel, B.J. and McElwee, R.L. (1964) Seed orchards for the production of genetically improved seed. *Silvae. Genet* 13: 4-11.
- Zobel, B.J. and Talbert, J. (1984) Applied forest tree improvement. 505pp, John Willey & Sons, New York.

Appendix—1 Identification of male parent of half-sib progeny of Tanabe-(t)54

No	A-09 510	A-11 490	A-11 810	A-12 700	A-12 620	A-16 450	A-17 750	C-06 520	C-06 820	C-09 670	C-09 810	D1 420	F-01 310	F-05 710	F-16 610	F-19 490	I10 750	I10 800	M17 490	M17 610	S-10 390	U-09 610	V-01 400	V-04 550	V-04 780	V-17 470	X-01 510	W-14 420	Male parent		
1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	Tsuyazaki-(t)50		
2	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	Namikata-(t)37		
3	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	Namikata-(t)37		
4	0	-	-	0	0	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	Tsuyazaki-(t)50		
5	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	Contamination		
6	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	0	1	0	0	0	0	-	Obama-(t)30		
7	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0	0	0	0	1	0	0	Ooseto-(t)12		
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0	0	0	0	1	0	1	Ooseto-(t)12		
9	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	Obama-(t)30		
10	1	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	Tsuyazaki-(t)50	
11	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	Namikata-(t)37	
12	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	Sendai-(t)290	
13	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	Namikata-(t)37	
14	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	1	0	0	1	1	1	1	Tsuyazaki-(t)50	
15	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	Namikata-(t)37	
16	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	Tsuyazaki-(t)50	
17	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	Namikata-(t)37
18	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	Namikata-(t)37
19	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	Namikata-(t)37
20	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	Sendai-(t)290
21	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	Namikata-(t)37
22	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	Sendai-(t)290
23	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	Namikata-(t)37
24	0	0	0	0	1	0	0	1	0	1	0	0	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	Namikata-(t)37
25	0	0	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	Namikata-(t)37
26	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	Namikata-(t)37
27	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	Yasu-(t)37
28	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	Tsuyazaki-(t)50
29	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	Sendai-(t)290
30	1	0	0	1	0	1	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	Namikata-(t)37
																															Tsuyazaki-(t)50

Appendix — 1 (Continued)

No	A-09 A-11 A-11			A-12 A-16 A-17			C-06 C-06			C-09 C-09			D1	F-01 F-05 F-16			F-19 I-10			M17 M17			S-10	U-09 V-01			V-04 V-04			V-17	X-01	W-14	Male parent																					
	510	490	810	A-11	700	A-12	620	A-16	450	A-17	750	C-06	520	C-06	820	C-09	670	C-09	810	420	F-01	310	F-05	710	F-16	610	490	I-10	750	I-10	800	M17	490	M17	610	390	S-10	610	U-09	400	V-01	550	V-04	780	470	510	420							
31	0	0	1	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	Namikata-(t)37						
32	0	0	1	0	1	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	Namikata-(t)37						
33	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	Namikata-(t)37						
34	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sendai-(t)290						
35	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	Tsuyazaki-(t)50						
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Tanabe-(t)54						
37	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	1	1	Tsuyazaki-(t)50						
38	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	Yasu-(t)37						
39	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	Ooita-(t)8						
40	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	Namikata-(t)37					
41	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Tsuyazaki-(t)50					
42	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	Yasu-(t)37					
43	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	Yasu-(t)37					
44	0	0	0	0	0	0	-	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	Yasu-(t)37					
45	0	0	0	0	0	0	-	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	Misaki-(t)90 or Namikata-(t)37					
46	0	0	1	0	1	0	1	1	0	0	0	0	0	0	0	-	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Namikata-(t)37				
47	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	Namikata-(t)37				
48	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Contamination				
49	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sendai-(t)290				
49	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	Yasu-(t)37				
50	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	Tsuyazaki-(t)50			
51	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	Tsuyazaki-(t)50			
52	1	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	Tsuyazaki-(t)50			
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	Tsuyazaki-(t)50			
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	Misaki-(t)90			
54	0	0	1	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	Namikata-(t)37		
55	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Yasu-(t)37			
56	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Misaki-(t)90			
57	0	0	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Namikata-(t)37			
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Ooseto-(t)12		
59	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	Yasu-(t)37		
60	0	1	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sendai-(t)290

Appendix-1 (Continued)

No	A-09		A-11		A-12		A-16		A-17		C-06		C-09		C-09		D1		F-01		F-05		F-16		F-19		I10		I-10		M17		M17		S-10		U-09		V-01		V-04		V-04		V-17		X-01		W-14		Male parent																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	510	490	810	A-11	700	620	450	750	520	820	670	810	420	310	710	610	490	750	800	490	610	490	610	390	610	400	550	780	470	510	420																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				

Appendix-2 Identification of male parent of a progeny (Namikata-(t)73)

No	A-09 510 Aa	A-12 700 aa	A-16 560 aa	A-17 450 Aa	A-17 750 aa	A-17 860 aa	A-17 950 aa	D-01 420 aa	D-03 700 Aa	D-03 800 aa	F-01 310 aa	F-05 710 aa	F-16 610 aa	I10 530 Aa	I10 750 Aa	I-10 800 aa	M-17 490 aa	U-09 610 aa	V-01 340 Aa	V-01 370 aa	V-01 400 Aa	V-04 550 aa	V-04 780 aa	V-17 470 aa	V-17 780 Aa	W-14 420 aa	Male parent
1	1	0	0	1	0	0	0	0	1	0	0	1	1	0	1	0	0	0	1	0	0	0	0	0	-	1	Misaki-(t)90
2	1	0	0	1	0	0	0	0	1	0	0	1	1	0	1	0	0	0	1	0	1	0	0	0	1	0	4, 7, 9
3	0	0	0	1	0	0	0	0	1	1	0	0	1	1	1	0	0	0	1	0	1	0	0	0	1	0	4, 5, 6, 8
4	1	0	0	1	0	0	0	0	1	0	0	0	1	1	1	0	0	0	1	0	1	0	0	1	1	0	Sendai-(t)290
5	0	0	0	1	0	0	0	1	1	1	0	0	0	0	1	0	0	1	0	0	1	0	1	0	0	0	Sendai-(t)290
6	0	1	0	1	0	0	0	1	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	0	1	1	Tsuyazaki-(t)50
7	1	0	0	1	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	Misaki-(t)90
8	0	0	0	1	0	0	0	0	1	0	0	1	1	1	1	0	0	1	0	0	1	0	0	0	-	0	Ooita-(t)8
9	1	0	0	1	0	1	0	0	1	0	0	-	1	0	1	0	0	0	1	0	0	0	0	0	0	0	Obama-(t)24
10	0	0	1	1	0	0	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	Tanabe-(t)54
11	1	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0	0	1	0	1	0	0	0	1	0	5,8,12
12	1	0	0	1	0	0	0	0	0	1	0	0	1	0	1	0	0	0	1	0	1	0	0	1	1	0	4,12
13	0	0	0	1	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	1	1	0	0	1	0	Misaki-(t)90
14	1	0	0	1	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1	1	0	0	1	1	0	Ooseto-(t)12
15	0	0	0	1	0	0	0	0	1	1	0	0	1	1	1	0	0	0	1	0	1	0	0	0	1	0	4,5,6,8,12,15
16	0	0	0	1	0	0	-	0	1	0	0	0	1	1	0	1	0	0	1	0	1	0	0	0	1	0	6,9
17	1	0	0	1	0	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	1	1	0	0	1	1	Misaki-(t)90
18	1	1	0	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	1	0	1	0	1	0	Sendai-(t)290
19	0	0	0	1	0	0	0	0	1	1	0	0	1	1	1	0	0	0	0	1	1	0	0	0	1	0	Ooseto-(t)12
20	0	1	0	1	0	0	0	0	-	-	0	0	0	1	1	0	0	1	1	0	1	0	0	0	1	0	Sendai-(t)290
21	1	0	0	1	0	0	0	0	1	1	1	0	0	1	1	0	0	0	1	0	1	0	0	0	1	0	Yasu-(t)37
22	0	0	1	0	0	0	1	0	1	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	Tanabe-(t)54
23	1	0	1	1	0	0	1	0	1	1	0	0	0	1	1	0	0	0	1	0	1	-	-	0	1	0	Tanabe-(t)54
24	1	0	0	1	0	0	0	0	1	0	0	1	0	1	1	0	0	0	1	0	1	0	0	0	0	0	7,9
25	0	1	0	1	0	0	0	1	1	1	0	0	0	0	1	0	0	1	1	0	1	0	0	0	1	0	Sendai-(t)290
26	1	0	0	1	0	0	0	0	1	0	0	0	1	1	1	0	0	-	0	0	1	0	0	0	1	0	3,4,6,8,15,16
27	1	1	0	1	0	0	0	0	1	1	0	0	0	1	1	0	0	1	0	0	1	0	0	0	1	0	Sendai-(t)290
28	0	0	1	1	0	0	1	0	1	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	Tanabe-(t)54
29	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	1	0	1,2,9,13,15
30	0	0	1	1	0	0	0	0	1	1	1	0	0	0	1	0	0	1	1	0	1	0	0	0	1	-	Yasu-(t)37
31	1	0	0	1	0	0	0	0	1	0	0	1	0	1	1	0	0	0	0	0	1	1	0	0	1	0	Misaki-(t)90
32	1	0	1	1	0	0	0	0	1	1	1	0	0	1	1	0	0	0	1	0	1	0	0	0	1	0	Yasu-(t)37
33	1	0	1	1	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	1	0	2,9,16
34	1	1	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	1	0	1	0	1	0	Sendai-(t)290
35	0	-	0	1	0	0	0	0	1	0	0	0	0	1	1	1	0	0	1	0	1	0	0	0	1	0	6,9
36	1	0	0	1	0	0	0	0	0	0	0	1	1	1	1	0	0	0	1	0	1	1	0	0	1	0	Misaki-(t)90
37	1	0	0	1	0	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0	1	0	0	0	1	0	4,6,8,15,16
38	1	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	5,6,14,15
39	1	0	0	1	0	0	0	1	1	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0	1	0	2,5,6,11,12,14
40	1	0	1	-	-	-	-	0	1	1	0	0	0	1	1	0	0	1	1	0	1	0	0	0	1	0	Yasu-(t)37
41	0	0	0	1	0	0	0	0	1	1	0	0	1	1	1	0	0	0	1	0	1	0	0	0	1	0	4,5,6,8,15
42	0	0	0	1	0	0	0	0	1	0	0	0	1	1	1	0	1	0	1	0	1	-	-	0	1	0	4,16
43	0	1	0	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	1	-	6,16
44	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	0	0	0	1	0	1	0	0	1	1	1	Ooseto-(t)12
45	1	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1	0	1	0	0	0	1	0	2,6,9
46	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	1	1	0	0	1	0	0	0	1	0	Sendai-(t)290
47	1	0	0	1	0	0	0	-	1	1	0	0	0	1	1	0	0	0	0	0	1	0	1	0	1	0	Sendai-(t)290

1: Namikata-(t)73, 2: Obama-(t)30, Tosashimizu-(t)63, Ooita-(t)8, 5: Ei-(t)425, 6: Tsuyazaki-(t)50,
7: Misaki-(t)90, 8: Ooseto-(t)12, 9: Namikata-(t)37, 10: Tanabe-(t)54, 11: Yasu-(t)37, 12: Shima-(t)64
13: Yoshida-(t)2, 14: Sendai-(t)290, 15: Mitoyo-(t)103, 16: Obama-(t)24

Appendix-2 Identification of male parent of a progeny (Obama-(t)30)

No.	A-11 490 aa	A-11 850 aa	A-12 700 aa	A-16 560 Aa	A-16 620 aa	A-17 750 aa	A-17 860 aa	A-17 950 aa	C-09 610 aa	D-03 700 aa	D-03 800 Aa	F-03 720 aa	F-05 710 aa	G-17 590 aa	I10 530 aa	I10 750 aa	U-03 700 aa	U-09 610 aa	U-13 580 aa	V-04 550 aa	V-04 850 aa	V-17 470 aa	W-14 420 aa	Male parent
1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	1	0	0	1	0	0	Yasu-(t)37
2	0	0	0	0	1	0	0	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	1,9
3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	1	1	1	Ooseto-(t)8
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1,8,9
5	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	Tsuyazaki-(t)50
6	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	1,9
7	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	Sendai-(t)290
8	0	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	1,11
9	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	1	0	Tsuyazaki-(t)50
10	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1,2,4,9,12,13,16
11	1	0	1	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	Sendai-(t)290
12	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1	0	0	1	0	0	1	Misaki-(t)90
13	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1,4,9,16
14	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	1	0	0	1,11
15	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	1	Ooseto-(t)12
16	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	1	0	0	Namikata-(t)73
17	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	14,16
18	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	1	0	0	Contamination
19	0	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	1	1	0	0	0	0	0	Yasu-(t)37
20	0	0	0	1	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	1	1	1	Ooseto-(t)12
21	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	1	1	Tsuyazaki-(t)50
22	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	1	1	Tsuyazaki-(t)50
23	0	0	1	1	0	0	0	0	0	0	1	0	0	1	0	1	1	1	0	0	0	0	0	Sendai-(t)290
24	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	4,12,16
25	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	1	1	0	Ooseto-(t)12
26	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	1	1	0	1	0	1	0	0	Namikata-(t)73
27	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	Sendai-(t)290
28	0	0	0	1	0	0	0	0	1	1	0	0	1	0	0	0	1	0	0	1	0	1	0	Misaki-(t)90
29	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	1	1	0	0	0	0	0	0	Misaki-(t)90
30	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1	0	Ooseto-(t)12
31	0	0	0	1	0	0	0	0	0	1	1	0	0	1	0	1	1	1	0	0	0	0	0	Yasu-(t)37
32	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1,9,16
33	0	0	0	1	0	0	0	0	1	1	1	0	1	0	0	1	1	0	1	1	0	0	0	Misaki-(t)90
34	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	Ooita-(t)8
35	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	4,14
36	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	1	1	Ooseto-(t)8
37	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	4,14
38	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	Namikata-(t)37
39	0	0	-	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	1	1	0	Ooseto-(t)12
40	0	1	0	1	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	1,9
41	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	Tsuyazaki-(t)50
42	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	Sendai-(t)290
43	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	1	0	0	0	0	1	1	Tsuyazaki-(t)50
44	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	Ooseto-(t)12
45	0	0	1	0	0	0	0	0	0	1	1	0	0	1	0	1	-	0	0	0	0	0	0	Yohida-(t)2
46	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	1	Ooseto-(t)12
47	0	0	0	1	0	0	0	0	1	1	0	0	1	0	0	1	1	0	1	1	0	0	1	Misaki-(t)90
48	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	1	Ooseto-(t)12

1: Namikata-(t)73, 2: Obama-(t)30, Tosashimizu-(t)63, Ooita-(t)8, 5: Ei-(t)425, 6: Tsuyazaki-(t)50,
7: Misaki-(t)90, 8: Ooseto-(t)12, 9: Namikata-(t)37, 10: Tanabe-(t)54, 11: Yasu-(t)37, 12: Shima-(t)64
13: Yoshida-(t)2, 14: Sendai-(t)290, 15: Mitoyo-(t)103, 16: Obama-(t)24

Appendix-2 Identification of male parent of a progeny (Tosashimizu-(t)63)

No.	A-09 510 aa	A-11 490 aa	A-11 850 aa	A-12 700 aa	A-16 560 aa	A-17 450 Aa	A-17 750 aa	A-17 950 aa	D-01 420 aa	D-03 700 Aa	D-03 800 Aa	F-05 710 aa	F-16 610 Aa	G-17 590 aa	I10 530 Aa	I10 750 aa	I-10 800 aa	S-10 390 aa	S-18 700 aa	V-01 340 Aa	V-01 370 aa	V-04 550 aa	V-04 780 aa	V-04 850 aa	W-14 420 aa	Male parent
1	0	0	0	-	0	1	0	0	0	1	0	0	1	1	1	1	0	-	0	1	0	0	1	0	0	Sendai-(t)290
2	0	0	0	-	0	0	0	0	0	1	0	0	1	0	1	1	0	-	1	0	0	0	0	1	1	Ooseto-(t)12
3	0	0	0	0	0	1	0	0	0	1	1	0	1	0	1	1	0	1	1	0	1	0	0	0	0	Ooseto-(t)12
4	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1	1	0	0	1	1	1	0	0	0	0	Ooseto-(t)12
5	0	0	0	-	0	1	0	0	1	1	1	0	0	0	0	0	1	-	1	1	0	0	0	0	0	Tsuyazaki-(t)50
6	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	0	0	1	1	0	0	0	0	0	0	1.8
7	0	1	0	-	0	1	0	0	1	1	0	0	1	1	1	1	0	-	1	1	0	0	1	0	0	Sendai-(t)290
8	0	0	0	0	0	1	0	0	0	1	1	0	1	0	1	0	0	0	1	0	0	0	0	1	0	4.8,13
9	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	1	0	0	1	1	0	0	0	0	0	4.6,8,11,13,15
10	0	0	0	-	0	1	0	0	0	1	1	0	1	1	0	1	0	-	1	0	0	0	1	0	0	Sendai-(t)290
11	1	0	0	-	0	1	0	0	0	1	1	0	1	0	1	0	0	-	0	0	0	0	-	-	0	12,16
12	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	Yoshida-(t)2
13	0	1	0	-	0	1	0	0	0	0	1	0	0	1	0	1	0	-	0	1	0	0	0	0	0	Sendai-(t)290
14	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	1	0	0	1	1	0	0	0	0	1	Ooseto-(t)12
15	0	0	1	-	0	1	0	0	0	1	1	1	1	0	0	1	0	-	0	1	0	0	0	0	0	Namikata-(t)37
16	0	0	0	-	0	1	0	0	0	1	1	0	1	1	1	1	0	-	0	1	0	0	1	0	0	Sendai-(t)290
17	0	0	0	1	0	1	0	0	1	0	1	0	1	1	0	1	0	0	0	1	0	0	0	0	0	14,16
18	1	0	0	0	0	1	0	0	0	1	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	2,4,6,8,15
19	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	1	0	1	1	0	1	0	0	0	0	Ooseto-(t)12
20	1	0	0	0	0	1	0	0	0	0	1	0	1	1	1	0	0	-	1	1	0	0	0	0	0	1.16
21	0	1	0	-	0	1	0	0	0	1	1	0	1	1	0	1	0	-	0	1	0	0	0	0	0	Sendai-(t)290
22	0	0	0	-	0	1	0	0	1	0	1	0	0	1	1	1	0	-	0	1	0	0	1	0	0	Sendai-(t)290
23	1	0	1	-	0	1	0	0	0	1	0	0	0	1	0	0	0	-	1	0	0	0	0	1	0	Namikata-(t)73
24	-	0	0	0	0	1	0	0	0	1	0	0	1	1	1	0	0	1	1	1	0	0	0	0	0	1.8
25	0	0	0	1	0	1	0	0	1	1	1	0	1	0	1	0	1	0	1	1	0	0	0	0	0	Tsuyazaki-(t)50
26	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	0	0	1	1	0	0	0	0	1	Ooseto-(t)12
27	0	0	0	0	0	-	0	0	0	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	3,5,16
28	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	1	0	0	1	1	0	0	0	0	0	6,11,14
29	0	0	0	1	0	1	0	0	0	1	1	0	1	0	1	1	0	0	0	1	0	0	0	0	0	14,16
30	0	0	1	0	0	0	0	0	0	1	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	Namikata-(t)37
31	0	0	0	0	0	1	0	0	0	1	1	0	1	1	1	0	0	0	1	1	0	0	0	0	0	4,16
32	0	0	0	0	1	1	0	0	0	1	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	Namikata-(t)37
33	0	0	0	1	0	0	0	0	0	1	0	0	1	0	1	1	0	1	1	0	1	1	0	0	-	Ooseto-(t)12
34	0	0	0	0	1	1	0	0	0	0	1	0	1	0	1	1	0	0	0	1	0	0	0	0	0	9,16
35	0	0	0	1	0	1	0	0	1	0	1	0	0	0	0	1	0	0	1	1	0	0	0	0	0	Sendai-(t)290
36	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	5,12
37	0	0	0	0	0	1	0	0	0	1	1	0	1	0	1	1	0	1	1	1	0	0	0	1	0	1.8
38	0	0	0	1	0	1	0	0	0	1	1	0	1	0	1	0	0	1	1	1	0	0	0	0	1	Ooseto-(t)12
39	1	0	0	0	0	1	0	0	1	1	1	0	0	0	1	1	0	0	1	1	0	1	0	0	0	Misaki-(t)90
40	1	0	0	0	0	1	0	0	0	1	0	0	0	1	1	0	0	1	1	1	0	0	0	1	0	Namikata-(t)73
41	0	1	0	0	0	1	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	Sendai-(t)290
42	1	0	0	0	0	1	0	0	0	1	1	0	1	1	1	0	0	1	1	1	0	0	0	1	0	Namikata-(t)73
43	1	0	0	0	0	1	0	0	0	1	1	0	1	0	1	1	0	0	1	1	0	0	0	1	1	Ooseto-(t)12
44	1	0	0	0	0	1	0	0	0	1	1	0	1	0	1	1	0	0	1	1	0	0	0	0	0	2,4,6,8,15
45	0	0	0	0	0	1	0	0	0	1	1	0	1	1	1	1	0	0	1	0	0	0	0	0	0	4,13,14,16

1: Namikata-(t)73, 2: Obama-(t)30, Tosashimizu-(t)63, Ooita-(t)8, 5: Ei-(t)425, 6: Tsuyazaki-(t)50,
7: Misaki-(t)90, 8: Ooseto-(t)12, 9: Namikata-(t)37, 10: Tanabe-(t)54, 11: Yasu-(t)37, 12: Shima-(t)64
13: Yoshida-(t)2, 14: Sendai-(t)290, 15: Mitoyo-(t)103, 16: Obama-(t)24

Appendix-2 Identification of male parent of a progeny (Ooita-(t)8)

No.	A-11 490 aa	A-11 850 aa	A-12 700 aa	A-16 560 aa	A-17 750 aa	A-17 1050 aa	C-09 610 aa	D-01 420 aa	D-03 700 Aa	D-03 800 Aa	F-03 720 aa	I-10 530 aa	I-10 750 Aa	I-10 800 aa	M-17 610 aa	S-10 390 aa	U-03 700 aa	U-13 580 aa	V-01 340 Aa	V-01 370 aa	V-04 550 aa	V-04 780 aa	W-14 420 aa	Male parent
1	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	Ooseto-(t)12
2	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	3,8,15
3	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	1	0	0	0	0	0	1	Ooseto-(t)12
4	0	1	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	1	0	0	0	0	Namikata-(t)37
5	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	1	0	0	0	0	0	0	1	Ooseto-(t)12
6	0	0	0	0	0	1	0	0	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	1,8
7	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	0	1	Ooseto-(t)12
8	0	0	0	0	0	1	0	0	1	1	0	-	-	-	0	1	1	0	1	0	0	0	1	7,8
9	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	1	1	0	0	1	Ooseto-(t)12
10	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	1	0	0	0	1	0	0	0	Ooseto-(t)12
11	0	0	0	0	0	1	0	0	1	1	0	1	1	0	0	1	1	0	1	0	0	0	1	Ooseto-(t)12
12	0	0	0	0	0	1	0	0	0	1	0	1	1	0	0	1	0	0	1	0	0	0	0	1,8
13	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	Namikata-(t)37
14	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	0	1	Ooseto-(t)12
15	0	0	1	0	0	0	0	1	1	1	0	0	1	0	0	0	-	0	1	0	0	0	1	Tsuyazaki-(t)50
16	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	1	0	0	1	0	0	0	0	1,8
17	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	0	3,8,15
18	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	1	0	0	0	0	0	1	Ooseto-(t)12
19	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	1	0	0	0	0	0	1	Ooseto-(t)12
20	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	-	-	0	0	1	Ooseto-(t)12
21	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	-	1	0	0	1	0	0	0	Ooseto-(t)12
22	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	Ooseto-(t)12
23	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	-	0	0	0	0	0	0	3,8,9,15
24	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0	0	0	1	Ooseto-(t)12
25	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	1	1	0	1	0	0	0	0	1,8
26	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	0	1	0	1	0	1	0	0	Misaki-(t)90
27	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	1	0	0	0	0	6,7,15,16
28	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	1	0	0	0	1	5,6,7
29	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	1	0	0	0	1	Ooseto-(t)12
30	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	1	0	1	0	0	0	0	1,7,8
31	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	1	0	1	0	0	0	1	Ooseto-(t)12
32	0	0	0	1	0	1	0	0	1	1	1	1	0	1	0	0	0	0	1	0	0	0	0	Namikata-(t)37
33	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	1	0	-	1	0	0	0	1	Ooseto-(t)12
34	0	0	0	0	0	1	0	0	1	1	0	1	1	0	0	0	1	0	0	0	-	-	1	Ooseto-(t)12
35	0	0	0	1	0	1	0	0	0	0	1	1	0	1	0	0	0	0	1	0	0	0	0	Namikata-(t)37
36	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0	Ooseto-(t)12
37	0	0	0	0	0	1	0	0	1	0	1	1	1	0	0	0	0	0	1	0	0	0	0	Namikata-(t)37
38	0	1	0	-	0	1	0	0	1	1	1	0	1	0	0	0	0	0	1	0	0	0	0	Namikata-(t)37
39	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0	1	0	0	0	0	8,9
40	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	1	1	0	1	0	0	0	0	1,8
41	0	0	0	0	0	1	0	0	1	0	1	1	1	0	0	0	0	0	1	0	0	0	0	Namikata-(t)37
42	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	Namikata-(t)37
43	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	1	0	0	1	0	0	0	0	1,8
44	0	0	0	1	0	1	0	0	0	1	0	1	1	0	0	1	1	0	1	0	0	0	0	Namikata-(t)73
45	0	0	0	0	0	1	0	0	1	1	0	1	1	0	0	1	1	0	1	0	0	0	0	1,8

1: Namikata-(t)73, 2: Obama-(t)30, Tosashimizu-(t)63, Ooita-(t)8, 5: Ei-(t)425, 6: Tsuyazaki-(t)50,
7: Misaki-(t)90, 8: Ooseto-(t)12, 9: Namikata-(t)37, 10: Tanabe-(t)54, 11: Yasu-(t)37, 12: Shima-(t)64
13: Yoshida-(t)2, 14: Sendai-(t)290, 15: Mitoyo-(t)103, 16: Obama-(t)24

Appendix-2 Identification of male parent of a progeny (Ei-(t)425)

No.	A-09		A-11		A-12	A-16		A-17			A-17	A-17	C-09	D-03	F-03	F-05	F-16	I10		I-10	S-18	U-09	V-01			V-01	V-01	V-04	V-04	V-04	V-17	V-17	Male parent
	510	490	850	700	560	620	450	860	950	670	700	720	710	610	530	800	700	610	340	370	400	550	780	850	470	780							
	Aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	Aa	aa	aa	Aa	aa	Aa	aa	Aa	aa	aa	aa	aa	aa	aa	aa	Aa				
1	1	0	0	1	0	0	1	0	0	0	1	1	0	1	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	1	Tsuyazaki-(t)50	
2	1	0	0	0	0	0	1	0	0	1	1	0	1	1	0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	1	Misaki-(t)90	
3	0	0	0	1	0	0	1	0	0	0	1	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	Tsuyazaki-(t)50	
4	1	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1,4,13	
5	1	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	Tsuyazaki-(t)50	
6	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	1	1	1	0	0	0	0	0	0	0	1	Ooseto-(t)12	
7	1	0	0	0	0	0	1	0	0	0	1	0	1	1	0	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	4,7,9	
8	1	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	4,6	
9	1	0	0	1	0	0	1	0	0	0	1	1	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	Tsuyazaki-(t)50	
10	1	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	1	Namikata-(t)37	
11	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	1	Namikata-(t)37	
12	1	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	Tsuyazaki-(t)50	
13	1	0	0	1	0	0	1	0	0	0	1	1	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	Tsuyazaki-(t)50	
14	1	0	0	1	0	0	0	1	0	1	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	1	Obama-(t)24	
15	1	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	1	1	Tsuyazaki-(t)50		
16	0	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	1	Sendai-(t)290		
17	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	1	0	1	0	1	0	0	0	0	0	1	1	4,6		
18	1	0	0	0	0	0	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	0	1	0	0	0	0	0	0	1	Namikata-(t)37		
19	1	0	1	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	1	Namikata-(t)37		
20	1	0	0	0	0	0	1	0	0	0	1	1	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	1	0	Tsuyazaki-(t)50		
21	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	0	0	1	0	Yoshida-(t)2		
22	0	0	0	1	0	0	1	0	0	0	1	1	0	0	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	1	Tsuyazaki-(t)50		
23	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	1	0	-	-	-	1	0	0	0	0	1	0	1	Misaki-(t)90			
24	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	Misaki-(t)90		
25	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	Tsuyazaki-(t)50		
26	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	1	Sendai-(t)290		
27	1	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0	0	1	1,9		
28	0	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	1	0	1	0	1	0	1	0	0	0	0	0	1	0	1,6,9		
29	1	0	1	0	0	0	0	0	0	1	1	1	0	0	1	0	1	0	1	0	1	0	1	0	0	0	0	0	0	1	Namikata-(t)73		
30	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	1	0	1	0	1	0	0	0	0	0	0	1	4,11		
31	1	0	0	0	0	0	1	0	0	0	1	0	0	1	1	0	1	0	1	0	1	1	1	0	0	1	1	1	1	1	Ooseto-(t)12		
32	1	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0	0	0	1	Namikata-(t)73		
33	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	1	Tsuyazaki-(t)50		
34	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	1	Tsuyazaki-(t)50		
35	1	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	1	0	1	1	0	0	0	0	0	0	Misaki-(t)90		
36	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	1	0	1	0	1	0	0	0	0	0	1	1	Ooseto-(t)12		
37	1	0	0	1	0	0	1	0	0	0	1	1	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	Tsuyazaki-(t)50		
38	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	1	0	1	0	0	0	0	0	1	1	Ooseto-(t)12		
39	1	0	1	0	1	0	0	0	0	1	0	1	0	0	1	0	1	-	1	0	1	0	0	0	0	0	0	0	0	0	Namikata-(t)73		
40	0	0	0	0	0	1	1	0	0	1	0	0	1	1	1	0	1	0	1	0	1	0	1	0	0	0	0	0	0	1	Contamination		
41	1	0	0	1	0	0	1	0	0	0	1	0	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	1	Tsuyazaki-(t)50		
42	0	1	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	1	0	1	0	0	0	0	0	Sendai-(t)290		
43	1	0	1	0	1	0	0	0	0	0	1	0	1	1	0	0	1	0	1	0	1	0	1	0	1	0	0	0	0	0	Namikata-(t)37		
44	1	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0	0	0	1	Tsuyazaki-(t)50		
45	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	0	1	0	0	0	0	0	Sendai-(t)290		
46	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0	0	0	1	6,13		

1: Namikata-(t)73, 2: Obama-(t)30, Tosashimizu-(t)63, Ooita-(t)8, 5: Ei-(t)425, 6: Tsuyazaki-(t)50,
7: Misaki-(t)90, 8: Ooseto-(t)12, 9: Namikata-(t)37, 10: Tanabe-(t)54, 11: Yasu-(t)37, 12: Shima-(t)64
13: Yoshida-(t)2, 14: Sendai-(t)290, 15: Mitoyo-(t)103, 16: Obama-(t)24

Appendix-2 Identification of male parent of a progeny (Tsuyazaki-(t)50)

No	A-09 510 Aa	A-11 A-11 490 850 aa aa	A-16 A-16 560 620 aa aa	A-17 A-17 A-17 750 860 950 aa aa aa	C-09 610 aa	D-03 800 Aa	F-05 F-05 570 710 Aa aa	F-16 610 Aa	G-17 590 aa	I10 I10 530 750 aa Aa	M-17 490 aa	S-10 390 aa	U-09 610 aa	U-13 580 aa	V-01 V-01 340 400 Aa Aa	V-04 V-04 V-04 550 780 850 aa aa aa	Male parent
1	0	0	0	0	0	0	1	1	1	0	0	1	1	0	0	0	Misaki-(t)90
2	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	Ooseto-(t)12
3	1	1	0	0	0	1	1	0	1	1	0	1	0	0	1	1	Sendai-(t)290
4	1	0	0	0	0	0	1	0	1	0	0	1	0	0	1	1	2,4,6,9,13,15,16
5	1	0	0	0	0	1	1	0	0	0	0	1	1	0	0	1	Contamination
6	0	0	1	0	0	1	1	0	0	1	0	1	0	1	1	1	Namikata-(t)73
7	1	0	0	0	0	1	1	1	1	0	0	1	1	0	0	1	Misaki-(t)90
8	0	0	0	1	0	1	1	1	1	1	1	0	0	0	1	1	Namikata-(t)37
9	1	0	0	0	0	0	1	1	1	0	0	1	0	1	1	1	Misaki-(t)90
10	1	0	0	0	0	1	1	1	0	0	0	1	0	1	1	1	Namikata-(t)73
11	1	0	0	0	0	0	1	1	1	0	0	1	1	0	0	1	Misaki-(t)90
12	1	0	0	0	0	0	1	1	1	0	0	1	0	0	1	0	Misaki-(t)90
13	1	0	0	0	0	1	1	1	0	1	1	0	0	0	1	0	Tanabe-(t)54
14	1	0	0	0	0	1	1	0	0	1	0	1	1	0	0	1	Sendai-(t)290
15	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	1	4,5,6,9,11,13,14,15,16
16	1	0	0	0	0	1	1	1	0	1	0	0	1	0	0	1	Obama-(t)24
17	0	0	0	0	0	1	1	1	1	0	0	1	1	0	1	1	Misaki-(t)90
18	1	0	0	0	1	1	1	0	0	0	1	1	0	1	0	1	Namikata-(t)73
19	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1	1	6,14,15
20	1	0	0	0	0	1	1	0	1	0	0	1	0	0	1	1	2,4,5,6,9,11,12,13,14,15
21	1	0	0	0	0	0	1	0	1	0	0	1	0	1	0	1	Namikata-(t)73
22	0	0	0	0	0	0	1	1	0	0	1	0	0	0	1	1	Namikata-(t)37
23	0	0	0	0	0	1	1	1	0	1	0	1	0	0	1	1	Tanabe-(t)54
24	1	0	0	0	1	0	1	0	1	0	0	1	0	0	1	1	Obama-(t)24
25	0	0	0	0	0	0	1	0	1	0	0	1	0	1	1	0	Namikata-(t)73
26	1	0	0	0	0	1	1	0	1	0	0	1	0	0	1	1	Ei-(t)425
27	1	0	0	0	0	1	1	0	1	1	0	1	0	0	1	1	4,5,9,11,13,14,16
28	0	0	0	0	0	1	1	0	1	1	0	1	1	0	0	1	4,5,14,16
29	0	0	0	0	1	0	1	0	1	0	0	1	0	1	0	0	Namikata-(t)73
30	0	0	0	0	0	0	1	1	1	0	0	1	1	0	0	0	4,7
31	1	0	0	1	0	0	1	1	0	0	0	1	0	0	0	1	2,9,11
32	1	0	0	0	0	0	1	1	1	0	0	1	0	0	1	1	Misaki-(t)90
33	1	0	0	0	0	0	1	1	0	1	0	1	0	0	1	1	Ooseto-(t)12
34	1	0	0	0	0	0	1	1	0	0	0	1	1	0	1	1	Sendai-(t)290
35	0	0	0	0	0	0	1	1	1	0	0	1	0	0	0	1	Misaki-(t)90
36	1	0	0	0	0	1	1	0	1	0	0	1	0	1	1	1	Tosahimizu-(t)63
37	1	0	0	0	0	1	1	0	0	1	0	1	0	0	1	1	Sendai-(t)290
38	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	0	Tosahimizu-(t)63
39	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	Namikata-(t)73
40	1	0	0	0	0	1	1	0	1	0	1	1	0	1	0	0	1,8
41	1	0	0	0	0	1	1	0	1	0	0	1	0	1	1	1	Tosahimizu-(t)63
42	0	0	0	0	1	0	1	1	0	1	0	0	1	0	1	0	Obama-(t)24
43	0	0	0	0	0	1	1	1	1	0	0	1	1	1	1	1	Misaki-(t)90
44	1	0	0	0	0	1	1	0	0	1	0	1	1	0	1	1	Sendai-(t)290
45	1	0	0	0	1	0	1	0	1	0	1	1	0	1	0	1	Namikata-(t)73
46	1	0	0	0	0	1	-	-	1	0	0	1	0	0	1	0	Sendai-(t)290

1: Namikata-(t)73, 2: Obama-(t)30, Tosashimizu-(t)63, Ooita-(t)8, 5: Ei-(t)425, 6: Tsuyazaki-(t)50,
7: Misaki-(t)90, 8: Ooseto-(t)12, 9: Namikata-(t)37, 10: Tanabe-(t)54, 11: Yasu-(t)37, 12: Shima-(t)64
13: Yoshida-(t)2, 14: Sendai-(t)290, 15: Mitoyo-(t)103, 16: Obama-(t)24

Appendix-2 Identification of male parent of a progeny (Misaki-(t)90)

No.	A-09 510 aa	A-11 490 aa	A-11 850 aa	A-12 700 aa	A-16 560 aa	A-16 620 aa	A-17 750 aa	A-17 860 aa	A-17 950 aa	C-06 520 aa	C-06 820 aa	D-03 700 Aa	D-03 800 aa	F-03 720 aa	F-16 610 Aa	G-17 510 aa	I10 530 aa	I-10 800 aa	U-09 610 aa	V-01 340 aa	V-01 370 aa	V-01 400 Aa	V-04 780 aa	V-04 850 aa	V-17 470 aa	V-17 780 Aa	Male parent
1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	1	0	1	0	1	8,15
2	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	1	Tsuyazaki-(t)50
3	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	1	1	Tsuyazaki-(t)50
4	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	Tsuyazaki-(t)50
5	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	1	1	0	1	0	1	0	0	0	0	Namikata-(t)37
6	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	0	1	0	Tsuyazaki-(t)50
7	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	0	0	1	Tsuyazaki-(t)50
8	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	1	0	0	0	Sendai-(t)290
9	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	1	0	1	0	0	1	1	Tsuyazaki-(t)50
10	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	0	1	1	0	1	0	0	1	Contamination
11	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	1	1	6,16
12	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	0	1	0	1	0	0	1	0	Tsuyazaki-(t)50
13	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	Tsuyazaki-(t)50
14	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	6,16
15	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	1	0	0	1	0	6,16
16	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	0	1	0	0	0	1	Tsuyazaki-(t)50
17	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0	0	0	1	0	0	1	0	Tsuyazaki-(t)50
18	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	1	0	0	0	0	Tsuyazaki-(t)50
19	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	1	Contamination
20	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	0	1	0	0	0	1	1,8,9,15
21	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1	1	6,12
22	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	1	1	0	0	0	1	Ooseto-(t)12
23	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0	1	0	1	0	1	0	1	Tanabe-(t)54
24	1	0	0	—	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	1	0	0	0	1	1,5,16
25	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	1	0	0	1	0	1	4,14
26	1	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	0	1	1	0	0	1	1	Tsuyazaki-(t)50
27	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	0	0	1	1	0	1	0	0	0	0	0	Tsuyazaki-(t)50
28	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1	1	0	0	1	0	1	1	0	0	1	0	4,16
29	1	0	0	1	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	1	1	0	0	1	1	Obama-(t)24
30	0	0	0	0	1	1	0	0	0	1	0	1	0	1	0	1	1	1	1	0	1	0	0	0	0	1	Namikata-(t)37
31	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	1	0	1	0	0	0	0	1	Tsuyazaki-(t)50
32	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	1	0	0	0	0	1	Namikata-(t)37
33	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	1	1	1	0	1	1	Ooseto-(t)12
34	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	1	0	1	0	0	1	Ooseto-(t)12
35	0	0	1	0	1	0	0	0	0	1	0	1	0	1	0	0	1	1	1	0	1	0	0	0	0	1	Namikata-(t)37
36	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	0	1	0	0	0	0	1	Obama-(t)30
37	1	0	0	0	0	0	0	0	0	0	0	1	0	0	—	1	0	0	1	0	1	0	0	0	0	0	Namikata-(t)73
38	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	1	1,9,15
39	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	1	0	0	0	0	1	2,6
40	1	0?	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	1	2,5,6,12,15
41	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	1	0	1	1	0	0	1	0	Tsuyazaki-(t)50
42	0	0	0	1	0	1	0	1	0	0	0	1	1	—	1	0	1	0	1	0	1	0	0	0	0	1	Obama-(t)24
43	0	1	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	1	Sendai-(t)290
44	0	—	—	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	1	0	1	0	0	0	0	1	8,15
45	1	0	0	0	0	0	0	0	—	0	0	1	1	1	1	0	0	1	1	0	1	1	0	0	1	1	Tsuyazaki-(t)50
46	0	0	1	0	1	0	0	0	0	0	0	1	0	1	1	1	0	0	1	0	1	0	0	0	0	1	Namikata-(t)37
47	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	1	0	1	11,14
48	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	1	1	0	1	Yasu-(t)37
49	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0	—	0	0	0	0	0	1	0	0	1	1	Tsuyazaki-(t)50

1: Namikata-(t)73, 2: Obama-(t)30, Tosashimizu-(t)63, Ooita-(t)8, 5: Ei-(t)425, 6: Tsuyazaki-(t)50,
7: Misaki-(t)90, 8: Ooseto-(t)12, 9: Namikata-(t)37, 10: Tanabe-(t)54, 11: Yasu-(t)37, 12: Shima-(t)64
13: Yoshida-(t)2, 14: Sendai-(t)290, 15: Mitoyo-(t)103, 16: Obama-(t)24

Appendix-2 Identification of male parent of a progeny (Ooseto-(t)12)

No.	A-09		A-11		A-12		A-16		A-17				C-09		D-01		D-03		F-03		F-05		G-17		I10		I-10		U-09		U-13		V-01		V-04		Male parent
	510	490	850	700	560	620	450	750	860	950	610	820	420	700	800	720	570	710	590	750	800	610	580	340	400	550	780										
	aa	aa	aa	aa	aa	aa	Aa	aa	aa	aa	aa	aa	aa	Aa	Aa	aa	Aa	aa	aa	Aa	aa	aa	aa	Aa	Aa	aa	aa										
1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	1	1	0	0	1,8,9,13,16								
2	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	1	1	0	1	0	0	1	1	0	0	0	0	Misaki-(t)90								
3	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	1	1	0	1	1	0	1	0	0	0	1	0	Misaki-(t)90								
4	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	Tsuyazaki-(t)50								
5	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	1	1	1	1	0	0	Tosashimizu-(t)63								
6	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	1	1	0	1	0	1	1	0	0	0	4,11,14								
7	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	1	1	0	0	0	Contamination								
8	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	1	1	0	0	0	1	1	0	0	0	1,4,5,9,11,13,14,16								
9	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	6,8,15,16								
10	0	0	0	0	0	0	1	0	0	0	1	0	1	1	0	0	1	1	0	1	1	0	0	0	0	1	0	0	Misaki-(t)90								
11	0	0	1	0	1	1	1	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	1	1	0	0	0	Namikata-(t)37								
12	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	0	1	0	0	1	0	1	0	1	1	0	0	0	11,14								
13	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	0	0	1	0	0	0	0	0	1	0	0	1,6,15,16								
14	0	0	0	1	0	0	1	0	0	0	0	0	1	1	1	0	1	0	0	1	1	0	0	0	0	1	0	0	Tsuyazaki-(t)50								
15	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1,6,8,15,16								
16	0	1	0	0	0	0	1	0	0	0	0	0	1	1	1	0	1	0	1	1	0	1	0	1	1	0	0	0	Sendai-(t)290								
17	0	0	0	0	0	0	1	0	0	0	0	0	0	-	-	1	1	0	0	1	0	0	1	1	1	0	0	0	1,16								
18	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	1	1	0	0	0	Yasu-(t)37								
19	0	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0	1	0	1	1	0	1	0	1	1	0	0	0	Yasu-(t)37								
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0	0	1	1	0	0	0	Namikata-(t)37								
21	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	1	1	0	0	Sendai-(t)290								
22	1	0	0	0	0	0	1	0	0	0	0	0	1	1	1	1	1	0	0	1	0	0	0	0	1	0	0	0	6,16								
23	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	1	1	0	1	0	Sendai-(t)290								
24	0	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0	1	1	0	1	0	0	0	1	1	0	0	0	Namikata-(t)37								
25	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1	1	0	1	0	1	1	0	0	0	4,14								
26	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	Tsuyazaki-(t)50								
27	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	1	1	0	0	0	Namikata-(t)37								
28	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	0	1	0	1	1	0	1	0	1	1	0	1	0	11,14								
29	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	1	0	1	0	1,16								
30	0	0	0	0	1	0	1	0	0	0	0	0	1	1	1	0	1	0	1	1	0	1	0	1	1	0	1	0	Yasu-(t)37								
31	1	0	0	1	1	0	1	0	0	0	0	0	1	1	1	1	1	0	0	1	1	0	0	0	0	-	-	0	Tsuyazaki-(t)50								
32	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	1	1	0	0	0	Namikata-(t)37								
33	0	0	0	0	1	0	1	0	0	0	0	0	1	1	1	0	1	0	0	-	-	1	0	1	1	0	1	0	Yasu-(t)37								
34	1	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	1	0	1	-	-	1	0	1	1	0	1	0	Ooita-(t)8								
35	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	-	-	0	0	1	1	0	0	0	1,4,5,6,8,9,11,13,14,15,16								
36	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0	1	1	0	1	0	Namikata-(t)37								
37	0	0	0	0	1	0	1	0	0	0	0	0	1	1	1	0	1	0	1	1	0	1	0	1	1	0	1	0	Yasu-(t)37								
38	1	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	1	0	0	-	-	0	0	1	1	1	1	0	Obama-(t)30								
39	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	1	0	0	-	-	0	0	0	0	0	0	0	Obama-(t)24								
40	1	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	1	0	0	1	1	0	0	1	1	0	0	0	Obama-(t)30								
41	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	0	1	0	1	1	1	1	0	0	0	Tosashimizu-(t)63								
42	1	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	1	0	0	-	-	1	0	1	1	0	0	0	Ooita-(t)8								
43	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	6,8,15								
44	1	0	0	0	0	0	1	0	0	0	0	0	1	1	1	0	1	0	0	1	0	1	1	1	1	0	1	0	Yasu-(t)37								
45	0	0	0	1	0	0	1	0	0	0	0	0	0	1	1	0	0	0	1	1	0	1	-	0	1	0	0	0	Sendai-(t)290								
46	0	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0	1	0	1	1	0	1	0	1	1	0	1	0	Yasu-(t)37								
47	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	1	1	0	0	0	1	1	0	0	0	1,4,5,9,11,13,14,16								
48	0	0	1	0	0	1	1	0	0	0	1	0	0	1	0	1	1	0	1	1	0	0	1	1	1	0	1	0	1,16								

1: Namikata-(t)73, 2: Obama-(t)30, Tosashimizu-(t)63, Ooita-(t)8, 5: Ei-(t)425, 6: Tsuyazaki-(t)50,
7: Misaki-(t)90, 8: Ooseto-(t)12, 9: Namikata-(t)37, 10: Tanabe-(t)54, 11: Yasu-(t)37, 12: Shima-(t)64
13: Yoshida-(t)2, 14: Sendai-(t)290, 15: Mitoyo-(t)103, 16: Obama-(t)24

Appendix-2 Identification of male parent of a progeny (Namikata-(t)37)

No.	A-09 510 aa	A-11 490 aa	A-12 700 aa	A-17 450 Aa	A-17 750 aa	A-17 950 aa	C-09 670 aa	C-09 810 aa	D-01 420 aa	D-03 700 Aa	D-03 800 aa	F-01 310 aa	F-16 610 Aa	I10 530 Aa	I10 750 Aa	S-18 700 Aa	U-03 700 aa	U-09 610 aa	U-13 580 aa	V-04 550 aa	V-04 780 aa	V-04 850 aa	V-17 470 aa	V-17 780 Aa	W-14 420 aa	Male parent
1	1	0	0	1	0	0	0	0	0	1	0	0	1	1	0	1	0	0	0	0	0	0	0	1	0	1,2,4,6,8,15
2	0	0	1	1	0	0	0	0	1	0	1	0	0	1	1	1	0	1	0	0	1	0	0	1	0	Sendai-(t)290
3	1	0	0	1	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0	6,12
4	0	0	0	1	0	0	0	0	0	1	0	0	1	1	1	1	1	0	0	0	0	0	0	1	1	5,6,7,8
5	1	0	0	0	0	0	0	0	1	1	1	0	1	1	0	0	1	1	1	0	0	0	0	1	0	Contamination
6	0	0	1	1	0	0	0	0	1	1	0	0	0	1	1	1	1	0	0	0	0	0	0	1	1	Tsuyazaki-(t)50
7	0	0	1	1	0	0	0	0	0	1	1	0	0	0	1	1	1	0	0	0	0	0	0	1	1	Tsuyazaki-(t)50
8	0	0	0	1	0	0	0	0	0	1	0	0	1	1	0	1	0	0	0	0	0	0	1	1	1	6,8
9	0	1	0	1	0	0	0	0	0	1	1	0	0	1	1	0	1	0	0	0	1	0	0	1	0	Sendai-(t)290
10	0	0	1	1	0	0	0	0	1	1	0	0	1	1	1	1	1	0	0	0	0	0	0	1	1	Tsuyazaki-(t)50
11	0	0	1	1	0	0	1	0	0	0	0	0	1	0	1	0	1	0	1	0	0	0	1	1	0	Obama-(t)24
12	0	0	1	1	0	0	0	0	0	1	1	0	0	1	1	1	1	1	0	0	1	0	0	0	0	Sendai-(t)290
13	0	0	0	1	0	0	0	0	1	1	1	1	0	1	0	1	1	1	0	0	0	1	0	1	0	Yasu-(t)37
14	0	0	0	1	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	1	0	0	1	0	Sendai-(t)290
15	1	0	0	1	0	0	0	0	1	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	Ei-(t)425
16	0	0	0	1	0	0	0	0	1	1	1	0	1	1	1	1	0	0	0	0	1	0	0	1	0	Sendai-(t)290
17	0	0	0	1	0	0	0	0	1	0	1	0	1	1	1	1	0	1	0	0	0	0	0	0	0	Sendai-(t)290
18	0	0	0	1	0	0	0	0	0	1	0	0	1	0	1	1	1	0	0	0	0	0	1	0	0	Tsuyazaki-(t)50
19	0	0	0	1	0	1	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	Tanabe-(t)54
20	0	0	0	1	0	0	0	0	1	1	1	1	0	0	1	1	1	1	0	0	0	0	0	1	0	Yasu-(t)37
21	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	1	1	1	1	Ooseto-(t)12
22	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	1	1	1	1	Ooseto-(t)12
23	1	0	0	1	0	0	0	0	0	1	1	0	0	0	1	1	1	0	0	0	0	0	1	1	0	Tsuyazaki-(t)50
24	0	0	0	1	0	0	0	0	0	1	1	0	1	1	1	1	1	0	0	0	0	0	0	1	0	5,6,8,11,14,15
25	0	0	1	1	0	0	0	0	1	0	1	0	1	1	1	0	0	1	0	0	0	0	0	1	0	Sendai-(t)290
26	0	0	0	1	0	0	0	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	1	0	Yasu-(t)37
27	1	0	0	1	0	0	0	0	1	1	1	0	0	1	1	1	1	0	0	0	0	0	0	1	0	Ei-(t)425
28	1	0	1	1	0	0	0	0	0	1	0	0	1	0	1	1	0	0	0	0	0	0	0	1	1	Tsuyazaki-(t)50
29	0	0	1	1	0	0	0	0	0	0	1	0	1	0	1	0	1	1	0	0	0	0	0	1	0	Sendai-(t)290
30	0	0	0	1	0	0	0	0	1	1	1	1	1	1	1	0	1	1	0	0	0	1	0	1	0	Yasu-(t)37
31	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	1	1	1	1	Ooseto-(t)12
32	0	0	0	1	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	Namikata-(t)37
33	1	0	1	1	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	0	0	0	1	0	Tsuyazaki-(t)50
34	0	0	1	1	0	0	0	0	0	1	1	0	1	1	1	1	1	0	0	0	0	0	0	1	0	Tsuyazaki-(t)50
35	0	0	0	1	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	Namikata-(t)37
36	0	0	0	1	0	0	0	0	0	1	0	0	1	1	1	1	0	0	0	0	0	0	0	1	1	Ooseto-(t)12
37	0	0	0	1	0	0	0	0	0	1	0	0	1	1	1	1	0	0	0	0	0	0	0	1	1	6,8
38	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	0	1	0	1	0	Namikata-(t)73
39	0	0	1	1	0	0	0	0	0	1	0	0	1	1	1	1	0	0	0	0	0	0	0	1	1	Tsuyazaki-(t)50
40	0	0	0	1	0	0	0	0	1	1	0	0	1	1	1	0	1	0	0	0	0	0	0	1	0	Ei-(t)425
41	0	0	1	1	0	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	1	0	Sendai-(t)290
42	0	0	0	1	0	0	0	0	1	1	1	0	0	1	0	1	1	0	0	0	0	0	0	1	0	6,11
43	0	0	1	1	0	0	0	0	0	1	1	0	1	1	1	0	1	0	0	0	0	0	0	1	0	Sendai-(t)290
44	0	0	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	0	0	1	1	1	Tsuyazaki-(t)50
45	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	1	1	0	0	0	0	0	0	1	1	Ooseto-(t)12
46	0	0	0	1	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	1	1	1	Ooseto-(t)12
47	1	0	0	1	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0	0	0	0	1	0	Obama-(t)24
48	1	0	0	0	0	0	0	0	1	0	1	0	1	1	1	0	1	1	1	0	0	0	0	1	0	Contamination
49	-	0	0	1	0	0	1	0	1	1	0	-	0	-	-	-	-	0	0	0	0	1	0	1	1	Misaki-(t)90
50	-	0	0	1	0	0	0	0	0	1	0	-	1	1	0	-	-	0	0	0	0	0	1	1	1	Ooseto-(t)12

1: Namikata-(t)73, 2: Obama-(t)30, Tosashimizu-(t)63, Ooita-(t)8, 5: Ei-(t)425, 6: Tsuyazaki-(t)50,
7: Misaki-(t)90, 8: Ooseto-(t)12, 9: Namikata-(t)37, 10: Tanabe-(t)54, 11: Yasu-(t)37, 12: Shima-(t)64
13: Yoshida-(t)2, 14: Sendai-(t)290, 15: Mitoyo-(t)103, 16: Obama-(t)24

Appendix-2 Identification of male parent of a progeny (Yasu-(t)37)

No.	A-09 510 aa	A-11 490 aa	A-11 850 aa	A-12 700 aa	A-16 560 Aa	A-16 620 aa	A-17 750 aa	A-17 860 aa	A-17 950 aa	C-09 670 aa	C-09 810 aa	F-03 720 aa	F-05 710 aa	F-16 610 aa	I10 530 aa	I10 750 Aa	I-10 800 aa	M-17 490 aa	M-17 610 aa	S-18 700 Aa	U-13 580 aa	V-04 550 aa	V-04 780 aa	V-17 470 aa	W-14 420 aa	Male parent
1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	1	1	0	0	0	1	Misaki-(t)90
2	1	0	0	0	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	1	0	0	0	1	1	Tsuyazaki-(t)50
3	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	1,9,15
4	0	0	0	0	1	1	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	Namikata-(t)37
5	0	0	0	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	0	0	0	0	0	0	Tsuyazaki-(t)50
6	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	0	0	0	0	0	1	Tsuyazaki-(t)50
7	1	0	0	0	1	0	0	0	0	0	1	0	0	1	1	0	0	0	1	1	1	0	0	0	0	Namikata-(t)73
8	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	1	Tsuyazaki-(t)50
9	0	0	0	0	-	-	0	0	0	0	0	1	1	0	1	0	0	0	1	1	1	1	0	0	1	Misaki-(t)90
10	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	6,13,14
11	1	0	0	0	1	0	0	0	1	0	0	0	1	1	0	1	0	0	0	1	0	0	0	1	0	Ooita-(t)8
12	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	16
13	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	5,9,11,14
14	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	1	0	0	0	0	0	1	Misaki-(t)90
15	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0	Misaki-(t)90
16	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	Namikata-(t)37
17	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	Namikata-(t)37
18	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	1	1	Tsuyazaki-(t)50
19	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	0	4,6,16
20	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0	0	0	0	0	0	1,8,9,15
21	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0	Tsuyazaki-(t)50
22	1	0	0	1	1	0	0	0	0	0	1	0	1	0	1	0	0	0	1	0	0	0	0	0	1	Tsuyazaki-(t)50
23	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	3,9,16
24	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	0	4,6,12,16
25	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0	Tsuyazaki-(t)50
26	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	1	Tsuyazaki-(t)50
27	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	5,9,11,14
28	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	1	1	Tsuyazaki-(t)50
29	0	0	0	1	0	0	0	0	0	0	1	0	1	0	1	0	0	0	1	0	0	0	0	0	1	Tsuyazaki-(t)50
30	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	Tsuyazaki-(t)50
31	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	1	1	0	0	0	0	1	Misaki-(t)90
32	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1	Tsuyazaki-(t)50
33	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	1	Tsuyazaki-(t)50
34	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	1	0	0	0	0	1	Misaki-(t)90
35	1	0	0	1	1	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	1	Tsuyazaki-(t)50
36	0	0	0	0	1	0	0	0	-	-	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	Tsuyazaki-(t)50
37	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	1	1	Tsuyazaki-(t)50
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,11
39	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	1	1	Tsuyazaki-(t)50
40	0	0	0	1	0	0	0	0	0	0	1	0	-	0	1	1	0	0	1	0	0	0	0	0	0	Tsuyazaki-(t)50
41	1	0	0	1	1	0	0	0	0	0	1	0	1	0	1	0	0	0	1	0	0	0	0	-	1	Tsuyazaki-(t)50
42	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	Tsuyazaki-(t)50
43	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	0	0	0	0	0	Tsuyazaki-(t)50
44	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	0	1	1	0	0	0	0	0	Misaki-(t)90
45	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	1	0	Tsuyazaki-(t)50
46	-	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	Tsuyazaki-(t)50
47	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	6,16
48	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	1	Ooseto-(t)12
49	-	0	0	0	0	1	0	0	0	0	0	0	-	0	1	0	-	-	1	0	0	0	0	1	1	Tsuyazaki-(t)50

1: Namikata-(t)73, 2: Obama-(t)30, Tosashimizu-(t)63, Ooita-(t)8, 5: Ei-(t)425, 6: Tsuyazaki-(t)50,
7: Misaki-(t)90, 8: Ooseto-(t)12, 9: Namikata-(t)37, 10: Tanabe-(t)54, 11: Yasu-(t)37, 12: Shima-(t)64
13: Yoshida-(t)2, 14: Sendai-(t)290, 15: Mitoyo-(t)103, 16: Obama-(t)24

Appendix-2 Identification of male parent of a progeny (Shima-(t)64)

No	A-11 490 aa	A-11 850 aa	A-12 700 aa	A-16 560 aa	A-16 620 aa	A-17 450 aa	A-17 750 aa	A-17 860 aa	A-17 950 aa	D-03 700 aa	F-03 720 aa	F-05 710 aa	G-17 590 aa	I10 530 aa	I10 750 Aa	I-10 800 aa	S-18 700 Aa	U-03 700 aa	U-09 610 aa	V-01 340 aa	V-01 370 aa	V-01 400 Aa	V-04 550 aa	V-04 780 aa	V-04 850 aa	W-14 420 aa	Male parent
1	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	Tsuyazaki-(t)50
2	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	1	1	1	0	0	0	1	0	0	0	1	Tsuyazaki-(t)50
3	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	1	1	1	0	1	0	0	0	0	Yasu-(t)37
4	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	Tsuyazaki-(t)50
5	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	1	1	0	0	0	1	0	0	1	0	Namikata-(t)73
6	0	0	1	0	0	1	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	Tsuyazaki-(t)50
7	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	1	1	0	0	0	0	1	0	0	0	1	Tsuyazaki-(t)50
8	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	Tsuyazaki-(t)50
9	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	1	0	1	0	0	Sendai-(t)290
10	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0	0	0	0	Namikata-(t)73
11	0	0	0	1	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	Tanabe-(t)54
12	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	1	1	1	0	1	0	1	0	0	0	1	Tsuyazaki-(t)50
13	0	0	1	0	0	1	0	0	0	1	1	0	0	0	1	0	1	1	0	0	0	1	0	0	0	0	Tsuyazaki-(t)50
14	0	1	0	1	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	1	0	1	0	0	0	0	Namikata-(t)37
15	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	1	1	0	0	1	0	0	0	0	0	0	Tsuyazaki-(t)50
16	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	1	1	0	1	0	1	0	1	Sendai-(t)290
17	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	1	1	1	0	1	0	1	0	0	0	1	Tsuyazaki-(t)50
18	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	1	1	0	0	0	1	0	0	0	1	Tsuyazaki-(t)50
19	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	Tsuyazaki-(t)50
20	0	0	0	0	0	1	0	0	0	1	0	1	0	0	1	0	1	1	0	0	0	1	1	0	0	0	Misaki-(t)90
21	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	1	1	0	0	0	1	1	0	0	0	Misaki-(t)90
22	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	Tsuyazaki-(t)50
23	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	Obama-(t)24
24	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	Sendai-(t)290
25	0	0	1	0	0	1	0	0	0	1	1	0	0	0	1	1	1	1	0	1	0	0	0	0	0	1	Tsuyazaki-(t)50
26	0	0	1	0	0	1	0	0	0	1	1	0	0	0	1	1	1	1	0	0	0	1	0	0	0	0	Tsuyazaki-(t)50
27	0	0	1	0	0	1	0	0	0	1	1	0	0	0	1	0	1	1	0	1	0	1	0	0	0	0	Tsuyazaki-(t)50
28	0	0	0	0	0	1	0	0	0	1	0	-	0	0	1	0	1	0	0	1	0	1	0	0	0	1	Tsuyazaki-(t)50
29	0	0	1	0	0	1	0	0	0	1	1	0	0	0	1	0	1	0	0	1	0	1	0	0	0	1	Tsuyazaki-(t)50
30	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	Tsuyazaki-(t)50
31	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	1	1	0	1	0	1	0	0	0	0	1,6
32	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	1	0	0	1	0	1	0	0	0	1	Tsuyazaki-(t)50
33	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	1	0	0	1	0	1	0	0	0	0	9,11
34	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	1	1	0	0	0	0	0	0	0	0	Misaki-(t)90
35	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	Ei-(t)425
36	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0	0	0	0	1,14,15,16
37	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	1	1	0	0	1	0	1	0	0	0	1	Tsuyazaki-(t)50
38	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	1	1	0	1	0	0	1	0	0	1	0	Ooita-(t)8
39	0	0	0	0	1	1	0	0	0	-	1	0	1	0	1	0	1	1	0	0	0	1	0	0	0	0	1,16
40	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	1	1	0	0	0	0	1	0	0	0	1	Tsuyazaki-(t)50
41	0	0	0	0	0	1	0	0	0	-	0	0	1	0	1	0	1	-	0	0	0	1	0	0	0	0	1,4,13,14,16
42	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	Tsuyazaki-(t)50
43	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	1	1	1	0	0	0	1	0	0	0	0	Tsuyazaki-(t)50
44	0	0	1	0	0	1	0	0	0	0	0	0	1	0	1	0	0	1	1	0	0	0	0	0	0	0	Sendai-(t)290
45	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	1	1	0	1	0	0	0	0	Sendai-(t)290
46	0	0	1	0	0	1	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	Tsuyazaki-(t)50
47	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	1	1	0	1	0	1	0	0	0	0	1,6,11

1: Namikata-(t)73, 2: Obama-(t)30, Tosashimizu-(t)63, Ooita-(t)8, 5: Ei-(t)425, 6: Tsuyazaki-(t)50,
7: Misaki-(t)90, 8: Ooseto-(t)12, 9: Namikata-(t)37, 10: Tanabe-(t)54, 11: Yasu-(t)37, 12: Shima-(t)64
13: Yoshida-(t)2, 14: Sendai-(t)290, 15: Mitoyo-(t)103, 16: Obama-(t)24

Appendix-2 Identification of male parent of a progeny (Yoshida-(t)2)

No.	A-09		A-11 A-11		A-16 A-16		A-17 A-17 A-17			C-09	D-01	D-03 D-03		F-03	F-05	I10	I10	I-10	S-10	U-09	V-01	V-01	V-01	V-04 V-04		V-17 V-17		W-14	Male parent
	510	490	850	560	620	750	860	950	610	420	700	800	720	710	530	750	800	390	610	340	370	400	550	780	470	800	420		
	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	Aa	aa	aa	aa	aa	Aa	aa	aa	aa	aa	aa	Aa	aa	aa	aa	aa	aa		
1	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	0	Misaki-(t)90
2	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	1	0	0	0	1	0	1	0	0	1	0	0	Tsuyazaki-(t)50
3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	4,6,16
4	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	1	0	Namikata-(t)37
5	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	-	-	-	1	0	0	1	1	Misaki-(t)90
6	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	Obama-(t)24
7	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	1	0	0	1	0	1	0	0	0	Sendai-(t)290
8	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	1	0	1	0	1	0	0	1	1	0	0	Ooseto-(t)12
9	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	1	1	0	1	0	0	0	1	0	3,4,11,14
10	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0	1	0	1	0	0	0	1	0	8,15
11	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	1	0	0	0	0	1	1	0	0	1	1	Misaki-(t)90
12	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	Misaki-(t)90
13	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	4,6,12
14	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	1	0	1	0	1	0	Sendai-(t)290
15	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	0	1	0	1	0	1	0	Sendai-(t)290
16	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	0	1	1	1	0	0	1	1	1	1	Ooseto-(t)12
17	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	-	0	0	0	0	1	0	0	0	1	0	1,4,16
18	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	1	0	0	0	0	0	0	1	1	0	0	1	1	Misaki-(t)90
19	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	1	0	Tsuyazaki-(t)50
20	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	0	0	0	1	0	1	0	0	0	1	1	1	Ooseto-(t)12
21	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	Tsuyazaki-(t)50
22	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	5,6,14
23	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	0	1	Tsuyazaki-(t)50
24	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	9,16
25	0	1	0	-	-	0	0	0	1	1	1	0	0	-	0	1	0	0	0	1	0	1	0	0	0	0	1	0	Sendai-(t)290
26	0	0	0	0	0	0	0	0	1	1	0	0	1	-	0	1	0	0	0	0	0	1	1	0	0	1	0	0	Misaki-(t)90
27	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	1	0	0	1	0	0	0	1	0	Namikata-(t)37
28	1	0	0	1	1	0	1	0	0	1	0	1	1	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0	Obama-(t)24
29	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	9,16
30	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	1	0	0	0	1	0	1	1	0	0	0	1	1	Misaki-(t)90
31	1	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	1	0	0	1	0	1	0	0	1	0	1	Tsuyazaki-(t)50
32	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	0	0	0	1	1	1	0	0	0	0	0	1	Ooseto-(t)12
33	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	0	0	0	1	1	1	0	0	0	0	1	1	Ooseto-(t)12
34	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	0	0	1	1	0	1	0	0	1	1	0	0	Ooita-(t)8
35	1	0	0	0	0	0	0	0	1	1	1	1	0	-	0	1	0	0	0	1	0	1	0	0	0	0	1	0	Tsuyazaki-(t)50
36	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	1	0	1	0	0	0	0	1	0	Namikata-(t)37
37	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	1	1	1	0	0	1	1	1	1	Ooseto-(t)12
38	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0	0	1	0	0	1	0	1	0	1	0	0	Sendai-(t)290
39	1	0	1	0	0	0	0	0	1	1	1	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	Contamination
40	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	1	0	1	0	0	0	0	1	0	8,9,15
41	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	1	0	Tsuyazaki-(t)50
42	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0	0	1	0	0	0	1	1	Ooseto-(t)12
43	0	1	0	0	0	0	0	0	0	1	1	0	0	0	1	1	0	1	1	1	0	1	0	0	0	0	1	0	Ooseto-(t)12
44	0	0	0	0	1	0	0	0	0	1	0	1	1	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	Namikata-(t)37
45	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1	Ooseto-(t)12
46	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	Sendai-(t)290
47	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	0	0	0	1	1	0	0	1	0	0	Misaki-(t)90
48	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1	0	0	0	1	0	1	0	0	0	1	1	0	Tsuyazaki-(t)50
49	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	Ei-(t)425

1: Namikata-(t)73, 2: Obama-(t)30, Tosashimizu-(t)63, Ooita-(t)8, 5: Ei-(t)425, 6: Tsuyazaki-(t)50,
7: Misaki-(t)90, 8: Ooseto-(t)12, 9: Namikata-(t)37, 10: Tanabe-(t)54, 11: Yasu-(t)37, 12: Shima-(t)64
13: Yoshida-(t)2, 14: Sendai-(t)290, 15: Mitoyo-(t)103, 16: Obama-(t)24

Appendix-2 Identification of male parent of a progeny (Sendai-(t)290)

No	A-09		A-11		A-16		A-16		A-17		A-17		A-17		A-17		C-09		D-03		F-03		F-05		F-05		F-16		I10		I-10		S-18		U-13		V-01		V-01		V-01		V-04		V-04		V-17		V-17		W-14		Male parent		
	510	850	560	620	450	750	860	950	670	700	720	570	710	610	530	800	700	590	340	370	400	550	850	470	780	420																													
	aa	aa	aa	aa	Aa	aa	aa	aa	aa	aa	aa	Aa	aa	Aa	aa	aa	Aa	aa	Aa	aa	aa	Aa	aa	Aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa	aa									
1	0	0	0	0	1	0	0	0	0	1	0	1	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Ooseto-(t)12							
2	0	0	0	0	1	0	0	0	0	0	1	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Tsuyazaki-(t)50				
3	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Misaki-(t)90				
4	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Misaki-(t)90				
5	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Misaki-(t)90				
6	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,5,14,15				
7	0	0	0	0	1	0	0	0	0	0	1	0	1	1	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Misaki-(t)90				
8	0	0	0	0	1	0	0	0	0	0	1	0	1	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Namikata-(t)37				
9	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Tsuyazaki-(t)50				
10	0	1	1	0	1	0	0	0	0	0	1	0	1	0	1	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Namikata-(t)37				
11	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Ooseto-(t)12				
12	0	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Tsuyazaki-(t)50			
13	0	1	1	1	1	0	0	0	0	0	0	1	1	1	0	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Namikata-(t)37				
14	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Namikata-(t)37				
15	0	0	0	0	1	0	0	0	0	1	1	0	1	1	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Misaki-(t)90				
16	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Tsuyazaki-(t)50				
17	0	0	0	0	1	0	0	0	0	0	1	0	1	1	1	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Misaki-(t)90				
18	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Misaki-(t)90				
19	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Obama-(t)30				
20	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Ooseto-(t)12				
21	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,6,9,11,13				
22	0	0	1	0	1	0	0	0	0	0	1	1	1	1	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Namikata-(t)37				
23	0	0	0	0	1	0	0	0	0	0	1	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Ooseto-(t)12				
24	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Ooseto-(t)12				
25	1	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Ei-(t)425				
26	0	1	1	0	1	0	0	-	0	1	0	1	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Namikata-(t)37				
27	0	0	0	0	1	0	0	0	0	0	1	0	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Misaki-(t)90				
28	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,5,13,14,15				
29	0	1	1	1	1	0	0	-	0	1	1	1	1	0	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Namikata-(t)37				
30	0	0	0	0	1	0	0	0	0	0	1	0	1	1	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Misaki-(t)90				
31	1	0	0	0	1	0	0	0	0	0	1	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Ooseto-(t)12				
32	1	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15,16				
33	0	0	1	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Yasu-(t)37				
34	0	0	0	0	1	0	0	0	0	0	1	0	1	1	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Misaki-(t)90				
35	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Ooseto-(t)12				
36	0	0	0	0	1	0	0	0	0	0	1	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0															

1: Namikata-(t)73, 2: Obama-(t)30, Tosashimizu-(t)63, Ooita-(t)8, 5: Ei-(t)425, 6: Tsuyazaki-(t)50,
7: Misaki-(t)90, 8: Ooseto-(t)12, 9: Namikata-(t)37, 10: Tanabe-(t)54, 11: Yasu-(t)37, 12: Shima-(t)64
13: Yoshida-(t)2, 14: Sendai-(t)290, 15: Mitoyo-(t)103, 16: Obama-(t)24

Appendix-2 Identification of male parent of a progeny (Mitoyo-(t)103)

No	A-11 A-11 490 850	A-12 700	A-16 A-16 560 620	A-17 A-17 860 950	C-09 670	D-01 420	D-03 D-03 700 800	F-05 710	G-17 590	I10 I10 I-10 530 750 800	U-09 610	U-13 580	V-01 V-01 V-01 340 370 400	V-04 V-04 V-04 550 780 850	V-17 V-17 470 780	W-14 420	Male parent
	aa aa	aa	aa aa	aa aa	aa	aa	aa Aa	aa	aa	Aa Aa aa	aa	aa	Aa aa Aa	aa aa aa	aa Aa	aa	
1	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	0 0 0 1	0 0 0 0	1 1 1	1	Tsuyazaki-(t)50
2	0 0 0	1	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	0 0 0 1	0 0 0 0	0 0 1	0	Tsuyazaki-(t)50
3	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	1 1 1	0 0 0	1 0 1	0 0 0 1	0 0 0 0	1 1 1	0	Tsuyazaki-(t)50
4	0 0 0	0	1 0 0	0 0 0	0 0 0	0 0 0	1 0 0	1 0 0	1 0 0	1 1 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 1	0	Namikata-(t)37
5	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 0	0 0 0	0 0 0	1 1 1	0 0 0	1 0 1	0 0 0 1	0 0 0 0	1 1 1	1	Tsuyazaki-(t)50
6	0 1 0	0	0 1 0	0 0 0	0 0 0	0 0 0	0 1 1	1 0 0	1 0 0	1 0 1	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 1	0	Namikata-(t)37
7	0 0 0	1	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	0 1 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 1	1	Tsuyazaki-(t)50
8	0 1 0	1	1 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	1 0 0	1 0 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 1	0	Namikata-(t)37
9	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	1 1 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	1 1 1	1	6,8
10	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	1 1 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	1 1 1	0	Tsuyazaki-(t)50
11	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	0 1 1	0 0 0	0 0 1	0 0 0 1	0 0 0 0	1 1 1	0	Tsuyazaki-(t)50
12	0 1 0	1	1 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 0 0	1 1 0	1 0 1	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 0	0	Namikata-(t)37
13	0 1 0	0	0 1 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	0 1 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 1	0	Namikata-(t)73
14	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 0 0	0 0 0	0 1 1	0 0 0	0 0 1	0 0 0 1	0 0 0 0	1 1 1	1	Tsuyazaki-(t)50
15	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	1 1 0	0 0 0	1 1 1	0 0 0 1	0 0 0 0	1 1 1	0	Ooseto-(t)12
16	0 0 0	0	1 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	1 1 1	1 1 1	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 1	0	Namikata-(t)37
17	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	0 0 0	1 0 0	0 0 0	1 0 1	0 0 0 1	0 0 0 1	0 0 1	0	1,8
18	0 1 0	1	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	1 1 0	0 0 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 1	0	Namikata-(t)37
19	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	1 1 0	0 0 0	1 0 1	0 0 0 1	0 0 0 1	1 1 1	1	Ooseto-(t)12
20	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	1 0 0	0 0 0	0 1 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 1	0	Misaki-(t)90
21	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 0 0	0 1 0	0 0 0	0 0 1	1 0 0 1	1 0 0 0	0 0 1	1	Misaki-(t)90
22	0 0 0	1	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	1 1 0	0 0 0	0 0 1	0 0 0 1	0 0 0 0	0 0 0	0	6,13
23	0 1 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	1 0 0	1 1 1	1 0 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 0	0	Namikata-(t)37
24	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	1 1 1	0 0 0	1 0 1	0 0 0 1	0 0 0 0	1 1 1	0	Tsuyazaki-(t)50
25	0 0 0	1	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	1 1 1	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 1	0	Tsuyazaki-(t)50
26	0 0 0	0	0 0 0	0 1 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 0 0	0 0 1	0 0 0 1	0 0 0 0	0 0 1	0	4,10
27	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	0 1 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	1 1 1	1	Tsuyazaki-(t)50
28	0 1 0	1	1 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1 0 1	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 1	0	Namikata-(t)37
29	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 0 0	1 1 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 1	0	4,7,9
30	0 0 0	1	0 0 1	1 0 0	1 0 0	1 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	1 1 1	0	Obama-(t)24
31	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 0 0	0 0 0	1 1 1	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 1	0	6,9
32	0 0 0	1	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	0 1 1	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 0	0	Tsuyazaki-(t)50
33	1 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 0	0	Sendai-(t)290
34	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 0 0	0 0 0	0 1 1	0 0 0	1 0 1	0 0 0 1	0 0 0 0	1 0 1	1	Tsuyazaki-(t)50
35	0 0 0	1	0 0 0	1 0 0	1 0 0	0 0 0	0 1 0	0 0 0	0 0 0	1 0 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	1 0 0	0	Obama-(t)24
36	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	0 1 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	1 0 1	1	Tsuyazaki-(t)50
37	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	1 1 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	1 0 1	1	Tsuyazaki-(t)50
38	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	0 0 0	1 1 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	1 1 1	1	Ooseto-(t)12
39	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	1 0 0	0 0 0	0 1 0	0 0 0	1 0 1	0 0 0 1	0 0 0 0	0 0 1	1	Misaki-(t)90
40	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	1 1 0	0 0 0	1 0 1	0 0 0 1	0 0 0 1	0 0 1	1	Ooseto-(t)12
41	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	1 1 0	0 0 0	0 1 1	0 0 0 1	0 0 0 0	0 0 1	0	Ooseto-(t)12
42	0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	1 0 0	0 0 0	1 0 1	0 0 0 1	0 0 0 1	0 0 1	0	Yasu-(t)37

1: Namikata-(t)73, 2: Obama-(t)30, Tosashimizu-(t)63, Ooita-(t)8, 5: Ei-(t)425, 6: Tsuyazaki-(t)50,
7: Misaki-(t)90, 8: Ooseto-(t)12, 9: Namikata-(t)37, 10: Tanabe-(t)54, 11: Yasu-(t)37, 12: Shima-(t)64
13: Yoshida-(t)2, 14: Sendai-(t)290, 15: Mitoyo-(t)103, 16: Obama-(t)24