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Cloning and phylogenetic analysis of phytoene synthase 1 (*Psy1*) genes in common wheat and related species

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Cloning and phylogenetic analysis of *Psy1* genes in common wheat and its relatives would help to understand the genetic diversity and evolution of *Psy1* gene in common wheat and its related species. In the present study, common wheat (AABBDD) and eight relative species, including *T. urartu* (A^uA^u), *T. boeoticum* (A^mA^m), *T. monococcum* (A^mA^m), *Ae. speltoides* (SS), *Ae. tauschii* (DD), *T. dicoccoides* (AABB), *T. dicoccum* (AABB) and *T. spelta* (AABBDD), were sampled for the isolation of novel alleles at *Psy1-A1*, *Psy1-B1/Psy1-S1* and *Psy1-D1* loci corresponding to common wheat *Psy1* genes, and 27 new alleles were identified at these loci, designated *Psy1-A1f* through *Psy1-A1k*, *Psy1-A1m* and *Psy1-A1n*, *Psy1-B1h* through *Psy1-B1m*, *Psy1-S1a* through *Psy1-S1c*, *Psy1-D1a* through *Psy1-D1j*, respectively. The genes contained six exons and five introns, and the sequences of exons were more conserved compared with those of introns. The *Psy1-A1* genes encoded a polypeptide of 428 aminoacid residues, with one residue longer than those encoded by *Psy1-D1* genes. The *Psy1-B1/Psy1-S1* genes encoded four types of polypeptides, with 421 (*Psy1-B1h* through *Psy1-B1j*, *Psy1-B1l*), 427 (*Psy1-B1k*, *Psy1-S1a* and *Psy1-S1c*), 428 (*Psy1-B1m*), and 429 (*Psy1-S1b*) aminoacid residues, respectively. Neighbor joining tree was generated based on the gene sequences of the 27 novel alleles and those of the 13 alleles reported previously in common wheat and its relatives. The phylogenetic tree consisted of two subtrees. The subtree I comprised 11 of 14 alleles at *Psy1-A1* locus, nine of 16 alleles at *Psy1-B1/Psy1-S1* locus, and ten novel alleles at *Psy1-D1* locus, while the subtree II included the other three alleles at *Psy1-A1* locus, the remaining four *Psy1-B1* alleles and three *Psy1-S1* alleles. The alleles from different clusters showed high sequence divergences, indicated by various SNPs and InDels (insertion/deletion). The phylogenetic relationships of these allelic variants at the three loci in common wheat and its relatives also supported the hypothesis that common wheat was originated by recurrent hexaploidization events. In addition, 193 Chinese wheat cultivars with different yellow pigment contents were genotyped with two novel STS markers *YP7D-1* and *YP7D-2*. The results indicated that 191 cultivars contained the allele *Psy1-D1a*, and two had *Psy1-D1g*.

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The formation of common wheat (*T. aestivum*, AABBDD) was attributed to two evolutionary events (Feuillet et al. 2001; Huang et al. 2002; Gu et al. 2004; Petersen et al. 2006). The first one was the hybridization between the A genome donor *T. urartu* (A^uA^u) and *Ae. speltoides* (SS) or a closely related species (the B genome donor), resulting in the formation of wild emmer wheat (*T. dicoccoides*, AABB). Afterwards, emmer wheat (*T. dicoccum*, AABB), a domesticated form of *T. dicoccoides*, hybridized with the D genome donor *Ae. tauschii* (DD), creating allohexaploid common wheat (AABBDD). Durum wheat (*T. durum*, AABB), an important cereal used for making pasta, is closely related to *T. dicoccum* that was domesticated from *T. dicoccoides* (Salamini et al. 2002; Ozkan et al. 2005; Jauhar 2007; Luo et al. 2007). *T. boeoticum* (A^mA^m) is a wild einkorn wheat species closely related to *T. urartu*, and its domesticated form *T. monococcum* is still being cultivated to a limited extent (Gill and Friebe 2002; Salamini et al. 2002).

Carotenoids, generated from the isoprenoid pathway, are the primary components of flour yellow pigment (Miskelly 1984; Adom et al. 2003; DellaPenna and Pogson 2006). The phytoene synthase (*Psy*) is considered a rate-limiting enzyme for the accumulation of carotenoid in the endosperm (Hirschberg 2001; Lindgren et al. 2003). Duplicated *Psy* genes, *Psy1* and *Psy2*, were characterized in the grass family (Gallagher et al. 2004). Also Pozniak et al. (2007) mapped the *Psy1* and *Psy2* genes to homoeologous group 7 and 5 chromosomes in durum wheat, respectively. However, only *Psy1* exhibited a strong association with yellow pigment content of endosperm in maize (Palaisa et al. 2003; Gallagher et al. 2004), and similar conclusion was also reported both in common and durum wheats (Pozniak et al. 2007; Zhang and Dubcovsky 2008; He et al. 2008, 2009a), and the QTLs detected on chromosomes 7A and 7B were orthologues of *Psy1* genes associated with grain yellow pigment content.

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Resently, Zhang and Dubcovsky (2008) isolated *Psy1-A1* and *Psy1-B1* genes from two durum cultivars U1113 and Kofa, and found the two cultivars shared the same *Psy1-A1* allele, but had different *Psy1-B1* alleles. Likewise, five allelic variants of *Psy1-A1* and seven of *Psy1-B1* were identified in common and durum wheats by He et al. (2008, 2009a, 2009c), and the functional markers were further developed based on the InDels and SNPs among different alleles for marker-assisted selection in wheat breeding. However, no full-length DNA sequence of *Psy1* genes on chromosome 7D in common wheat has been reported so far, and the orthologs of the three genes in the wild species of common wheat have not been investigated yet. Therefore, the objectives of this study were to characterize allelic variations of *Psy1* on chromosome 7D in common wheat cultivars, isolate novel alleles of *Psy1-A1, Psy1-B1/Psy1-S1* and *Psy1-D1* from common wheat relatives, and analyze their sequence characteristics and phylogenetic relationships with the *Psy1* genes in common wheat. This information will expand the knowledge of allelic diversity in the *Psy1* genes and help to understand the genetic evolution of *Psy1* gene in common wheat and its relative species.

MATERIAL AND METHODS

Plant material

Five accessions of *T. boeoticum*, four of *T. monococcum*, five of *T. urartu*, five of *T. dicoccoides*, five of *T. dicoccum* and four of *T. spelta* were used for cloning the *Psy1-A1* gene. Three accessions of *Ae. speltoides* were used for cloning the *Psy1-S1* gene. Five of *T. dicoccoides*, five of *T. dicoccum* and four of *T. spelta* were used for cloning the *Psy1-B1* gene, while two accessions of *T. aestivum*, 15 of *Ae. tauschii* and four of *T. spelta* were employed to clone the *Psy1-D1* gene (Table A1). These accessions are available at the National Key Facilities for Crop Genetic Resources and Improvement (NFCRI), Institute of Crop Science, CAAS, China, except for four accessions of *T. urartu*, i.e. PI428326, PI428333, PI538729 and PI538732, and three of *T. spelta*, i.e. Spelt167, Spelt217 and Spelt220, which were provided by Prof. Yueming Yan at the College of Life Science, Capital Normal University, Beijing, China. The Chinese Spring nullisomic-tetrasomic lines, nullisomic 7A-tetrasomic 7B (N7A-T7B), N7B-T7D, N7D-T7A, and ditelosomic line 7DS, kindly provided by Prof. R. A. McIntosh, University of Sydney, were employed to verify the chromosomal location of the STS markers. One hundred and ninety-three Chinese winter wheat cultivars and advanced lines were used for the investigation of allelic variations at *Psy1-D1* locus.

Field trials and grain yellow pigment assay

During the 2001–2002 and 2002–2003 cropping seasons, 193 Chinese wheat cultivars and advanced lines were sown in a randomized complete block with three replicates in the Anyang experimental station, CAAS located in Henan Province. Each plot consisted of two 2-m rows spaced 25 cm apart, with 100 plants in each row. All field trials were kept free of weeds and diseases, with two applications of broad-range herbicides and fungicides, respectively. The procedure for estimating yellow pigment content in wheat grains followed the recommended AACC method (AACC 1995).

Strategies for the identification of new Psy1 alleles in common wheat and its relatives

The common wheat *Psy1-D1* gene was obtained through a PCR-based cloning approach. Two primer sets *P7B1* and *P7B3* for cloning the 3' and 5' end sequences of *Psy1-B1* in common wheat (He et al. 2009a) were used to clone the 3' and 5' end sequences of *Psy1-D1* from Chinese Spring nullisomic-tetrasomic line N7B-T7D. Then another primer set *P7D1* (Table 1) was generated to amplify midstream sequence of *Psy1-D1*, with its forward primer generated from the PCR product of *P7B3* and the reverse primer from that of *P7B1*. Subsequently, three primer sets, *P7D2*, *P7D3* and *P7D4*, were developed based on *Psy1-D1a* (EU650397) to isolate its orthologs in *Ae. tauschii* lines (Table 1, Table A1). Meanwhile, based on the sequences of *Psy1-A1a* (EF600063), *Psy1-A1b* (EF600064) and *Psy1-A1c* (EU650391) from common wheats, and *Psy1-A1d* (EU263018) and *Psy1-A1e* (EU263019) from durum wheats (He et al. 2008, 2009a, 2009c), six pairs of primers, *Y1*, *Y2*, *Y3*, *Y8*, *Y9*, and *Y10*, were developed to amplify the full-length genomic DNA sequences of *Psy1-A1* in wheat relative species (Table 1, Table A1). Likewise, according to the sequences of seven *Psy1-B1* alleles identified by He et al. (2009a, 2009c), i.e. *Psy1-B1a* (EU650392), *Psy1-B1b* (EU650393), *Psy1-B1c* (EU650394) and *Psy1-B1d* (EU650395) from common wheats, and *Psy1-B1f* (EU263020) and *Psy1-B1g* (EU650396) from durum wheats, and *Psy1-B1e* (EU263021) from both common and durum wheats, six primer sets, *P7B1*, *P7B3*, *P7B8*, *P7B9*, *P7B10* and *P7B11*, were designed to clone the full-length genomic DNA sequences of *Psy1-B1* in common wheat relatives (Table 1, Table A1).

Primers were designed using the software Premier Primer 5 (<www.premierbiosoft.com>) and synthesized by Beijing Augct Biological Technology Co., Ltd. (<www.augct.com>). DNA sequencing was performed in Shanghai Sangon Biological Engineering & Technology and Service Co., Ltd. (<www.sangon.com>).

Complete genomic DNA sequences of *Psy1* genes were constructed by the PCR products for *Psy1-A1*, *Psy1-B1/*

Table 1. *Primer sequences used for the cloning of Psy1 alleles and the STS markers developed for Psy1-D1 in this study.*

Locus	Primer set	Primer sequence (5'–3')	Annealing temperature (°C)
Psy1-A1	*Y1*	Forward: GGCAGGCTAGTGGTCGGTA Reverse: TGACGGTCTGAAGTGAGAATGA	62
	Y2	Forward: GGACCTTGCTGATGACCGAG Reverse: GGGGAACTTGGTGATGGTGTC	62
	Y3	Forward: TATGGTGCAGGAGGACAGAC Reverse: CAAGATGGTGGATTCAGGCTC	62
	Y8	Forward: GAGATGCATACGGCCACTTTA Reverse: CGGGACCAACAACGAGTATA	60
	Y9	Forward: TATGGTGCAGGAGGACAGAC Reverse: CGGGACCAACAACGAGTATA	60
	Y10	Forward: TATGGTGCAGGAGGACAGAC Reverse: CAGATGTCGCCACACTGCCA	62
Psy1-B1/Psy1-S1	*P7B1*	Forward: GGACCTCAAGAAGGCAAGAT Reverse: CGGGACCGACAACGAGTATA	63
	P7B3	Forward: GGCAGGCTAGTGGTCGGTA Reverse: GGGGAACTTGGTGATGGTGTC	62
	P7B8	Forward: GGTGCGTGCCTCACTTCTC Reverse: GGGGAACTTGGTGATGGTGTC	62
	P7B9	Forward: GACACCATCACCAAGTTCCCC Reverse: CTGGTTCGCCAACCCGAGA	62
	P7B10	Forward:CGAGATCTGCGAGGAGTACGCC Reverse: CTGGTTCGCCAACCCGAGA	60
	P7B11	Forward: CAGATGGCCACCACCGTCAC Reverse: CTGGTTCGCCAACCCGAGA	60
Psy1-D1	*P7D1*	Forward: GCAGTGTGGTGTAGGAGGAC Reverse: CGTGGCTTTAGGGCACTTAC	62
	P7D2	Forward: GGCAGGCTAGTGGTCGGTA Reverse: AGGGGCAATCTGATGCTGAC	60
	P7D3	Forward: CAGATGGCCACCACCGTCAC Reverse: AGGGGCAATCTGATGCTGAC	60
	P7D4	Forward: TCCGACACCATCACCAAGTTCC Reverse: CCGATTCGCCGCATTGACTA	62
	YP7D-1	Forward: TCCGACACCATCACCAAGTTCC Reverse: CGTTGTAGGTTTGTGGGAGT	58
	YP7D-2	Forward: ACTCCCACAAACCTACAACG Reverse: ACGCTCATCAACCCCACG	58

Psy1-S1, and *Psy1-D1* loci. Intron positions were determined by the alignment of amplified genomic DNA sequences and their corresponding orthologs in common wheat, using the software DNAMAN (<www.lynnon.com>).

Genomic DNA was isolated from kernels following the method modified from Lagudah et al. (1991). PCR reactions were performed in an MJ Research PTC-200 thermal cycler in a total volume of 20 µl including 20 mM of Tris-HCl (pH 8.4), 20 mM of KCl, 150 µM of each of dNTPs, 1.5 mM of $MgCl_2$, 8 pmol of each primer, 1 unit of *Taq* DNA polymerase (TIANGEN Biotech Co.) or *LA-Taq* DNA polymerase (TaKaRa Biotechnology Co., Dalian, China), and 50 ng of genomic DNA. Reaction conditions were 95°C for 5 min, followed by 40 cycles of 95°C for 30 s, 58°C to 63°C for 30 s (according to the annealing temperatures of different primer sets), and 72°C for 1–3 min, with a final extension of 72°C for 5 min. The PCR products were separated on a 1.5% agarose gel, stained with ethidium bromide, and visualized using UV light. The targeting bands for sequencing were recovered and cloned into pMD18-T vector (TaKaRa Biotechnology Co., Dalian, China) following the manufacturer's instructions.

Phylogenetic analyses

All the genomic DNA sequences of *Psy1* genes cloned in this study, together with those of common wheat and durum wheat genes *Psy1-A1* and *Psy1-B1* cloned previously (He et al. 2008, 2009a, 2009c; Zhang and

Dubcovsky 2008) were used to construct the phylogenetic trees. Gene sequences were aligned with the software ClustalW 1.83 (Thompson et al. 1997). Neighbor joining tree, Minimum evolution tree and Maximum parsimony tree were generated by the program MEGA ver. 4.0 (Tamura et al. 2007) with default parameters, in which bootstrap test was performed with 1000 replicates.

Identification of allelic variants at Psy1-D1 locus in chinese wheat cultivars

Molecular markers were developed based on three InDels of 21 bp, 39 bp and 40 bp in the third intron between *Psy1-D1a* and *Psy1-D1g* to test 193 Chinese wheat cultivars and advanced lines. The PCR products from the newly developed marker, *YP7D-1*, were separated on 6% polyacrylamide gels and subjected to silver staining (Bassam et al. 1991), and those of *YP7D-2* were separated on 1.5% agarose gels, stained with ethidium bromide and visualized using UV light.

RESULTS

Cloning of Psy1-A1 genes in wheat relative species

Using the primer sets, *Y1*, *Y2*, *Y3*, *Y8*, *Y9*, and *Y10* (Table 1), eight novel alleles at *Psy1-A1* locus were cloned (Table 2, Fig. 1), i.e. *Psy1-A1f* (from *T. urartu*, FJ393516), *Psy1-A1g* (*T. urartu*, FJ393517), *Psy1-A1h* (*T. boeoticum* and *T. monococcum*, FJ393518), *Psy1-A1i* (*T. monococcum*,

Table 2. *Novel alleles at Psy1-A1, Psy1-B1/Psy1-S1 and Psy1-D1 loci cloned in this study.*

Locus	Allele	Species	Genome	Accession[a]	Primer set	GenBank accession number
Psy1-A1	*Psy1-A1f*	*T. urartu*	A^u	PI428326, (2)	*Y1*, *Y2*, *Y10*	FJ393516
	Psy1-A1g	*T. urartu*	A^u	UR1, (3)	*Y1*, *Y2*, *Y10*	FJ393517
	Psy1-A1h	*T. boeoticum*	A^m	BO1, (5)	*Y1*, *Y2*, *Y9*	FJ393518
		T. monococcum	A^m	MO5, (1)	*Y1*, *Y2*, *Y9*	
	Psy1-A1i	*T. monococcum*	A^m	MO1, (2)	*Y1*, *Y2*, *Y9*	FJ393520
	Psy1-A1j	*T. monococcum*	A^m	MO2, (1)	*Y1*, *Y2*, *Y9*	FJ393521
	Psy1-A1k	*T. dicoccides*	AB	DS3, (4)	*Y1*, *Y2*, *Y3*, *Y8*	FJ393522
		T. dicoccum	AB	DM37, (2)	*Y1*, *Y2*, *Y3*, *Y8*	
		T. spelta	ABD	Spelt167, (3)	*Y1*, *Y2*, *Y3*, *Y8*	
	Psy1-A1m	*T. dicoccum*	AB	DM26, (1)	*Y1*, *Y2*, *Y3*, *Y8*	FJ393525
	Psy1-A1n	*T. spelta*	ABD	SP9, (1)	*Y1*, *Y2*, *Y3*, *Y8*	FJ393526
Psy1-B1/ Psy1-S1	*Psy1-B1h*	*T. dicoccides*	AB	DS3, (2)	*P7B1*, *P7B3*, *P7B9*	FJ393531
	Psy1-B1i	*T. dicoccides*	AB	DS8, (1)	*P7B1*, *P7B3*, *P7B9*	FJ393532
	Psy1-B1j	*T. dicoccum*	AB	DM26, (1)	*P7B1*, *P7B3*, *P7B9*	FJ393533
	Psy1-B1k	*T. dicoccum*	AB	DM33, (1)	*P7B1*, *P7B8*, *P7B9*	FJ393534
	Psy1-B1l	*T. dicoccum*	AB	DM37, (1)	*P7B1*, *P7B3*, *P7B9*	FJ393535
	Psy1-B1m	*T. dicoccum*	AB	DM47, (1)	*P7B1*, *P7B10*, *P7B11*	FJ393539
		T. spelta	ABD	Spelt167, (3)	*P7B1*, *P7B10*, *P7B11*	
	Psy1-S1a	*Ae. speltoides*	S	Ae48	*P7B1*, *P7B3*, *P7B10*	FJ393536
	Psy1-S1b	*Ae. speltoides*	S	Ae49	*P7B1*, *P7B8*, *P7B10*	FJ393537
	Psy1-S1c	*Ae. speltoides*	S	Y162	*P7B1*, *P7B3*, *P7B10*	FJ393538
Psy1-D1	*Psy1-D1a*	*T. aestivum*	ABD	Chinese Spring, (1)	*P7B1*, *P7B3*, *P7D1*	EU650397
	Psy1-D1b	*Ae. tauschii*	D	Ae34, (4)	*P7D2*, *P7D4*	FJ393542
	Psy1-D1c	*Ae. tauschii*	D	Ae46, (6)	*P7D2*, *P7D4*	FJ393543
	Psy1-D1d	*Ae. tauschii*	D	Y99, (2)	*P7D2*, *P7D4*	FJ393544
	Psy1-D1e	*T. spelta*	ABD	SP9, (2)	*P7D2*, *P7D4*	FJ393545
	Psy1-D1f	*T. spelta*	ABD	Spelt217, (2)	*P7D2*, *P7D4*	FJ393546
	Psy1-D1g	*T. aestivum*	ABD	Zhongliang 88375, (2)	*P7D2*, *P7D4*	FJ807498
	Psy1-D1h	*Ae. tauschii*	D	Ae37, (1)	*P7D3*, *P7D4*	FJ807499
	Psy1-D1i	*Ae. tauschii*	D	Ae38, (1)	*P7D3*, *P7D4*	FJ807500
	Psy1-D1j	*Ae. tauschii*	D	Ae42, (1)	*P7D2*, *P7D4*	FJ807501

[a] The number of accessions of each genotype was indicated in parentheses, and a representative accession was shown for each allele. Accession identifiers were from NFCRI, Institute of Crop Science, CAAS, China and College of Life Science, Capital Normal University, Beijing, China.

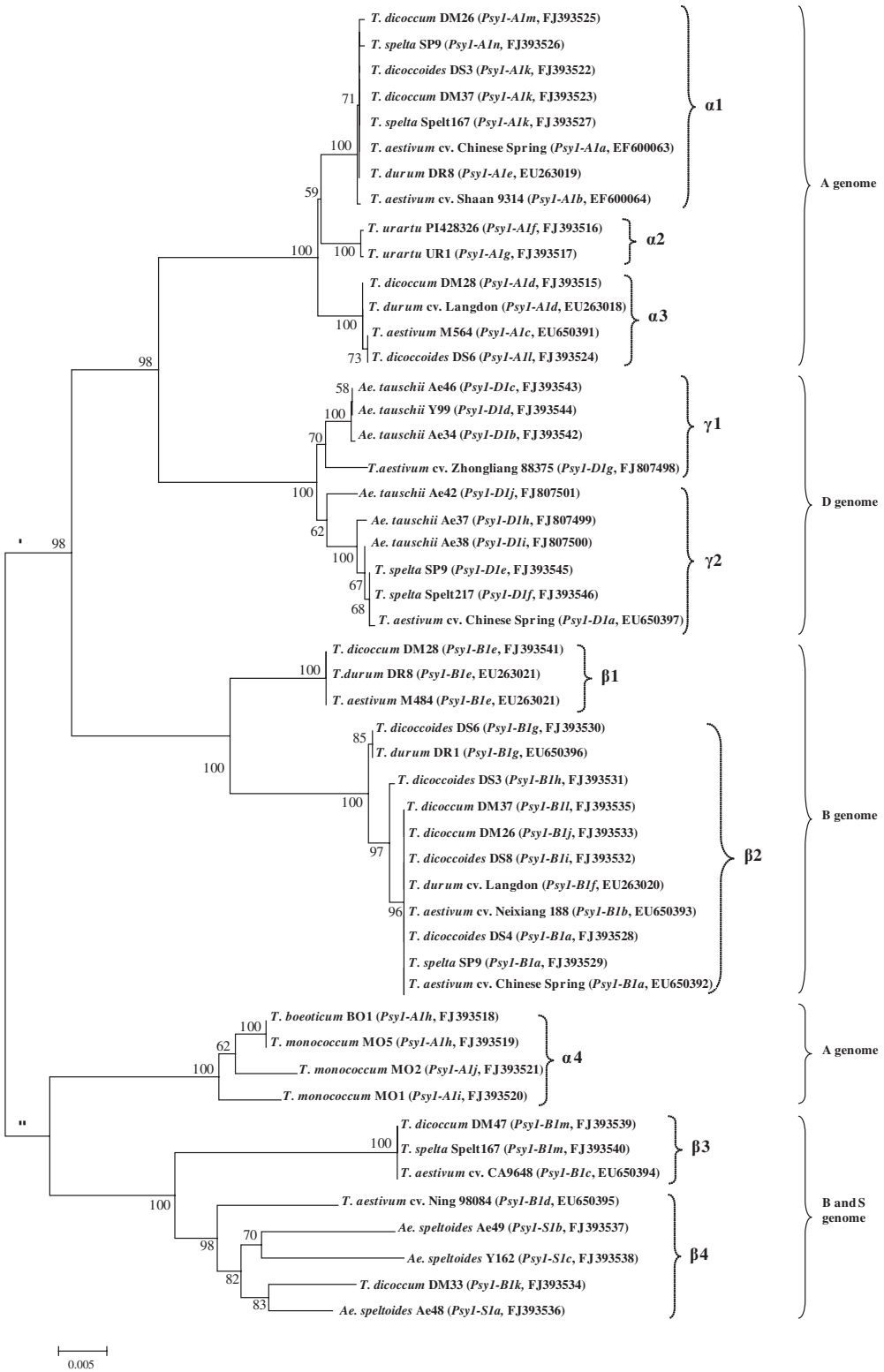

Fig. 1. Phylogenetic tree of the *Psy1* gene families in common wheat and related species. The tree was constructed by the software MEGA ver. 4.0 with neighbor joining algorithm, including 27 new alleles found in this study and seven alleles in common wheat and five alleles in durum wheat and one in both of them reported previously (Zhang and Dubcovsky 2008, He et al. 2008, 2009a, 2009c). Genes are labeled by species name, accession identifier, allele name and GenBank accession number. Different species have its corresponding GenBank accession number even if they shared the same allele. Bootstrap values are shown and the scale bar indicates the number of nucleotide substitutions per site.

FJ393520), *Psy1-A1j* (*T. monococcum*, FJ393521), *Psy1-A1k* (*T. dicoccoides* and *T. dicoccum* and *T. spelta*, FJ393522), *Psy1-A1m* (*T. dicoccum*, FJ393525), and *Psy1-A1n* (*T. spelta*, FJ393526).

The eight *Psy1-A1* alleles detected in the wheat relatives showed high similarities at the deduced aminoacid sequences, ranging from 98.3% to 100%, and they shared the same size of open reading frame (ORF) with 1284 bp, encoding a polypeptide of 428 residues. However, these *Psy1-A1* alleles demonstrated lower DNA sequence identities, ranging from 71.4% to 99.9%, which were mainly attributed to a number of SNPs and several InDels in the introns (Fig. A1).

Cloning of Psy1-B1/Psy1-S1 genes in wheat relative species

Utilizing the primer sets, *P7B1*, *P7B3*, *P7B8* through *P7B11* (Table 1), nine novel alleles at *Psy1-B1/Psy1-S1* locus were obtained (Table 2, Fig. 1), i.e. *Psy1-B1h* (from *T. dicoccoides*, FJ393531), *Psy1-B1i* (*T. dicoccoides*, FJ393532), *Psy1-B1j* (*T. dicoccum*, FJ393533), *Psy1-B1k* (*T. dicoccum*, FJ393534), *Psy1-B1l* (*T. dicoccum*, FJ393535), *Psy1-B1m* (*T. dicoccum* and *T. spelta*, FJ393539), *Psy1-S1a* (*Ae. speltoides*, FJ393536), *Psy1-S1b* (*Ae. speltoides*, FJ393537) and *Psy1-S1c* (*Ae. speltoides*, FJ393538).

The nine *Psy1-B1/Psy1-S1* alleles cloned in this study shared lower sequence identities of 53.0 to 99.7%, exhibiting divergent sequences, with significant numbers of SNPs and InDels (Fig. A2). Nevertheless, they showed high identities in the deduced amino acid sequences, ranging from 92.4% to 100%. The sizes of the exons were conserved among the alleles except the first exon (Table 3), encoding four different types of polypeptides, with 421 (*Psy1-B1h* through *Psy1-B1j*, *Psy1-B1l*), 427 (*Psy1-B1k*, *Psy1-S1a* and *Psy1-S1c*), 428 (*Psy1-B1m*), and 429 (*Psy1-S1b*) aminoacid residues, respectively.

Cloning of Psy1-D1 genes in common wheat and its relative species

The cloned genomic DNA sequence of the *Psy1-D1* allele from Chinese Spring, designated *Psy1-D1a* (GenBank accession EU650397), contained 4653 base pairs, including a 186-bp 5' UTR and a 302-bp 3' UTR. The *Psy1-D1a* allele had an ORF of 1281 bp, encoding 427 aminoacid residues, with a calculated molecular mass of ~47.7 kDa.

With the primer sets, *P7D2*, *P7D3* and *P7D4* (Table 1), nine other allelic variants at *Psy1-D1* locus were isolated (Table 2), i.e. *Psy1-D1b* (*Ae. tauschii*, FJ393542), *Psy1-D1c* (*Ae. tauschii*, FJ393543), *Psy1-D1d* (*Ae. tauschii*, FJ393544), *Psy1-D1e* (*T. spelta*, FJ393545), *Psy1-D1f* (*T. spelta*, FJ393546), *Psy1-D1g* (*T. aestivum*, FJ807498), *Psy1-D1h* (*Ae. tauschii*, FJ807499), *Psy1-D1i* (*Ae. tauschii*, FJ807500) and *Psy1-D1j* (*Ae. tauschii*, FJ807501).

All the ten *Psy1-D1* alleles encoded the same polypeptide except for *Psy1-D1j*, differing in the 2nd (substitution from alanine in *Psy1-D1a* to proline in *Psy1-D1j*), 56th (leucine to valine) and 122nd (alanine to threonine) residues. The differences in intron regions resulted in the DNA sequence divergences, ranging from 85.7% to 100%, among ten *Psy1-D1* alleles (Fig. A3). In the first intron, the allele *Psy1-D1j*, from *Ae. tauschii* Ae42, showed a 174-bp insertion compared with the other *Psy1-D1* alleles. In the second intron, the alleles *Psy1-D1b*, *c*, *d* and *g* had a 172 bp deletion compared with the other six alleles *Psy1-D1a*, *e*, *f*, *h*, *i* and *j*. Intetrestingly, a large InDel of 1252 bp and three other InDels of 21 bp, 39 bp and 40 bp were present in the third intron; compared with the alleles *Psy1-D1a*, *e*, *f* and *i*, the alleles *Psy1-D1b*, *c*, *d* and *j* showed a 1252 bp deletion and a 40 bp insertion, the allele *Psy1-D1g* had three insertions of 21 bp, 39 bp and 40 bp, and the allele *Psy1-D1h* showed only the 40 bp insertion (Fig. A3).

Allelic variants at Psy1-D1 locus in Chinese wheat cultivars

Two co-dominant markers, *YP7D-1* and *YP7D-2*, were developed to discriminate the alleles *Psy1-D1a* and *Psy1-D1g* of common wheat (Table 1). The former primer set amplified 1074 bp and 1093 bp fragments in the genotypes with *Psy1-D1a* and *Psy1-D1g*, respectively (Fig. 2), and the latter produced 967 bp and 1046 bp fragments in the cultivars with *Psy1-D1a* and *Psy1-D1g*, respectively (Fig. 2). The location of *YP7D-1* and *YP7D-2*, on the long arm of chromosome 7D, was determined by amplifying genomic DNA from a set of Chinese Spring nulli-tetrasomic lines and ditelosomic line 7DS (Fig. 3). For the 193 Chinese wheat cultivars and advanced lines genotyped with the markers *YP7D-1* and *YP7D-2*, all were the genotype of *Psy1-D1a*, except for two lines, CA9550 and Zhongliang 88375, with the allele *Psy1-D1g*. The association between the allelic variants at *Psy1-D1* locus and yellow pigment content in the Chinese wheat cultivars was not analyzed due to a very limiting number of *Psy1-D1g* genotype.

Phylogenetic inferences and sequence comparisons

Using program MEGA, three trees were generated by different algorithms, and only the neighbor joining tree is presented here (Fig. 1). Topologies of the three trees are highly similar to each other, and they differed in the relative position of *Psy1-S1c* and two other alleles, *Psy1-B1d* and *Psy1-S1b*, i.e. in the minimum evolution tree and neighbor joining tree, *Psy1-S1c* was located on the inner clade forming a cluster with *Psy1-S1b*, while it was located on the outer clade forming a cluster with *Psy1-B1d* in the maximum parsimony tree. The other clades and clusters

Table 3. *Sizes (bp) in exons and introns of Psy1 alleles identified in the previous and present study.*

Locus	Allele	1st exon	1st intron	2nd exon	2nd intron	3rd exon	3rd intron	4th exon	4th intron	5th exon	5th intron	6th exon
Psy1-A1	*Psy1-A1a*, *Psy1-A1k*, *Psy1-A1m*, *Psy1-A1n*	460	118	51	591	173	652	236	804	193	199	171
	Psy1-A1b, *Psy1-A1e*	460	118	51	628	173	652	236	804	193	199	171
	Psy1-A1c	460	118	51	591	173	652	236	116	193	202	171
	Psy1-A1d, *Psy1-A1l*	460	118	51	591	173	653	236	116	193	202	171
	Psy1-A1f	460	118	51	591	173	653	236	116	193	203	171
	Psy1-A1g	460	118	51	590	173	653	236	116	193	204	171
	Psy1-A1h	460	106	51	591	173	456	236	121	193	239	171
	Psy1-A1i	460	107	51	595	173	455	236	121	193	237	171
	Psy1-A1j	460	107	51	595	173	455	236	121	193	238	171
Psy1-B1/ Psy1-S1	*Psy1-B1a*, *Psy1-B1j*	439	125	51	598	173	620	236	116	193	210	171
	Psy1-B1b	439	125	51	598	173	620	236	116	193	215	171
	Psy1-B1c	460	126	51	647	173	917	236	124	193	201	171
	Psy1-B1d	469	129	51	578	173	1065	236	124	193	248	171
	Psy1-B1e	439	125	51	580	173	645	236	116	193	211	171
	Psy1-B1f, *Psy1-B1h*	439	125	51	598	173	620	236	116	193	211	171
	Psy1-B1g, *Psy1-B1i*	439	125	51	598	173	620	236	116	193	213	171
	Psy1-B1k	457	125	51	569	173	1070	236	124	193	248	171
	Psy1-B1l	439	125	51	577	173	620	236	116	193	212	171
	Psy1-B1m	460	126	51	647	173	914	236	124	193	201	171
	Psy1-S1a	457	126	51	570	173	902	236	124	193	247	171
	Psy1-S1b	463	126	51	570	173	1058	236	124	193	247	171
	Psy1-S1c	457	127	51	555	173	905	236	124	193	248	171
Psy1-D1	*Psy1-D1a*, *Psy1-D1e*, *Psy1-D1f*, *Psy1-D1i*	457	121	51	577	173	1864	236	121	193	201	171
	Psy1-D1b, *Psy1-D1c*	457	121	51	403	173	652	236	121	193	200	171
	Psy1-D1d	457	121	51	403	173	652	236	121	193	199	171
	Psy1-D1g	457	121	51	404	173	1962	236	121	193	201	171
	Psy1-D1h	457	121	51	577	173	1901	236	121	193	201	171
	Psy1-D1j	457	295	51	575	173	649	236	121	193	201	171

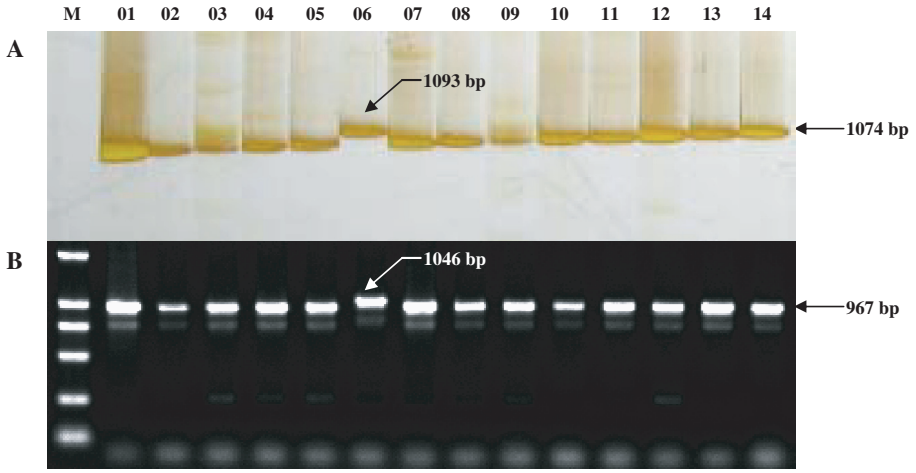

Fig. 2A–B. PCR amplification with the markers *YP7D-1* (**A**) and *YP7D-2* (**B**) in 14 Chinese winter wheat lines. M – DNA ladder DL2000; 01 Nongda 3291 (*Psy1-D1a*, yellow pigment content 3.18 mg kg^{-1}); 02 Shannong 1355 (*Psy1-D1a*, 3.36); 03 Yan 2801 (*Psy1-D1a*, 2.69); 04 Yun 97169 (*Psy1-D1a*, 3.42); 05 N9209-3 (*Psy1-D1a*, 2.27); 06 Zhongliang 88375 (*Psy1-D1g*, 2.88); 07 Shannong 413863 (*Psy1-D1a*, 1.84); 08 Huaimai 17 (*Psy1-D1a*, 1.16); 09 Jimai 1 (*Psy1-D1a*, 0.93); 10 Xinong 336 (*Psy1-D1a*, 0.48); 11 Ning 97-18 (*Psy1-D1a*, 0.35); 12 Huaimai 16 (*Psy1-D1a*, 0.57); 13 E86642 (*Psy1-D1a*, 0.62); 14 R25 (*Psy1-D1a*, 0.86). (**A**) The PCR products from *YP7D-1* were separated on 6% polyacrylamide gels. (**B**) The PCR products from *YP7D-2* were separated on 1.5% agarose gels.)

were identical among the three trees and were well supported by high bootstrap values.

The phylogenetic tree consisted of two subtrees (Fig. 1). The subtree I comprised 11 out of 14 alleles at *Psy1-A1* locus, 10 alleles at *Psy1-D1* locus and nine out of 16 alleles at *Psy1-B1/Psy1-S1* locus, while subtree II included the other three alleles of *Psy1-A1*, i.e. *Psy1-A1h*, *Psy1-A1i*, *Psy1-A1j* and the other seven alleles at *Psy1-B1/Psy1-S1* locus, i.e. *Psy1-B1c*, *Psy1-B1d*, *Psy1-B1k*, *Psy1-B1m*, *Psy1-S1a*, *Psy1-S1b* and *Psy1-S1c*. Within the subtree I, three groups were found, i.e. *Psy1-A1* group, *Psy1-B1* group and *Psy1-D1* group.

The *Psy1-A1* group was further divided into three clusters, 1, 2 and 3, and the first one included *Psy1-A1a* and

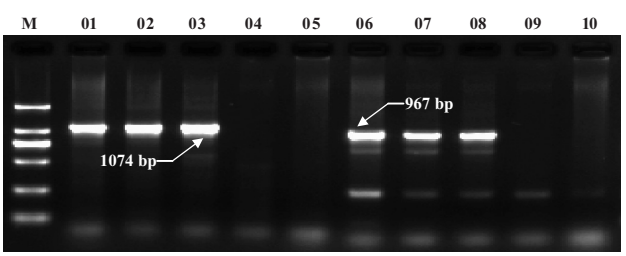

Fig. 3. PCR amplification of Chinese Spring, its nullisomic-tetrasomic lines, and ditelosomic line 7DS with STS markers *YP7D-1* and *YP7D-2*, respctively. M – DNA ladder DL2000; Chinese Spring (lanes 01 and 06); 02 N7A-T7B (lanes 02 and 07); 03 N7B-T7D (lanes 03 and 08); 04 N7D-T7A (lanes 04 and 09); 05 DT7DS (lanes 05 and 10).

Psy1-A1b from common wheat and *Psy1-A1e* from durum wheat, *Psy1-A1k* from *T. dicoccoides*, *T. dicoccum* and *T. spelta*, *Psy1-A1m* and *Psy1-A1n* from *T. dicoccum* and *T. spelta*, respectively. Evidently, *T. dicoccoides* DS3, *T. dicoccum* DM37 and *T. spelta* Spelt167 shared the same allele, *Psy1-A1k*, which was highly homologous to that of *T. aestivum* cv. Chinese Spring (*Psy1-A1a*) with only one SNP in the fourth intron, and that of *T. dicoccum* DM26 (*Psy1-A1m*) and *T. spelta* Spelt167 (*Psy1-A1n*) with a few SNPs in introns (Fig. A1). The allele from *T. aestivum* Shaan 9314 (*Psy1-A1b*) and that from *T. durum* DR8 (*Psy1-A1e*) showed high sequence identity, with only one synonymous SNP in the first exon. Although the allele from *Psy1-A1b* resided on the peripheral clade of the cluster 1, only a 37 bp InDel and a few SNPs were detected between *Psy1-A1b* and other *Psy1-A1* alleles in this cluster, demonstrating their close relationships. The second one consisted of *Psy1-A1f* and *Psy1-A1g* from *T. urartu*. There was two 1 bp InDels and two SNPs between them in introns (Fig. A1). The last one contained *Psy1-A1c* from common wheat, *Psy1-A1d* from *T. durum* and *T. dicoccum*, and *Psy1-A1l* from *T. dicoccoides* (Fig. 1). It is notable that *T. dicoccum* DM28, *T. durum* Langdon shared the same allele *Psy1-A1d*, which was highly homologous to that of *T. aestivum* M564 (*Psy1-A1c*) with only one 1 bp InDel and one SNP in introns, and that of *T. dicoccoides* DS6 (*Psy1-A1l*) with only one SNP in the fifth intron, respectively (Fig. A1).

The *Psy1-D1* group was further divided into two clusters, 1 and 2, and the former included *Psy1-D1b*, *Psy1-D1c* and

Psy1-D1d from *Ae. tauschii* and *Psy1-D1g* from *T. aestivum*, which shared a very high identity of 97.7 to 99.9%. Although the allele *Psy1-D1g* from common wheat resided on the peripheral clade of cluster 1, only several SNPs and a 1311 bp InDel were detected between *Psy1-D1g* and other *Psy1-D1* alleles in this cluster, demonstrating their close relationships. The latter contained *Psy1-D1a* from common wheat, *Psy1-D1e* and *Psy1-D1f* from *T. spelta*, and *Psy1-D1h*, *Psy1-D1i* and *Psy1-D1j* from *Ae. tauschii*, which showed high sequence identity of 91.3 to 100%. Three SNPs were found in introns among *Psy1-D1a*, *Psy1-D1e* and *Psy1-D1f*. Actually, *Psy1-D1e* was identical to *Psy1-D1f* in the coding region, and there was only one SNP in 5' untranslated region between them. In addition, three SNPs in introns and one synonymous SNP in the first exon were found between *Psy1-D1a* from *T. aestivum* and *Psy1-D1i* from *Ae. tauschii*, demonstrating their close relationships (Fig. A3). It is notable that the allele *Psy1-D1j* and *Psy1-D1h* located on the outer clade of the cluster 2 (Fig. 1), which were mainly attributed to several SNPs and InDels. What the allele *Psy1-D1j* mainly differed from *Psy1-D1a* was a 174 bp insertion in the first intron, and a 1252 bp deletion and a 40 bp insertion in the third intron, respectively. The allele *Psy1-D1h* showed a 40 bp insertion in the third intron compared with *Psy1-D1a*, besides a 1 bp InDel, a 2 bp InDel and 17 SNPs in introns and one synonymous SNP in the first exon (Fig. A3).

Similarly, the *Psy1-B1* group also comprised two clusters, 1 and 2, and the former included *Psy1-B1e* found in durum, *T. dicoccum* and common wheat, and the latter contained *Psy1-B1a* from *T. dicoccoides*, *T. spelta* and common wheat, *Psy1-B1b* from common wheat, *Psy1-B1f* from durum wheat, *Psy1-B1g* from *T. dicoccoides* and durum wheat, *Psy1-B1h* and *Psy1-B1i* from *T. dicoccoides*, and *Psy1-B1j* and *Psy1-B1l* from *T. dicoccum* (Fig. 1). *T. dicoccum* DM28, *T.durum* DR8, and *T. aestivum* M484 shared the same allele, *Psy1-B1e*, showing lower sequence identities with the other *Psy1-B1* alleles. Likewise, *T. dicoccoides* DS6 and *T. durum* DR1 shared the same allele, *Psy1-B1g*, which resided on the outer clade of the cluster 2, besides *T. dicoccoides* (*Psy1-B1h*). There was a 3 bp InDel in the poly C region of the fifth intron between *Psy1-B1g* and *Psy1-B1a* (Fig. A2). Of the eight SNPs between the two alleles, three were found in introns and five in exons resulting in the changes of three aminoacid residues at positions 95 (substitution from leucine in *Psy1-B1a* to valine in *Psy1-B1g*), 128 (lysine to glutamate) and 324 (valine to phenylalanine), respectively. *Psy1-B1h* showed a 1 bp InDel in the Poly C region of the fifth intron and four SNPs compared with *Psy1-B1a*, with three in introns and one in exons, resulting in a shift from valine to phenylalanine in deduced amino acid sequences. In addition, *T. dicoccoides* DS4, *T. spelta* SP9 and *T. aestivum* Chinese Spring shared the same allele, *Psy1-B1a,* which was highly homologous to those of *T. aestivum* (*Psy1-B1b*), *T. dicoccoides* (*Psy1-B1i*), *T. dicoccum* (*Psy1-B1j* and *Psy1-B1l*), and *T. durum* (*Psy1-B1f*) with a few SNPs and InDels in the introns (Fig. A2).

Within the subtree II, two groups were found, i.e. *Psy1-A1* group and *Psy1-B1/Psy1-S1* group. The *Psy1-A1* group included *Psy1-A1h* from *T. boeoticum* and *T. monococcum*, and *Psy1-A1i* and *Psy1-A1j* from *T. monococcum*. The accessions *T. boeoticum* BO1, *T. monococcum* M5 shared the same allele, *Psy1-A1h*, encoding exactly the same polypeptide sequence as *Psy1-A1i*, but different from that of *Psy1-A1j* with only four residues at positions 112 (substitution from serine in *Psy1-A1h* to glutamine in *Psy1-A1j*), 116 (glutamine to alanine), 117 (glutamine to alanine) and 118 (alanine to glutamine), respectively. Apart from several SNPs and InDels, the sequence differences between *Psy1-A1* alleles from *T. boeoticum* and *T. monococcum* and other *Psy1-A1* alleles from common wheat and its relatives were mainly present in one 210 bp InDel, located in the third intron (Fig. A1).

The *Psy1-B1/Psy1-S1* group was further divided into two clusters, 3 and 4, and the former included *Psy1-B1c* from common wheat, and *Psy1-B1m* from *T. dicoccum* and *T. spelta*. A same allele, *Psy1-B1m*, was detected in *T. dicoccum* DM47 and *T. spelta* Spelta167, highly similar to *Psy1-B1c*, an allele from *T. aestivum* cv. CA9648, with only one SNP and two 1 bp InDels in the third intron, demonstrating their close relationships. The latter contained *Psy1-B1d* from common wheat, *Psy1-B1k* from *T. dicoccum* and *Psy1-S1a*, *Psy1-S1b*, *Psy1-S1c* from *Ae. speltoides*. A sequence identity of 90.1 to 96.6% was shown among these five *Psy1-B1/Psy1-S1* alleles in the cluster 4. The allele *Psy1-B1k* from *T. dicoccum* DM33 and *Psy1-S1a* from *Ae. speltodies* Ae48 shared a very high sequence identity of 96.6%, with a few SNPs and InDels, particularly a 163 bp InDel in the third intron (Fig. A2). Moreover, they shared a highly similar polypeptide sequence and differed only in the 62nd (substitution from valine in *Psy1-B1k* to alanine in *Psy1-S1a*) and 275th (aspartate to glutamate) residues, demonstrating their close relationships.

DISCUSSION

Phylogenetic relationships of the Psy1 alleles and the origin of common wheat

Common wheat (*T. aestivum*, AABBDD) originated from the hybridization of emmer wheat (*T. dicoccum*, AABB) with *Ae. tauschii* (DD) about 8000 years ago (Huang et al. 2002). Many studies suggested more than one emmer line was involved in the formation of allohexaploid wheat (Gu et al. 2004; Isidore et al. 2005; Ragupathy et al. 2008; He et al. 2009b). Similarly, our results may also imply the same result of polyphyletic origin of common wheat as

demonstrated above. We found *T. spelta* Spelt167 shared the same allele, *Psy1-A1k*, with *T. dicoccoides* DS3 and *T. dicoccum* DM37. In addition, *T. dicoccoides* DS4, *T. spelta* SP9 and *T. aestivum* Chinese Spring shared the same allele, *Psy1-B1a*. From the above results, we can deduce that common wheat was domesticated from *T. spelta* which might be the earliest hexaploid wheat. It is notable that durum and emmer wheats shared the same ancestor of *T. dicoccoides* and closely related to each other (Salamini et al. 2002; Ozkan et al. 2005; Jauhar 2007). In the present study, *T. dicoccum* DM28, *T. durum* Langdon shared the same allele, *Psy1-A1d*, and the common allele *Psy1-B1g* was also isolated from *T. dicoccoides* DS6 and *T. durum* DR1. We also found that the allele *Psy1-A1l* from *T. dicoccoides* DS6 was identical to *TtPSY1-A1* (EU096090; Zhang and Dubcovsky 2008) identified from durum cultivars U1113 and Kofa, further supporting the above theory. Based on the previous (He et al. 2009a, 2009b, 2009c) and present studies, common wheat may be created by recurrent hexaploidization events, involving more than one *T. dicoccum* and *Ae. tauschii* lines, coinciding with the theory of recurrent formation of polyploid plant proposed by Soltis et al. (1999).

The A genome of common and durum wheats was originated from *T. urartu* (Dvorak et al. 1993; Ciaffi et al. 2000; Huang et al. 2002; Petersen et al. 2006), which is in agreement with the results inferred from the structure of the subtree I (Fig. 1), where the allele from *T. urartu* was clustered with those from tetraploid and hexaploid wheats. As expected, the three alleles, *Psy1-A1h* from *T. boeoticum* and *T. monococcum*, and *Psy1-A1i* and *Psy1-A1j* from *T. monococcum*, were clustered together as outgroup of the tribe, which were markedly different from the other *Psy1-A1* alleles with a number of SNPs and InDels, further supporting the above theory.

On the other hand, three trees were generated based on different algorithms; nevertheless, topologies of the trees were highly similar to each other, implying the validity of the phylogenetic relationships. Only the relative position of *Psy1-S1c* and the two other alleles, *Psy1-B1d* and *Psy1-S1b*, differed in the three trees as mentioned above, which were probably due to unusual sequence characteristics of these alleles making variable phylogenetic inferences when different algorithms were used. These *Psy1-B1/Psy1-S1* alleles in subtree II exhibited largely sequence divergences from those in subtree I, ranging from 53.0 to 71.1%. As expected, the seven alleles, *Psy1-B1c* and *Psy1-B1d* from common wheat, *Psy1-B1k* from *T. dicoccum*, *Psy1-S1a*, *Psy1-S1b*, *Psy1-S1c* from *Ae. speltoides*, and *Psy1-B1m* from *T. dicoccum* and *T. spelta*, were clustered together as outgroup of the phylogenetic tree. He et al. (2009a) inferred *Psy1-B1c* and *Psy1-B1d* probably evolved from a common ancestor early in the divergence of the *Psy-B1* alleles from the common presence of a *Stowaway* element in the third introns. In this study, we also found the *Stowaway* element in *Psy1-B1m*, *Psy1-B1k*, *Psy1-S1a* through *Psy1-S1c* (Fig. A2), demonstrating that *Ae. speltoides* might be the B genome donor of common wheat or at least major donor of that. Moreover, the allele *Psy1-B1c* of common wheat showed high sequence identity with that of *T. dicoccum* DM47 (*Psy1-B1m*) and *T. spelta* Spelta167 (*Psy1-B1m*), with only one SNP and two 1 bp InDels detected, suggesting that *Psy1-B1c* might have evolved from *Psy1-B1m*, or inherited from an ancestor closely related to *T. dicoccum* DM47. Therefore, discovery of *Psy1-B1m* from common wheat relative species further supported that *Psy1-B1c* and *Psy1-B1d* must have been inherited from two ancestors of emmer wheat (He et al. 2009c). Similarly, another unusual sequence characteristic allele, *Psy1-B1e*, was detected in CIMMYT wheat line M484 and durum wheat line DR8 by He et al. (2009a, 2009c). They suggested that the allele *Psy1-B1e* found in common wheat was actually introduced from durum wheat by an introgression event. However, in this study, we isolated *Psy1-B1e* in *T. dicoccum* DM28, indicating that *Psy1-B1e* from common wheat inherited from an ancestor of *T. dicoccum*, and further demonstrated the very close relationship between emmer wheat and durum wheat, which shared the common ancestor of *T. dicoccoides*.

In the recent years, increasing evidences showed that more than one *Ae. tauschii* lines participated in the formation of allohexaploid common wheat (Hammer 1980; Dvorak et al. 1998; Lelley et al. 2000; Caldwell et al. 2004; Giles and Brown 2006; He et al. 2009b). In this study, the genome tribe D included two distinct alleles from common wheat, *Psy1-D1a* and *Psy1-D1g* (Fig. A3), implying they have been inherited from different *Ae. tauschii* donors. The allele *Psy1-D1i* from *Ae. tauschii* Ae38 showed great sequence identity with the allele *Psy1-D1a* from common wheat, with only one synonymous SNP in the first exon and three SNPs in introns, indicating that *Psy1-D1a* from common wheat might have been derived from *Ae. tauschii* Ae38 or other *Ae. tauschii* donors closely related to it. However, the ancestor of *Psy1-D1g* was not identified in this study. This may be ascribed to the limited samples of *Ae. tauschii* accessions, missing the *Ae. tauschii* lines with an allele related to the ancestor of *Psy1-D1g*.

Allelic variants of Psy1-D1 in common wheat

Grain yellow pigment content is an important trait in common wheat. The two *Psy1* genes highly associated with grain yellow pigment content, *Psy1-A1* and *Psy1-B1* on chromosomes 7A and 7B, respectively, were identified previously (Parker et al. 1998; Ma et al. 1999; Mares and Campbell 2001; Kuchel et al. 2006; Zhang et al. 2006; He et al. 2008, 2009a; Zhang et al. 2009). However, no QTLs

for grain yellow pigment content on chromosomes 7D have been detected in common wheat yet. This might be attributed to little variation at *Psy1-D1* locus of common wheat. In the present study, 193 Chinese wheat cultivars and advanced lines with different yellow pigment contents were genotyped with the markers *YP7D-1* and *YP7D-2*, and 191 of them were the genotype of *Psy1-D1a*, and only two lines, CA9550 and Zhongliang 88375, had the allele *Psy1-D1g*. The results indicated that little variation was present at *Psy1-D1* locus in common wheat cultivars, and thus no major QTL for yellow pigment content were detected on chromosome 7D. However, we can not rule out the possibility that the InDels among the allelic variants at *Psy1-D1* locus might influence the splicing of premature mRNA, which could influence the expression of the *Psy1-D1* gene. Howitt et al. (2009) reported that the 37 bp insertion at the 5'-end of the second intron of *Psy1-A1b* created a new splice site, resulting in four different transcripts, in which only the wild type splice variant could produce an enzymatically active protein. Thus it is essential to intensively study the *Psy1-D1* alleles of common wheat and its relatives in the future, which might help us to understand the molecular mechanism of grain yellow pigment content.

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APPENDIX 1

Table A1. *Forty-eight accessions of wheat and its relatives used in this study.*

Accession identifier[a]	Species	Genome	Allele	Donor[b]	Origin[b]
PI428326	*T. urartu*	A^u	*Psy1-A1f*	Lebanon	/
PI428333	*T. urartu*	A^u	*Psy1-A1f*	Lebanon	/
UR1	*T. urartu*	A^u	*Psy1-A1g*	/	Hungary
PI538729	*T. urartu*	A^u	*Psy1-A1g*	Turkey	/
PI538732	*T. urartu*	A^u	*Psy1-A1g*	Turkey	/
BO1	*T. boeoticum*	A^m	*Psy1-A1h*	/	/
BO3	*T. boeoticum*	A^m	*Psy1-A1h*	Germany	/
BO5	*T. boeoticum*	A^m	*Psy1-A1h*	USA	/
BO8	*T. boeoticum*	A^m	*Psy1-A1h*	Hungary	/
BO9	*T. boeoticum*	A^m	*Psy1-A1h*	Hungary	/
MO1	*T. monococcum*	A^m	*Psy1-A1i*	/	/
MO2	*T. monococcum*	A^m	*Psy1-A1j*	/	Soviet Union
MO4	*T. monococcum*	A^m	*Psy1-A1i*	/	Spain
MO5	*T. monococcum*	A^m	*Psy1-A1h*	Germany	/
Ae48	*Ae. speltoides*	S	*Psy1-S1a*	Germany	Israel
Ae49	*Ae. speltoides*	S	*Psy1-S1b*	Germany	Turkey
Y162	*Ae. speltoides*	S	*Psy1-S1c*	Germany	Iraq
Ae34	*Ae. tauschii*	D	*Psy1-D1b*	Canada	/
Ae35	*Ae. tauschii*	D	*Psy1-D1b*	Canada	/
Ae37	*Ae. tauschii*	D	*Psy1-D1h*	France	Soviet Union
Ae38	*Ae. tauschii*	D	*Psy1-D1i*	France	Iran
Ae39	*Ae. tauschii*	D	*Psy1-D1c*	France	Soviet Union
Ae42	*Ae. tauschii*	D	*Psy1-D1j*	Sichuan, China	Shaanxi, China
Ae43	*Ae. tauschii*	D	*Psy1-D1b*	USA	/
Ae46	*Ae. tauschii*	D	*Psy1-D1c*	/	Henan, China
Y57	*Ae. tauschii*	D	*Psy1-D1b*	Middle East	Middle East
Y59	*Ae. tauschii*	D	*Psy1-D1c*	/	Xinjiang, China
Y92	*Ae. tauschii*	D	*Psy1-D1c*	Xinjiang, China	Xinjiang, China
Y93	*Ae. tauschii*	D	*Psy1-D1c*	Xinjiang, China	Xinjiang, China
Y95	*Ae. tauschii*	D	*Psy1-D1d*	Xinjiang, China	Xinjiang, China
Y98	*Ae. tauschii*	D	*Psy1-D1c*	Xinjiang, China	Xinjiang, China
Y99	*Ae. tauschii*	D	*Psy1-D1d*	Xinjiang, China	Xinjiang, China
DS3	*T. dicoccoides*	AB	*Psy1-A1k* *Psy1-B1h*	/	/
DS4	*T. dicoccoides*	AB	*Psy1-A1k* *Psy1-B1a*	USA	/
DS6	*T. dicoccoides*	AB	*Psy1-A1l* *Psy1-B1g*	Germany	/
DS7	*T. dicoccoides*	AB	*Psy1-A1k* *Psy1-B1h*	Germany	/
DS8	*T. dicoccoides*	AB	*Psy1-A1k* *Psy1-B1i*	Germany	/
DM26	*T. dicoccum*	AB	*Psy1-A1m* *Psy1-B1j*	/	Ethiopia
DM28	*T. dicoccum*	AB	*Psy1-A1d* *Psy1-B1e*	Hungary	/
DM33	*T. dicoccum*	AB	*Psy1-A1d* *Psy1-B1k*	/	Morocco
DM37	*T. dicoccum*	AB	*Psy1-A1k* *Psy1-B1l*	/	Poland
DM47	*T. dicoccum*	AB	*Psy1-A1k* *Psy1-B1m*	/	Yemen

(Continued)

Table A1. *(Continued)*.

Accession identifier[a]	Species	Genome	Allele	Donor[b]	Origin[b]
SP9	*T. spelta*	ABD	*Psy1-A1n* *Psy1-B1a* *Psy1-D1e*	Germany	/
Spelt167	*T. spelta*	ABD	*Psy1-A1k* *Psy1-B1m* *Psy1-D1e*	/	/
Spelt217	*T. spelta*	ABD	*Psy1-A1k* *Psy1-B1m* *Psy1-D1f*	/	/
Spelt220	*T. spelta*	ABD	*Psy1-A1k* *Psy1-B1m* *Psy1-D1f*	/	/
Chinese Spring	*T. aestivum*	ABD	*Psy1-A1a* *Psy1-B1a* *Psy1-D1a*	/	Sichuan, China
Zhongliang 88375	*T. aestivum*	ABD	*Psy1-D1g*	/	Gansu, China

[a]accession identifiers except those of common wheats were from NFCRI, Inst. of Crop Science, CAAS, China and College of Life Science, Capital Normal Univ., Beijing, China.
[b]donor and origin refer to countries or regions from where the germplasms were introduced and were originally collected, respectively; slashes denote missing records.

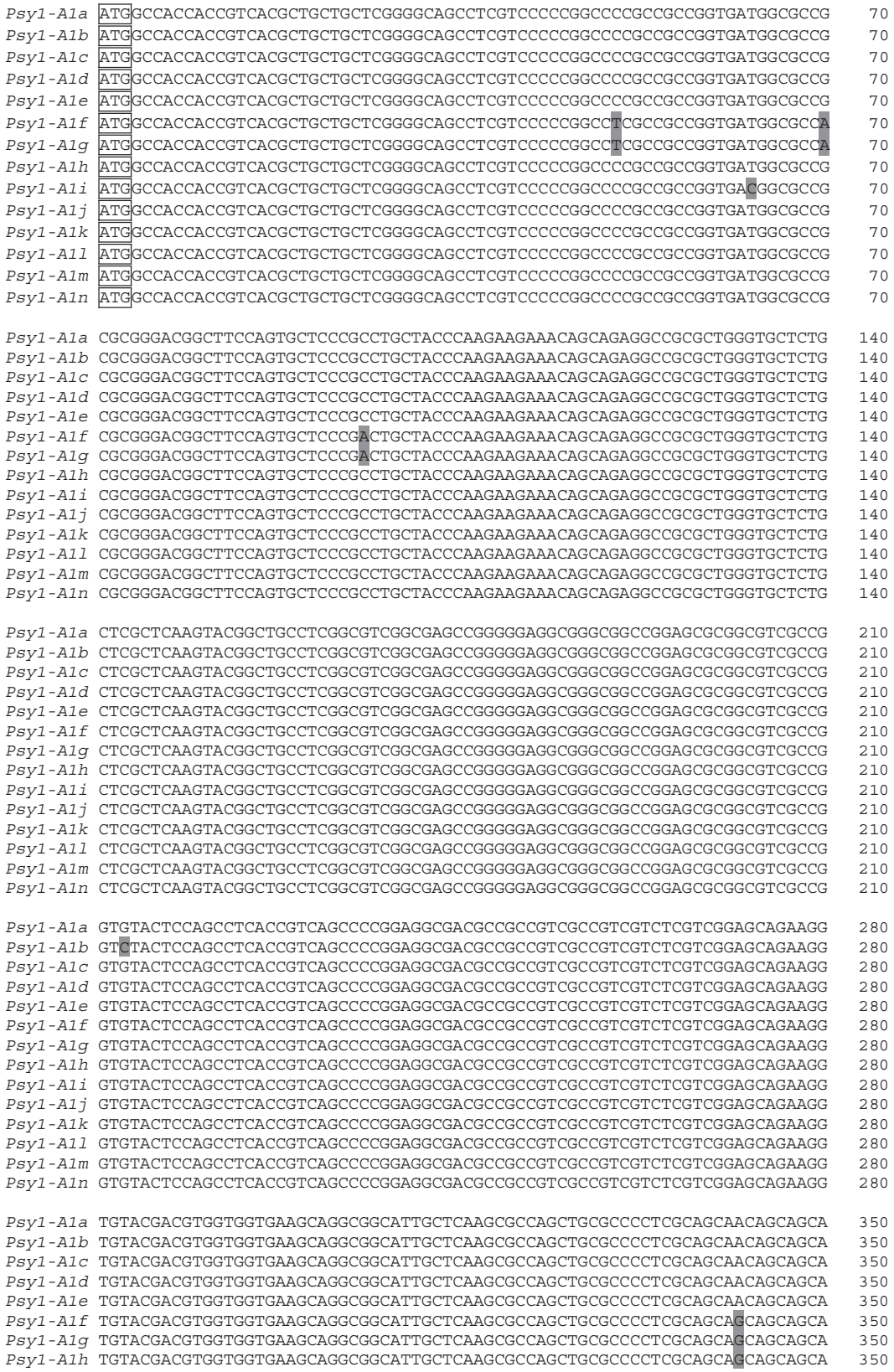

Fig. A1. Alignment of the alleles at Psy1-A1 locus. SNPs are shadowed; gaps are filled with dashes. The introns are underlined, and the start and terminal codons are boxed.

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Psy1-A1i TGTACGACGTGGTGGTGAAGCAGGCGGCATTGCTCAAGCGCCAGCTGCGCCCCTCGCAGCAGCAGCAGCA   350
Psy1-A1j TGTACGACGTGGTCGTGAAGCAGGCGGCATTGCTCAAGCGCCAGCTGCGCCCCCAGCAGCAGCAGGCGGC   350
Psy1-A1k TGTACGACGTGGTGGTGAAGCAGGCGGCATTGCTCAAGCGCCAGCTGCGCCCCTCGCAGCAACAGCAGCA   350
Psy1-A1l TGTACGACGTGGTGGTGAAGCAGGCGGCATTGCTCAAGCGCCAGCTGCGCCCCTCGCAGCAACAGCAGCA   350
Psy1-A1m TGTACGACGTGGTGGTGAAGCAGGCGGCATTGCTCAAGCGCCAGCTGCGCCCCTCGCAGCAACAGCAGCA   350
Psy1-A1n TGTACGACGTGGTGGTGAAGCAGGCGGCATTGCTCAAGCGCCAGCTGCGCCCCTCGCAGCAACAGCAGCA   350

Psy1-A1a GGCGCCGCCAGCCGTCGCCAGGGAGCTGGACGCGCCGCGCGGCGGGCTCGGGGAGGCCTACGCCCGCTGC   420
Psy1-A1b GGCGCCGCCAGCCGTCGCCAGGGAGCTGGACGCGCCGCGCGGCGGGCTCGGGGAGGCCTACGCCCGCTGC   420
Psy1-A1c GGCGCCGCCCGCCGTCGCCAGGGAGCTGGACGCGCCGCGCGGCGGGCTCGGGGAGGCCTACGCCCGCTGC   420
Psy1-A1d GGCGCCGCCCGCCGTCGCCAGGGAGCTGGACGCGCCGCGCGGCGGGCTCGGGGAGGCCTACGCCCGCTGC   420
Psy1-A1e GGCGCCGCCAGCCGTCGCCAGGGAGCTGGACGCGCCGCGCGGCGGGCTCGGGGAGGCCTACGCCCGCTGC   420
Psy1-A1f GGCGCCGCCCGCCGTCGCCAGGGAGCTGGACGCGCCGCGCGGCGGGCTCGGGGAGGCCTACGCCCGCTGC   420
Psy1-A1g GGCGCCGCCCGCCGTCGCCAGGGAGCTGGACGCGCCGCGCGGCGGGCTCGGGGAGGCCTACGCCCGCTGC   420
Psy1-A1h GGCGCCGCCCGCCGTCGCCAGGGAGCTGGACGCGCCGCGCGGCGGGCTCGGGGAGGCCTACGCCCGCTGC   420
Psy1-A1i GGCGCCGCCCGCCGTCGCCAGGGAGCTGGACGCGCCGCGCGGCGGGCTCGGGGAGGCCTACGCCCGCTGC   420
Psy1-A1j ACAGCCGCCCGCCGTCGCCAGGGAGCTGGACGCGCCGCGCGGCGGGCTCGGGGAGGCCTACGCCCGCTGC   420
Psy1-A1k GGCGCCGCCAGCCGTCGCCAGGGAGCTGGACGCGCCGCGCGGCGGGCTCGGGGAGGCCTACGCCCGCTGC   420
Psy1-A1l GGCGCCGCCCGCCGTCGCCAGGGAGCTGGACGCGCCGCGCGGCGGGCTCGGGGAGGCCTACGCCCGCTGC   420
Psy1-A1m GGCGCCGCCAGCCGTCGCCAGGGAGCTGGACGCGCCGCGCGGCGGGCTCGGGGAGGCCTACGCCCGCTGC   420
Psy1-A1n GGCGCCGCCAGCCGTCGCCAGGGAGCTGGACGCGCCGCGCGGCGGGCTCGGGGAGGCCTACGCCCGCTGC   420

Psy1-A1a GGCGAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACGCCACTCCTT-CGTGGATACTCTGTT   489
Psy1-A1b GGCGAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACGCCACTCCTT-CGTGGATACTCTGTT   489
Psy1-A1c GGCGAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACGCCACTCCTT-CGTGGATACTCTGTT   489
Psy1-A1d GGCGAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACGCCACTCCTT-CGTGGATACTCTGTT   489
Psy1-A1e GGCGAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACGCCACTCCTT-CGTGGATACTCTGTT   489
Psy1-A1f GGCGAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACGCCACTCCTT-CGTGGATACTCTGTT   489
Psy1-A1g GGCGAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACGCCACTCCTT-CGTGGATACTCTGTT   489
Psy1-A1h GGCGAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACGCCACTCCTT-CGTGGATACTCTGTT   489
Psy1-A1i GGCGAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACGGTCCTCCTTTCATGCATACTCTGTT   490
Psy1-A1j GGCGAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACGGTCCTCCTTTCATGCATACTCTGTT   490
Psy1-A1k GGCGAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACGCCACTCCTT-CGTGGATACTCTGTT   489
Psy1-A1l GGCGAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACGCCACTCCTT-CGTGGATACTCTGTT   489
Psy1-A1m GGCGAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACGCCACTCCTT-CGTGGATACTCTGTT   489
Psy1-A1n GGCGAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACGCCACTCCTT-CGTGGATACTCTGTT   489

Psy1-A1a TTTCTTGAGCCATGGTGGCAGGCTGCGTGCCAAGCCGGTGTTCCGGTGATCATGGAGCTCACTCGTTCAT   559
Psy1-A1b TTTCTTGAGCCATGGTGGCAGGCTGCGTGCCAAGCCGGTGTTCCGGTGATCATGGAGCTCACTCGTTCAT   559
Psy1-A1c TTTCTTGAGCCATGGTGGCAGGCTGCGTGCCAAGCCGGTGTTCCGGTGATCATGGAGCTCACTCGTTCAT   559
Psy1-A1d TTTCTTGAGCCATGGTGGCAGGCTGCGTGCCAAGCCGGTGTTCCGGTGATCATGGAGCTCACTCGTTCAT   559
Psy1-A1e TTTCTTGAGCCATGGTGGCAGGCTGCGTGCCAAGCCGGTGTTCCGGTGATCATGGAGCTCACTCGTTCAT   559
Psy1-A1f TTTCTTGAGCCATGGTGGCAGGCTGCGTGCCAAGCCGGTGTTCCGGTGATCATGGAGCTCACTCGTTCAT   559
Psy1-A1g TTTCTTGAGCCATGGTGGCAGGCTGCGTGCCAAGCCGGTGTTCCGGTGATCATGGAGCTCACTCGTTCAT   559
Psy1-A1h TTTCTTGAGCCATGGTGGCA------------AGCCGATGTTCCGGTGATCATGGAGCTCCTTCATTCAT   547
Psy1-A1i TTTCTTGAGCCATGGTGGCA------------AGCCGATGTTCCGGTGATCATGGAGCTCCTTCATTCAT   548
Psy1-A1j TTTCTTGAGCCATGGTGGCA------------AGCCGATGTTCCGGTGATCATGGAGCTCCTTCATTCAT   548
Psy1-A1k TTTCTTGAGCCATGGTGGCAGGCTGCGTGCCAAGCCGGTGTTCCGGTGATCATGGAGCTCACTCGTTCAT   559
Psy1-A1l TTTCTTGAGCCATGGTGGCAGGCTGCGTGCCAAGCCGGTGTTCCGGTGATCATGGAGCTCACTCGTTCAT   559
Psy1-A1m TTTCTTGAGCCATGGTGGCAGGCTGCGTGCCAAGCCGGTGTTCCGGTGATCATGGAGCTCACTCGTTCAT   559
Psy1-A1n TTTCTTGAGCCATGGTGGCAGGCTGCGTGCCAAGCCGGTGTTCCGGTGATCATGGAGCTCACTCGTTCAT   559

Psy1-A1a GTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACCGAGGAGCGGCGGCGCGCCATATGGGCCATCTACG   629
Psy1-A1b GTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACCGAGGAGCGGCGGCGCGCCATATGGGCCATCTACG   629
Psy1-A1c GTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACCGAGGAGCGGCGGCGCGCCATATGGGCCATCTACG   629
Psy1-A1d GTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACCGAGGAGCGGCGGCGCGCCATATGGGCCATCTACG   629
Psy1-A1e GTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACCGAGGAGCGGCGGCGCGCCATATGGGCCATCTACG   629
Psy1-A1f GTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACCGAGGAGCGGCGGCGCGCCATATGGGCCATCTACG   629
Psy1-A1g GTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACCGAGGAGCGGCGGCGCGCCATATGGGCCATCTACG   629
Psy1-A1h GTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACCGAGGAGCGGCGGCGCGCCATATGGGCCATCTACG   617
Psy1-A1i GTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACCGAGGAGCGGCGGCGCGCCATATGGGCCATCTACG   618
Psy1-A1j GTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACCGAGGAGCGGCGGCGCGCCATATGGGCCATCTACG   618
Psy1-A1k GTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACCGAGGAGCGGCGGCGCGCCATATGGGCCATCTACG   629
Psy1-A1l GTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACCGAGGAGCGGCGGCGCGCCATATGGGCCATCTACG   629
Psy1-A1m GTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACCGAGGAGCGGCGGCGCGCCATATGGGCCATCTACG   629
Psy1-A1n GTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACCGAGGAGCGGCGGCGCGCCATATGGGCCATCTACG   629

Psy1-A1a ------------------------------------GT----AATCTGAAAATTCACCATGCCTGGTTT   658
Psy1-A1b GTAATCTGAAAATTCGCCGCCATATGGGCCATCTACGGT----AATCTGAAAATTCACCATGCCTGGTTT   695
Psy1-A1c ------------------------------------GT----AATCTGAAAATTCACCATGCCTGGTTT   658
Psy1-A1d ------------------------------------GT----AATCTGAAAATTCACCATGCCTGGTTT   658
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Fig. A1. *(Continued).*

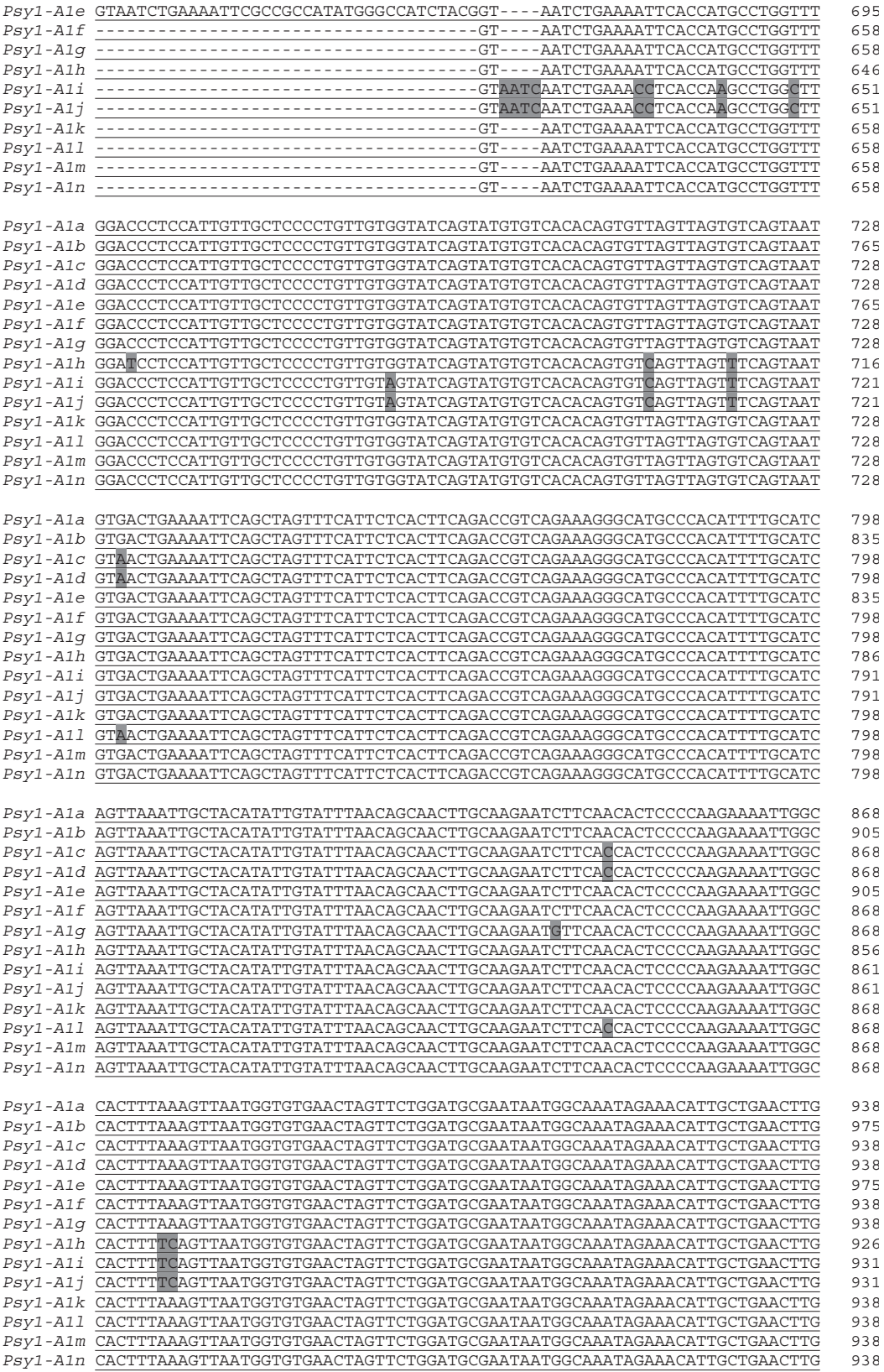

Fig. A1. *(Continued)*.

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Psy1-A1b CATGCTATGTGTTTACAGATACTCCTATATACGTAGTATAGTCAGTGAAGAATAAAGGGTTCGTATAACA 1045
Psy1-A1c CATGCTATGTGTTTACAGATACTCCTATATACGTAGTATAGTCAGTGAAGAATAAAGGGTTCGTATAACA 1008
Psy1-A1d CATGCTATGTGTTTACAGATACTCCTATATACGTAGTATAGTCAGTGAAGAATAAAGGGTTCGTATAACA 1008
Psy1-A1e CATGCTATGTGTTTACAGATACTCCTATATACGTAGTATAGTCAGTGAAGAATAAAGGGTTCGTATAACA 1045
Psy1-A1f CATGCTATGTGTTTACAGATACTCCTATATACGTAGTATAGTCAGTGAAGAATAAAGGGCTCGTATACCA 1008
Psy1-A1g CATGCTATGTGTTTACAGATACTCCTATATACGTAGTATAGTCAGTGAAGAATAAAGGGCTCGTATACCA 1008
Psy1-A1h CATGCTATGTGTTTACAGATACTCCTATATACGTAGTATAGTCAGTGAAGAATAAAGGGCTCGTATACCA  996
Psy1-A1i CATGCTATGTGTTTACAGATACTCCTATATACGTAGTATAGTCAGTGAAGAATAAAGGGCTCGTATACCA 1001
Psy1-A1j CATGCTATGTATTTACAGATACTCCTATATACGTAGTATAGTCAGTGAAGAATAAAGGGCTCGTATACCA 1001
Psy1-A1k CATGCTATGTGTTTACAGATACTCCTATATACGTAGTATAGTCAGTGAAGAATAAAGGGTTCGTATAACA 1008
Psy1-A1l CATGCTATGTGTTTACAGATACTCCTATATACGTAGTATAGTCAGTGAAGAATAAAGGGTTCGTATAACA 1008
Psy1-A1m CATGCTATGTGTTTACAGATACTCCTATATACGTAGTATAGTCAGTGAAGAATAAAGGGTTCGTATAACA 1008
Psy1-A1n CATGCTATGTGTTTACAGATACTCCTATATACGTAGTATAGTCAGTGAAGAATAAAGGGTTCGTATAACA 1008

Psy1-A1a CTTTTTTATATGCCATTATGTGTGGAAGCATCAAATTAGGCTTTTTGTTGGCTAAATGGCTTCAATAGGA 1078
Psy1-A1b CTTTTTTATATGCCATTATGTGTGGAAGCATCAAATTAGGCTTTTTGTTGGCTAAATGGCTTCAATAGGA 1115
Psy1-A1c CTTTTTTATATGCCATTATGTGTGGAAGCATCAAATTAGGCTTTTTGTTGGCTAAATGGCTTCAATAGGA 1078
Psy1-A1d CTTTTTTATATGCCATTATGTGTGGAAGCATCAAATTAGGCTTTTTGTTGGCTAAATGGCTTCAATAGGA 1078
Psy1-A1e CTTTTTTATATGCCATTATGTGTGGAAGCATCAAATTAGGCTTTTTGTTGGCTAAATGGCTTCAATAGGA 1115
Psy1-A1f CTTTTTTATATGCCATTATGTGTGGAAGCATCAAATTAGGCTTTTTTTTGGCTAAATGGCTTCAATAGGA 1078
Psy1-A1g CTTTTT-ATATGCCATTATGTGTGGAAGCATCAAATTAGGCTTTTTTTTGGCTAAATGGCTTCAATAGGA 1077
Psy1-A1h CTTTTTTATATGCCATTATGTGTGGAAGCATCAAATTAGGCTTTTTGTTGGCTAAATGGCTCCAATAGGA 1066
Psy1-A1i CTTTTTTATATGCCATTATGTGTGGAAGCATCAAATTAGGCTTTTTGTTGGCTAAATGGCTCCAATAGGA 1071
Psy1-A1j CTTTTTTATATGCCATTATGTGTGGAAGCATCAAATTAGGCTTTTTGTTGGCTAAATGGCTCCAATAGGA 1071
Psy1-A1k CTTTTTTATATGCCATTATGTGTGGAAGCATCAAATTAGGCTTTTTGTTGGCTAAATGGCTTCAATAGGA 1078
Psy1-A1l CTTTTTTATATGCCATTATGTGTGGAAGCATCAAATTAGGCTTTTTGTTGGCTAAATGGCTTCAATAGGA 1078
Psy1-A1m CTTTTTTATATGCCATTATGTGTGGAAGCATCAAATTAGGCTTTTTGTTGGCTAAATGGCTTCAATAGGA 1078
Psy1-A1n CTTTTTTATATGCCATTATGTGTGGAAGCATCAAATTAGGCTTTTTGTTGGCTAAATGGCTTCAATAGGA 1078

Psy1-A1a TCAAAGTACACGAGAAAAGGTTGCAAGAACATATTCCTCAAATTGCCTGGGGACATGAATCTGAGGGTAC 1148
Psy1-A1b TCAAAGTACACGAGAAAAGGTTGCAAGAACATATTCCTCAAATTGCCTGGGGACATGAATCTGAGGGTAC 1185
Psy1-A1c TCAAAGTACACGAGAAAAGGTTGCAAGAACATATTCCTCAAATTGCCTAAGGACATGAATCTGAGGGTAC 1148
Psy1-A1d TCAAAGTACACGAGAAAAGGTTGCAAGAACATATTCCTCAAATTGCCTAAGGACATGAATCTGAGGGTAC 1148
Psy1-A1e TCAAAGTACACGAGAAAAGGTTGCAAGAACATATTCCTCAAATTGCCTGGGGACATGAATCTGAGGGTAC 1185
Psy1-A1f TCAAAGTACACGAGAAAAGGTTGCAAGAACATATTCCTCAAATTGCCTAAGGACATGAATCTGAGAGTAC 1148
Psy1-A1g TCAAAGTACACGAGAAAAGGTTGCAAGAACATATTCCTCAAATTGCCTAAGGACATGAATCTGAGAGTAC 1147
Psy1-A1h TCAAAGTACACGAGAAAAGGTTGCAAGAACATATTCCTCAAATTGCCTAAGGACATGAATCTGAGAGTAC 1136
Psy1-A1i TCAAAGTACACGAGAAAAGGTTGCAAGAACATATTCCTCAAATTGCC-AAGGACATGAATCTGAGAGTAC 1140
Psy1-A1j TCAAAGTACACGAGAAAAGGTTGCAAGAACATATTCCTCAAATTGCCTAAGGACATGAATCTGAGAGTAC 1141
Psy1-A1k TCAAAGTACACGAGAAAAGGTTGCAAGAACATATTCCTCAAATTGCCTGGGGACATGAATCTGAGGGTAC 1148
Psy1-A1l TCAAAGTACACGAGAAAAGGTTGCAAGAACATATTCCTCAAATTGCCTAAGGACATGAATCTGAGGGTAC 1148
Psy1-A1m TCAAAGTACACGAGAAAAGGTTGCAAGAACATATTCCTCAAATTGCCTGGGGACATGAATCTGAGGGTAC 1148
Psy1-A1n TCAAAGTACACGAGAAAAGGTTGCAAGAACATATTCCTCAAATTGCCTGGGGACATGAATCTGAGGGTAC 1148

Psy1-A1a CGTCAGTTCTAAATGAGATATACTCTAGGCATCAATCACTTTCAGAATCTGATGTATAGCATCATT-GTT 1217
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Psy1-A1c CGTCAGTTCTAAATGAGATATACTCTAGGCATCAATCACTTTCAGAATCTGATGTATAGCATCATT-GTT 1217
Psy1-A1d CGTCAGTTCTAAATGAGATATACTCTAGGCATCAATCACTTTCAGAATCTGATGTATAGCATCATT-GTT 1217
Psy1-A1e CGTCAGTTCTAAATGAGATATACTCTAGGCATCAATCACTTTCAGAATCTGATGTATAGCATCATT-GTT 1254
Psy1-A1f CGTCAGTTCTAAATGAGATATACTCTAGGCATCAATCACTTTCAGAATCTGATGTATAGCATCATT-GTT 1217
Psy1-A1g CGTCAGTTCTAAATGAGATATACTCTAGGCATCAATCACTTTCAGAATCTGATGTATAGCATCATT-GTT 1216
Psy1-A1h TGTCAGTTCTAAATGAGATATACTCTAGGCATCAATCACTTTCAGAATCTGATGTATAGCATCATT-GTT 1205
Psy1-A1i TGTCAGTTCTAAATGAGATATACTCTAGGCATCAATCACTTTCAGAATCTGATGTACAGCATCGTTTGTG 1210
Psy1-A1j TGTCAGTTCTAAATGAGATATACTCTAGGCATCAATCACTTTCAGAATCTGATGTATAGCATCATT-GTT 1210
Psy1-A1k CGTCAGTTCTAAATGAGATATACTCTAGGCATCAATCACTTTCAGAATCTGATGTATAGCATCATT-GTT 1217
Psy1-A1l CGTCAGTTCTAAATGAGATATACTCTAGGCATCAATCACTTTCAGAATCTGATGTATAGCATCATT-GTT 1217
Psy1-A1m CGTCAGTTCTAAATGAGATATACTCTAGGCATCAATCACTTTCAGAATCTGATGTATAGCATCATT-GTT 1217
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Psy1-A1a CAGTATGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAACGCGTCGCACATCACGCCGCAGGCGCT 1287
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Psy1-A1c CAGTATGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAACGCGTCGCACATCACGCCGCAGGCGCT 1287
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Psy1-A1j CAGTATGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAACGCGTCGCACATCACGCCGCAGGCGCT 1280
Psy1-A1k CAGTATGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAACGCGTCGCACATCACGCCGCAGGCGCT 1287
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Fig. A1. *(Continued)*.

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Psy1-A1m CAGTATGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAACGCGTCGCACATCACGCCGCAGGCGCT  1287
Psy1-A1n CAGTATGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAACGCGTCGCACATCACGCCGCAGGCGCT  1287

Psy1-A1a GGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTC  1357
Psy1-A1b GGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTC  1394
Psy1-A1c GGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTC  1357
Psy1-A1d GGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTC  1357
Psy1-A1e GGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTC  1394
Psy1-A1f GGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTC  1357
Psy1-A1g GGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTC  1356
Psy1-A1h GGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTC  1345
Psy1-A1i GGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTC  1350
Psy1-A1j GGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTC  1350
Psy1-A1k GGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTC  1357
Psy1-A1l GGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTC  1357
Psy1-A1m GGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTC  1357
Psy1-A1n GGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTC  1357

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Psy1-A1b TCTGACACCATCACCAAGTTCCCCATAGATATTCAGGTATCAGCTTAGCCGGTGCATAATTGTTCAGTCC  1464
Psy1-A1c TCTGACACCATCACCAAGTTCCCCATAGATATTCAGGTATCAGCTTAGCCGGTGCATAATTGTTCAGTCC  1427
Psy1-A1d TCTGACACCATCACCAAGTTCCCCATAGATATTCAGGTATCAGCTTAGCCGGTGCATAATTGTTCAGTCC  1427
Psy1-A1e TCTGACACCATCACCAAGTTCCCCATAGATATTCAGGTATCAGCTTAGCCGGTGCATAATTGTTCAGTCC  1464
Psy1-A1f TCTGACACCATCACCAAGTTCCCCATAGATATTCAGGTATCAGCTTAGCCGGTGCATAATTGTTCAGTCC  1427
Psy1-A1g TCTGACACCATCACCAAGTTCCCCATAGATATTCAGGTATCAGCTTAGCCGGTGCATAATTGTTCAGTCC  1426
Psy1-A1h TCCGACACCATCACCAAGTTCCCCATAGATATTCAGGTACCAGCTC-GCCGGTGCATAATTGTTCAGTCC  1414
Psy1-A1i TCTGACACCATCACCAAGTTCCCCATAGATATTCAGGTATCAGCTTAGCCGGTGCATAATTGTTCAGTCC  1420
Psy1-A1j TCCGACACCATCACCAAGTTCCCCATAGATATTCAGGTACCAGCTC-GCCGGTGCATAATTGTTCAGTCC  1419
Psy1-A1k TCTGACACCATCACCAAGTTCCCCATAGATATTCAGGTATCAGCTTAGCCGGTGCATAATTGTTCAGTCC  1427
Psy1-A1l TCTGACACCATCACCAAGTTCCCCATAGATATTCAGGTATCAGCTTAGCCGGTGCATAATTGTTCAGTCC  1427
Psy1-A1m TCTGACACCATCACCAAGTTCCCCATAGATATTCAGGTATCAGCTTAGCCGGTGCATAATTGTTCAGTCC  1427
Psy1-A1n TCTGACACCATCACCAAGTTCCCCATAGATATTCAGGTATCAGCTTAGCCGGTGCATAATTGTTCAGTCC  1427

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Psy1-A1b ACATTGTATGATTCTGGTAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATCAAATTGCCCCTAGACC  1534
Psy1-A1c ACATTGTATGATTCTGGTAGAACAGAGCGGTGGTGGATATTCCCTGTCAGCATCAGATTGCCCCTAGACC  1497
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Psy1-A1f ACATTGTATGATTCTGGTAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATCAAATTGCCCCTAGACC  1497
Psy1-A1g ACATTGTATGATTCTGGTAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATCAAATTGCCCCTAGACC  1496
Psy1-A1h ACATTGTATGATTCCGGTAGAACAGAGTGGTAGTGGATATTCCCTGTCAGCATCAGATT-CCCCCAGACC  1483
Psy1-A1i ACATTGTCTGATTCTGGTAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATCAGATT-CCCCCAGACC  1489
Psy1-A1j ACATTGTATGATTCCGGTAGAACAGAGTGGTAGTGGATATTCCCTGTCAGCATCAGATT-CCCCCAGACC  1488
Psy1-A1k ACATTGTATGATTCTGGTAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATCAAATTGCCCCTAGACC  1497
Psy1-A1l ACATTGTATGATTCTGGTAGAACAGAGCGGTGGTGGATATTCCCTGTCAGCATCAGATTGCCCCTAGACC  1497
Psy1-A1m ACATTGTATGATTCTGGTAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATCAAATTGCCCCTAGACC  1497
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Psy1-A1b TCACAATCTCAGTGCAAGATGAC----------------------CGGAAAGTCGATGATTG-GTCAAAA  1581
Psy1-A1c TCACAATCTAAGTGCAAGATGAC----------------------CAGAAAGTCGATGATTG-GTCAAAA  1544
Psy1-A1d TCACAATCTAAGTGCAAGATGAC----------------------CAGAAAGTCGATGATTG-GTCAAAA  1544
Psy1-A1e TCACAATCTCAGTGCAAGATGAC----------------------CGGAAAGTCGATGATTG-GTCAAAA  1581
Psy1-A1f TCACAATCTCAGTGCAAGATGAC----------------------CGGAAAGTCGATGATTG-GTCAAAA  1544
Psy1-A1g TCACAATCTCAGTGCAAGATGAC----------------------CGGAAAGTCGATGATTG-GTCAAAA  1543
Psy1-A1h TCACAATCTCAGTGCAAGATGACTAGCTAGGCCTTCTAAGTTGACCAGAAAGTCGATGATTTTGTCAAAA  1553
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Psy1-A1k TCACAATCTCAGTGCAAGATGAC----------------------CGGAAAGTCGATGATTG-GTCAAAA  1544
Psy1-A1l TCACAATCTAAGTGCAAGATGAC----------------------CAGAAAGTCGATGATTG-GTCAAAA  1544
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Psy1-A1f TTGTTTCGTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTGTTGAGCCGTATGAACTTTTCACACATTG  1614
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Fig. A1. *(Continued)*.

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Psy1-A1j TTATTTCGTTTGTCGGCCTTTTATTAGTCTCTGATGCTGTAATTGAGCTGTATGAACTTTTCACACATTG  1628
Psy1-A1k TTGTTTCGTTTGTCGGCCTTTGGTTAGTCTCTGATGCTGTTGTTGAGCCGTATGAACTTTTCACACATTG  1614
Psy1-A1l TTGTTTCGTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTGTTGAGCCGTATGAACTTTTCACACATTG  1614
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Psy1-A1b TAGTGGGGGCTTATCCTGTTGACTAGACGCTATAGTGGGAATCGTCTGGTCAAAGATATGTTTAATCAAA  1721
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Psy1-A1g TAGTGGGGACTTATCCTGTTGACTAGACGCTATAGTGGGAATCATCTGGTCAAAGATATGTTTAATCAAA  1683
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Psy1-A1i TAGTGGGGGCTTATCCAGTTGACTAGACG-TATAGTGGGAATCATCTGGTAAAAGATATGTTTAATCAAT  1698
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Psy1-A1m GTGGGGAAATTATAAGGAGAACTTTTCAGTAAGTATTATTCCCGAGCATACCTAGAACAAACAGGAACTT  1754
Psy1-A1n GTGGGGAAATTATAGGGAGAACTTTTCAGTAAGTATTATTCCCGAGCATACCTAGAACAAACAGGAACTT  1754

Psy1-A1a GGAAATGATGTAGAAGGAGAAATGAAATCAGGGAGAGTCCAAGTAACTCCAGACCTGAATTATACATCAT  1824
Psy1-A1b GGAAATGATGTAGAAGGAGAAATGAAATCAGGGAGAGTCCAAGTAACTCCAGACCTGAATTATACATCAT  1861
Psy1-A1c GGAAATGATGTAGAAGGAGAAATGAAATCAGGGAGAGTCCAAGTAACTCCAGACCTGAATTATACATCAT  1824
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Psy1-A1e GGAAATGATGTAGAAGGAGAAATGAAATCAGGGAGAGTCCAAGTAACTCCAGACCTGAATTATACATCAT  1861
Psy1-A1f GGAA-TGATGTAGAAGGAGAAATGAAATCAGGGAGAGTCCAAGTAACTCCAGACCTGAATTATACATCAT  1823
Psy1-A1g GGAA-TGATGTAGAAGGAGAAATGAAATCAGGGAGAGTCCAAGTAACTCCAGACCTGAATTATACATCAT  1822
Psy1-A1h ---------------------------------------------------------------------  1730
Psy1-A1i ---------------------------------------------------------------------  1736
Psy1-A1j ---------------------------------------------------------------------  1735
Psy1-A1k GGAAATGATGTAGAAGGAGAAATGAAATCAGGGAGAGTCCAAGTAACTCCAGACCTGAATTATACATCAT  1824
Psy1-A1l GGAAATGATGTAGAAGGAGAAATGAAATCAGGGAGAGTCCAAGTAACTCCAGACCTGAATTATACATCAT  1824
Psy1-A1m GGAAATGATGTAGAAGGAGAAATGAAATCAGGGAGAGTCCAAGTAACTCCAGACCTGAATTATACATCAT  1824
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Psy1-A1h ---------------------------------------------------------------------  1730
Psy1-A1i ---------------------------------------------------------------------  1736
Psy1-A1j ---------------------------------------------------------------------  1735
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Psy1-A1l GAAAATGTACTTGGTCACTCTTTTTTACTGGGCTTTGTGGTTTTCGGCCTAATTTCCCATATAAACCGCG  1894
Psy1-A1m GAAAATGTACCTGGTCACTCTTTTTTACTGGGCTTTGTGGTTTTCGGCCTAATTTCCCATATAAACCGCG  1894
Psy1-A1n GAAAATGTACCTGGTCACTCTTTTTTACTGGGCTTTGTGGTTTTCGGCCTAATTTCCCATATAAACCGCG  1894

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Fig. A1. *(Continued)*.

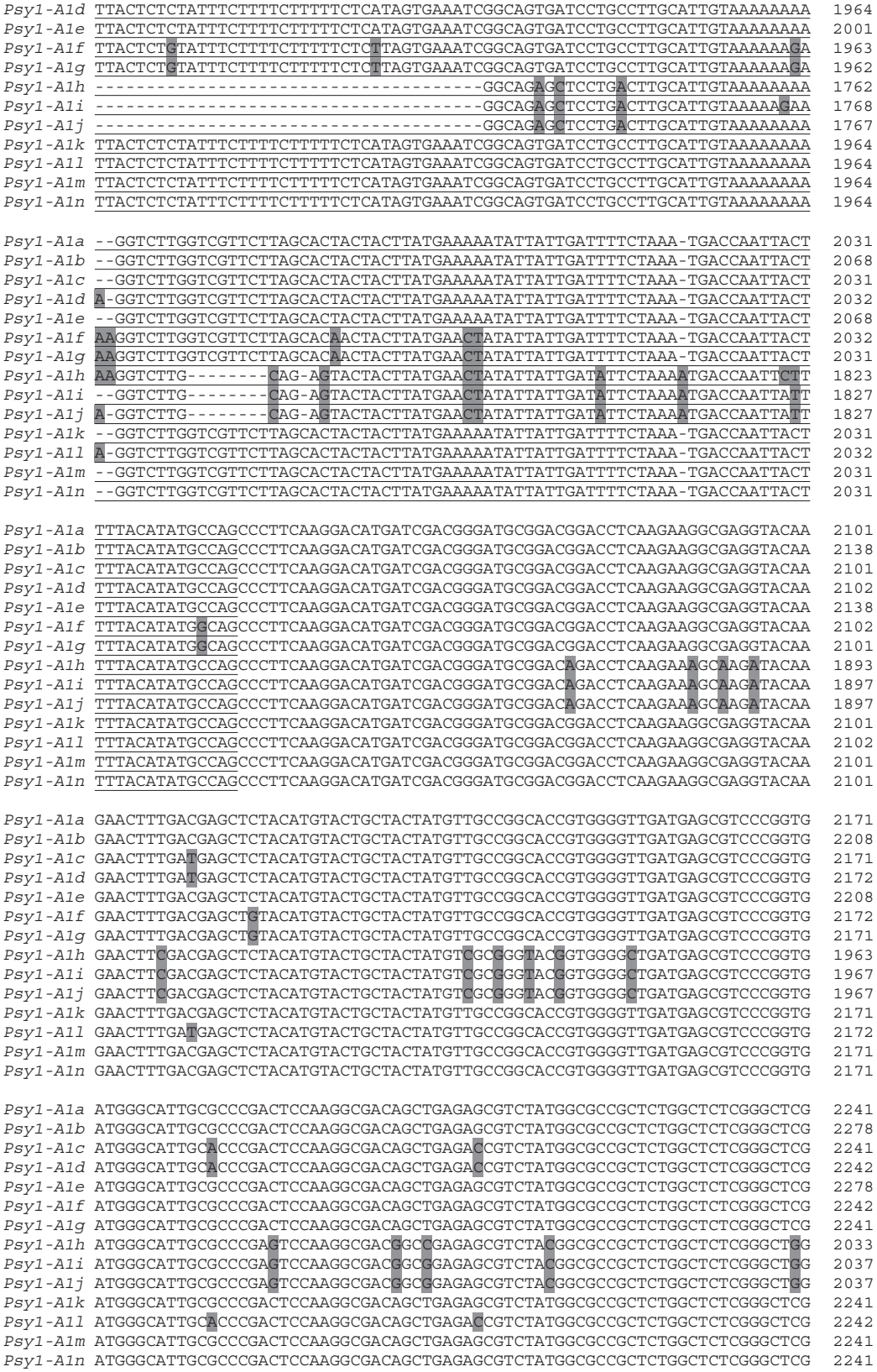

Fig. A1. *(Continued)*.

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Psy1-A1c CGAACCAGCTCACCAACATACTCAGGGATGTCGGAGAAGAGTAAGCCACTCACTCACTACCAATACAATG 2311
Psy1-A1d CGAACCAGCTCACCAACATACTCAGGGATGTCGGAGAAGAGTAAGCCACTCACTCACTACCAATACAATG 2312
Psy1-A1e CGAACCAGCTCACCAACATACTCAGGGATGTCGGAGAAGAGTAAGCCACTCACTCACTACCAATACAATG 2348
Psy1-A1f CGAACCAGCTCACCAACATACTCAGGGATGTCGGAGAAGAGTAAGCCACTCACTCACTACCAATACAATG 2312
Psy1-A1g CGAACCAGCTCACCAACATACTCAGGGATGTCGGAGAAGAGTAAGCCACTCACTCACTACCAATACAATG 2311
Psy1-A1h CGAACCAGCTCACCAACATACTCAGGGATGTTGGAGAAGAGTAAGCCACCCACTGATTACAACTAAAATG 2103
Psy1-A1i CGAACCAGCTCACCAACATACTCAGGGATGTTGGAGAAGAGTAAGCCACCCACTGATTACAACTAAAATG 2107
Psy1-A1j CGAACCAGCTCACCAACATACTCAGGGATGTTGGAGAAGAGTAAGCCACCCACTGATTACAACTAAAATG 2107
Psy1-A1k CGAACCAGCTCACCAACATACTCAGGGATGTCGGAGAAGAGTAAGCCACTCACTCACTACCAATACAATG 2311
Psy1-A1l CGAACCAGCTCACCAACATACTCAGGGATGTCGGAGAAGAGTAAGCCACTCACTCACTACCAATACAATG 2312
Psy1-A1m CGAACCAGCTCACCAACATACTCAGGGATGTCGGAGAAGAGTAAGCCACTCACTCACTACCAATACAATG 2311
Psy1-A1n CGAACCAGCTCACCAACATACTCAGGGATGTCGGAGAAGAGTAAGCCACTCACTCACTACCAATACAATG 2311

Psy1-A1a CAATAGTTTTCCCTTG-TAAAATCATTTTTTTTTAGAAAAGGAGCATGACCCCCGGCCTCTGCATCTGAGA 2380
Psy1-A1b CAATAGTTTTCCCTTG-TAAAATCATTTTTTTTTAGAAAAGGAGCATGACCCCCGGCCTCTGCATCTGAGA 2417
Psy1-A1c CAATGGTTTTCCCTTG-TAAAATCAT---------------------------------------------- 2336
Psy1-A1d CAATGGTTTTCCCTTG-TAAAATCAT---------------------------------------------- 2337
Psy1-A1e CAATAGTTTTCCCTTG-TAAAATCATTTTTTTTTAGAAAAGGAGCATGACCCCCGGCCTCTGCATCTGAGA 2417
Psy1-A1f CAATGGTTTTCCCTTG-TAAAATCAT---------------------------------------------- 2337
Psy1-A1g CAATGGTTTTCCCTTG-TAAAATCAT---------------------------------------------- 2336
Psy1-A1h CAACGGTTTTCCCTTCCTAAGAACAGT------------------------------------------- 2130
Psy1-A1i CAACGGTTTTCCCTTCCTAAGAACAGT------------------------------------------- 2134
Psy1-A1j CAACGGTTTTCCCTTCCTAAGAACAGT------------------------------------------- 2134
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Psy1-A1m CAATAGTTTTCCCTTG-TAAAATCATTTTTTTTTAGAAAAGGAGCATGACCCCCGGCCTCTGCATCTGAGA 2380
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Psy1-A1c ------------------------------------------------------------------- 2336
Psy1-A1d ------------------------------------------------------------------- 2337
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Psy1-A1f ------------------------------------------------------------------- 2337
Psy1-A1g ------------------------------------------------------------------- 2336
Psy1-A1h ------------------------------------------------------------------- 2130
Psy1-A1i ------------------------------------------------------------------- 2134
Psy1-A1j ------------------------------------------------------------------- 2134
Psy1-A1k GATGCATACGGCCACTTTATTGATTATTCTCAGGACCTTACAAAGTATTACAACAATGAGCCTGAATCCA 2450
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Psy1-A1f ------------------------------------------------------------------- 2337
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Psy1-A1i ------------------------------------------------------------------- 2134
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Fig. A1. *(Continued)*.

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Psy1-A1c ------------------------------------------------------------------- 2336
Psy1-A1d ------------------------------------------------------------------- 2337
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Psy1-A1f ------------------------------------------------------------------- 2337
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Psy1-A1i ------------------------------------------------------------------- 2134
Psy1-A1j ------------------------------------------------------------------- 2134
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Psy1-A1d ------------------------------------------------------------------- 2337
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Psy1-A1f ------------------------------------------------------------------- 2337
Psy1-A1g ------------------------------------------------------------------- 2336
Psy1-A1h ------------------------------------------------------------------- 2130
Psy1-A1i ------------------------------------------------------------------- 2134
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Psy1-A1k CAGATCATATTGAGGCTTCTACCTTGTCTGGCCACTCTACCATCGACGTCACCATGACGCCAGACAGCAA 2730
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Psy1-A1f ------------------------------------------------------------------- 2337
Psy1-A1g ------------------------------------------------------------------- 2336
Psy1-A1h ------------------------------------------------------------------- 2130
Psy1-A1i ------------------------------------------------------------------- 2134
Psy1-A1j ------------------------------------------------------------------- 2134
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Psy1-A1d ------------------------------------------------------------------- 2337
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Psy1-A1f ------------------------------------------------------------------- 2337
Psy1-A1g ------------------------------------------------------------------- 2336
Psy1-A1h ------------------------------------------------------------------- 2130
Psy1-A1i ------------------------------------------------------------------- 2134
Psy1-A1j ------------------------------------------------------------------- 2134
Psy1-A1k GCCGCCATCAATGAGTGAGATGAAGTACCGCTCCACCACGGCATGTACAAGGTGACGAAGGGCGAGGTCC 2870
Psy1-A1l ------------------------------------------------------------------- 2337
Psy1-A1m GCCGCCATCAATGAGTGAGATGAAGTACCGCTCCACCACGGCATGTACAAGGTGACGAAGGGCGAGGTCC 2870
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Psy1-A1c ------------------------------------------------------------------- 2336
Psy1-A1d ------------------------------------------------------------------- 2337
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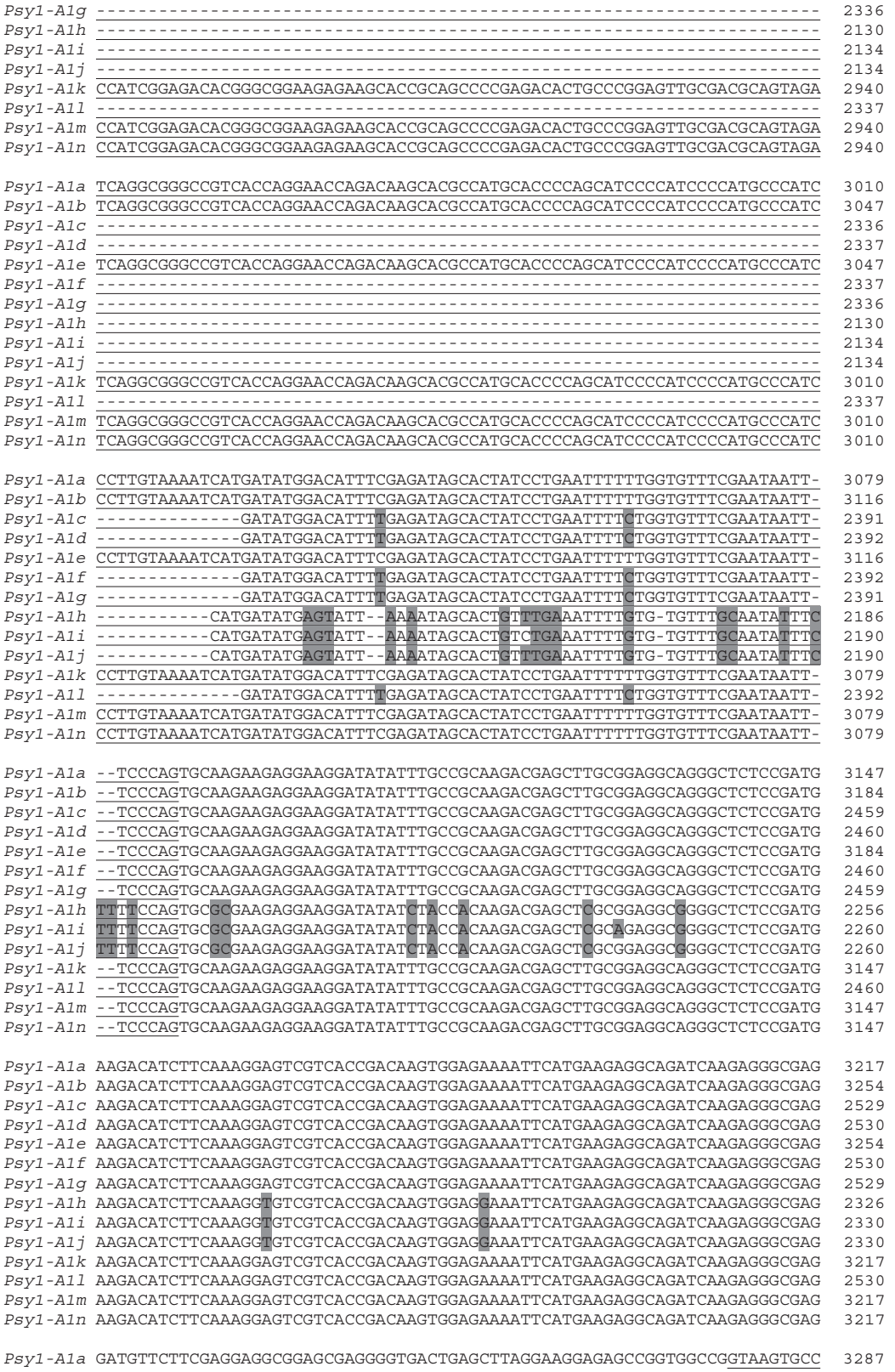
Fig. A1. *(Continued)*.



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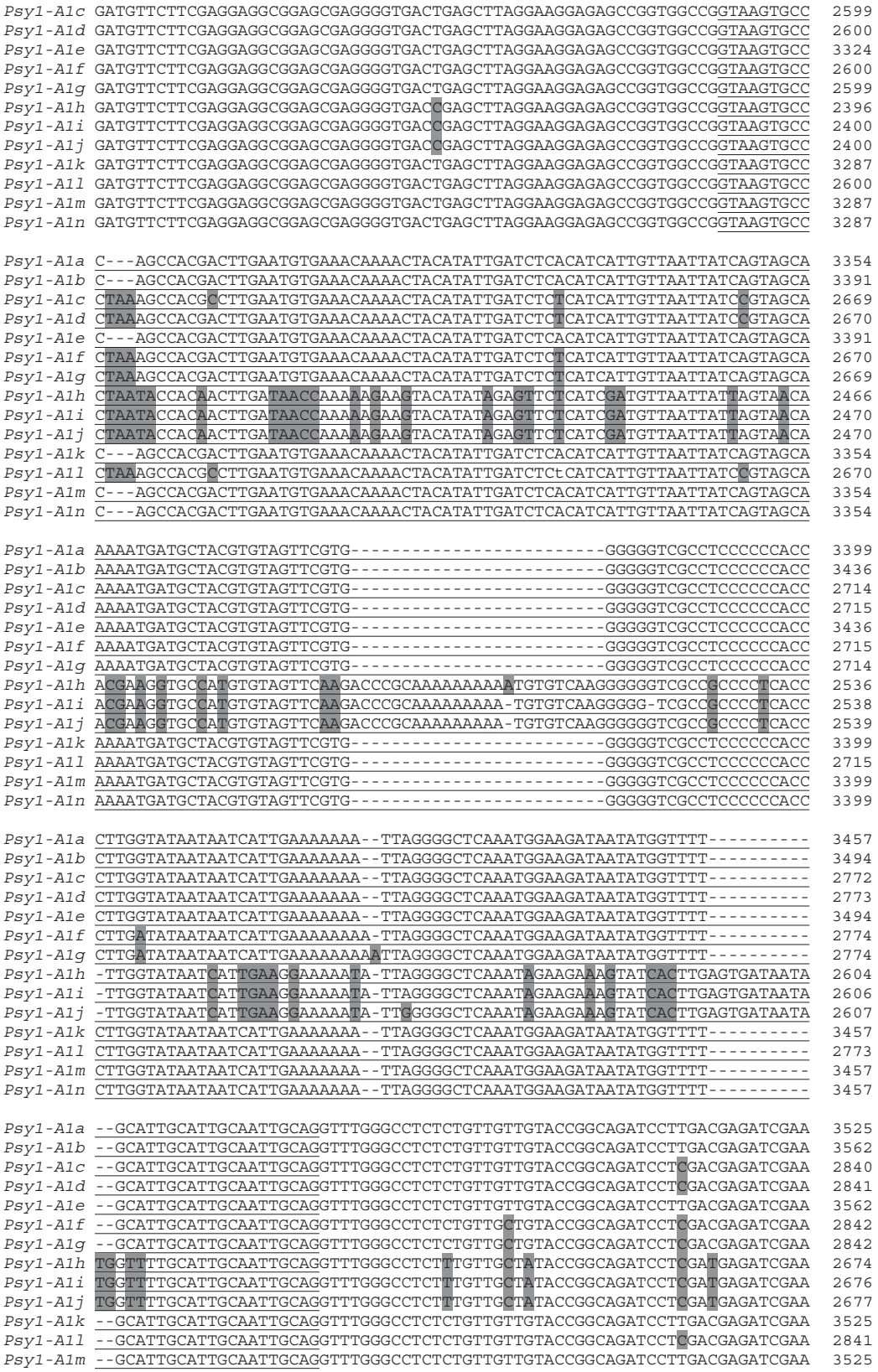

Fig. A1. *(Continued)*.

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Psy1-A1b GCGAATGACTACAACAACTTCACCAAGAGGGCCTATGTTGGGAAGGCGAAAAAGGTGCTTGCGCTCCCTG  3632
Psy1-A1c GCGAATGACTACAACAACTTCACCAAGAGGGCCTATGTTGGGAAGGCGAAAAAGGTGCTTGCGCTGCCTG  2910
Psy1-A1d GCGAATGACTACAACAACTTCACCAAGAGGGCCTATGTTGGGAAGGCGAAAAAGGTGCTTGCGCTGCCTG  2911
Psy1-A1e GCGAATGACTACAACAACTTCACCAAGAGGGCCTATGTTGGGAAGGCGAAAAAGGTGCTTGCGCTCCCTG  3632
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Psy1-A1g GCGAATGACTACAACAACTTCACCAAGAGGGCCTATGTTGGGAAGGCGAAAAAGGTGCTTGCGCTCCCTG  2912
Psy1-A1h GCGAACGACTACAACAACTTCACCAAGAGGGCCTATGTTGGGAAGGCGAAGAAGGTGCTGGCGCTCCCTG  2744
Psy1-A1i GCGAACGACTACAACAACTTCACCAAGAGGGCCTATGTTGGGAAGGCGAAGAAGGTGCTGGCGCTCCCTG  2746
Psy1-A1j GCGAACGACTACAACAACTTCACCAAGAGGGCCTATGTTGGGAAGGCGAAGAAGGTGCTGGCGCTCCCTG  2747
Psy1-A1k GCGAATGACTACAACAACTTCACCAAGAGGGCCTATGTTGGGAAGGCGAAAAAGGTGCTTGCGCTCCCTG  3595
Psy1-A1l GCGAATGACTACAACAACTTCACCAAGAGGGCCTATGTTGGGAAGGCGAAAAAGGTGCTTGCGCTGCCTG  2911
Psy1-A1m GCGAATGACTACAACAACTTCACCAAGAGGGCCTATGTTGGGAAGGCGAAAAAGGTGCTTGCGCTCCCTG  3595
Psy1-A1n GCGAATGACTACAACAACTTCACCAAGAGGGCCTATGTTGGGAAGGCGAAAAAGGTGCTTGCGCTCCCTG  3595

Psy1-A1a TCGCGTACGGGAGATCGCTGCTCTTACCGTATTCACTGAGAAATAACCAGACCTAG               3651
Psy1-A1b TCGCGTACGGGAGATCGCTGCTCTTACCGTATTCACTGAGAAATAACCAGACCTAG               3688
Psy1-A1c TCGCGTACGGGAGATCGCTGCTCTTACCGTATTCACTGAGAAATAACCAGACCTAG               2966
Psy1-A1d TCGCGTACGGGAGATCGCTGCTCTTACCGTATTCACTGAGAAATAACCAGACCTAG               2967
Psy1-A1e TCGCGTACGGGAGATCGCTGCTCTTACCGTATTCACTGAGAAATAACCAGACCTAG               3688
Psy1-A1f TCGCGTATGGGAGATCGCTGCTCTTACCGTATTCACTGAGAAATAACCAGACCTAG               2968
Psy1-A1g TCGCGTATGGGAGATCGCTGCTCTTACCGTATTCACTGAGAAATAACCAGACCTAG               2968
Psy1-A1h TCGCGTACGGGAGATCGCTGCTCTTACCGTATTCACTGAGAAATAACCAGACCTAG               2800
Psy1-A1i TCGCGTACGGAAGATCGCTGCTCTTACCGTATTCACTGAGAAATAACCAGACCTAG               2802
Psy1-A1j TCGCGTACGGGAGATCGCTGCTCTTACCGTATTCACTGAGAAATAACCAGACCTAG               2803
Psy1-A1k TCGCGTACGGGAGATCGCTGCTCTTACCGTATTCACTGAGAAATAACCAGACCTAG               3651
Psy1-A1l TCGCGTACGGGAGATCGCTGCTCTTACCGTATTCACTGAGAAATAACCAGACCTAG               2967
Psy1-A1m TCGCGTACGGGAGATCGCTGCTCTTACCGTATTCACTGAGAAATAACCAGACCTAG               3651
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Fig. A1. *(Continued)*.

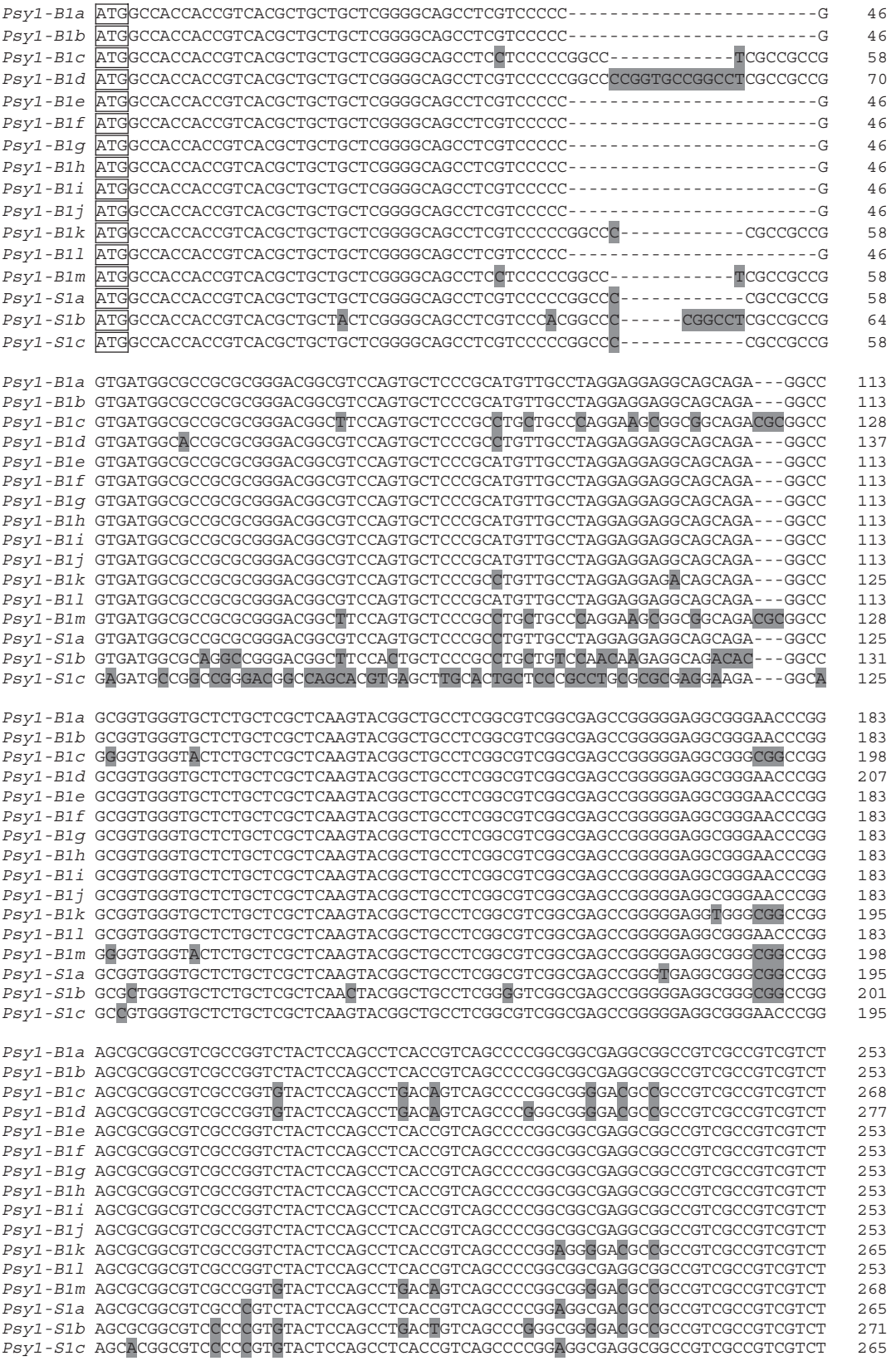

Fig. A2. Alignment of the alleles at Psy1-B1/Psy1-S1 locus. The Stowaway element sequences are in italic.

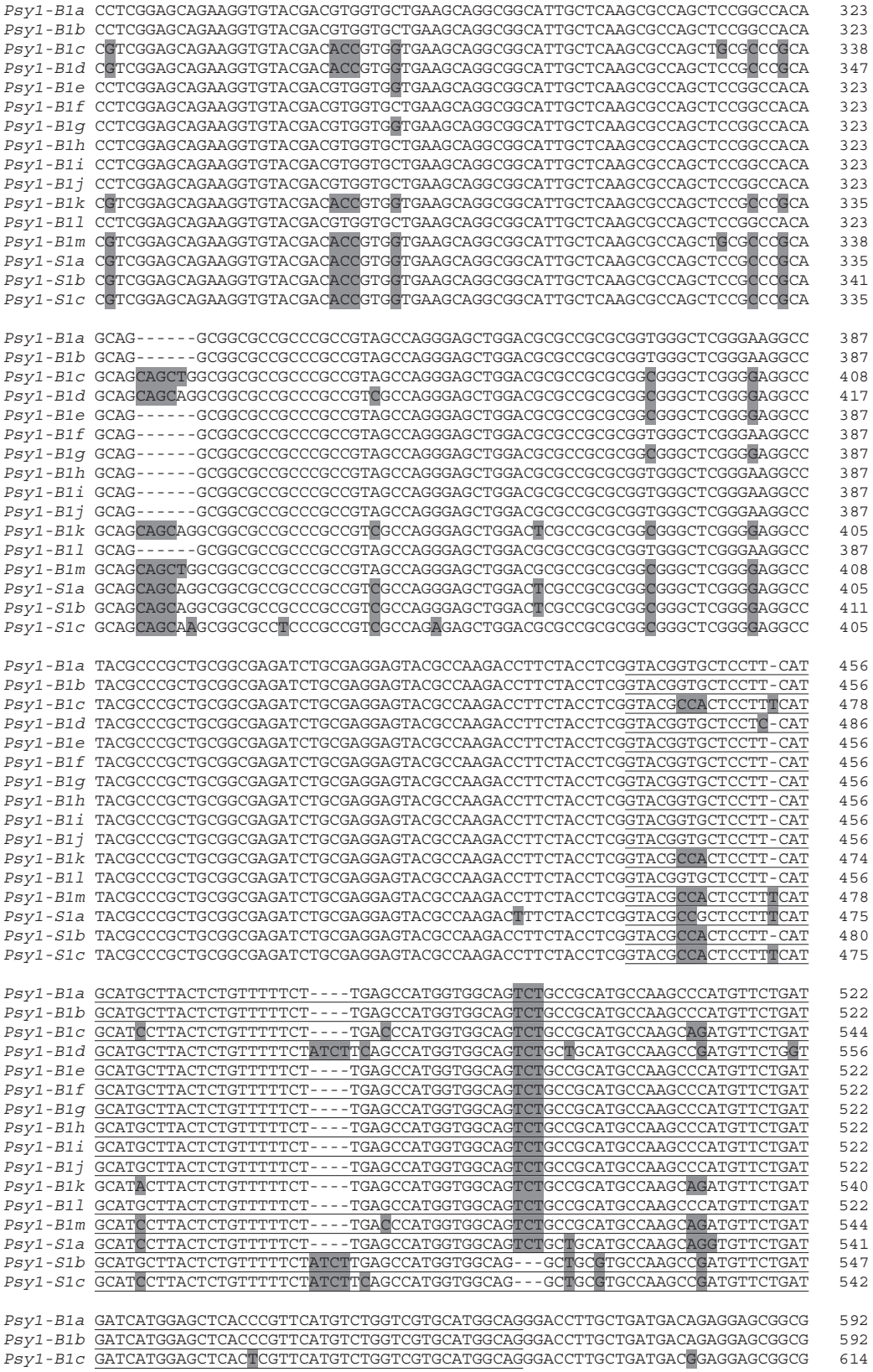

Fig. A2. *(Continued).*

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Psy1-B1f GATCATGGAGCTCACCCGTTCATGTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACAGAGGAGCGGCG   592
Psy1-B1g GATCATGGAGCTCACCCGTTCATGTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACAGAGGAGCGGCG   592
Psy1-B1h GATCATGGAGCTCACCCGTTCATGTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACAGAGGAGCGGCG   592
Psy1-B1i GATCATGGAGCTCACCCGTTCATGTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACAGAGGAGCGGCG   592
Psy1-B1j GATCATGGAGCTCACCCGTTCATGTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACAGAGGAGCGGCG   592
Psy1-B1k GATCATGGAGCTCACCCGTTCATGTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACGGAGGAGCGGCG   610
Psy1-B1l GATCATGGAGCTCACCCGTTCATGTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACAGAGGAGCGGCG   592
Psy1-B1m GATCATGGAGCTCACTCGTTCATGTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACGGAGGAGCGGCG   614
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Psy1-S1b GATCATCGAGCTCACCCGTTCATGTCTGGTCGTGAATGGCAGGGACCTTGCTGATGACGGAGGAGCGGCG   617
Psy1-S1c GATCATGGAGCTCACCCGTTCATGTCTGGTCGTGCATGGCAGGGACCTTGCTCATGACGGAGGAGCGGCG   612

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Psy1-B1c GCGCGCCATATGGGCCATCTACGGTAATCAATCTGAAACCTCACCATGCCTGGCTTGGACCCTCAATTGT   684
Psy1-B1d GCGCGCCATATGGGCCATCTACGGTAATC----TGAAACCTCACCATACCAGGCTTCGACCTTCCATTGT   692
Psy1-B1e GCGCGCCATATGGGCCATCTACGGTAATCAATCTGAAACCTCACCATGCCTGGCTTGGACCCTCCATTGT   662
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Psy1-B1g GCGCGCCATATGGGCCATCTACGGTAATCAATCTGAAACCTCACCATGCCTGGCTTGGACCCTCCATTGT   662
Psy1-B1h ACGCGCCATATGGGCCATCTACGGTAATCAATCTGAAACCTCACCATGCCTGGCTTGGACCCTCCATTGT   662
Psy1-B1i ACGCGCCATATGGGCCATCTACGGTAATCAATCTGAAACCTCACCATGCCTGGCTTGGACCCTCCATTGT   662
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Psy1-B1l ACGCGCCATATGGGCCATCTACGGTAATCAATCTGAAACCTCACCATGCCTGGCTTGGACCCTCCATTGT   662
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Psy1-B1c TGCTCCCCTGTTCTAGTGTCAGTATGTGTCACACAGT--------GTCAGTTAGTTTCAGTAATGTGACT   746
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Psy1-B1e TGCTCCCCTGCTGTAGTATCAGTATGTGTCACACAGT--------GTCAGTTAGTTTCAGTAATGTGACT   724
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Psy1-B1i TGCTCCCCTGCTGTAGTATCAGTATGTGTCACACAGT--------GTCAGTTAGTTTCAGTAATGTGACT   724
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Psy1-S1a TGCTCCCCTGTTGCAGTATCAGTATGTGTCA------------------GTTAGTTTCAGTAATGTGACT   733
Psy1-S1b TGCTCCCCTGTTGCAGTATCAGTATGTGTCACACAGT--------GTCAGTTAGTTTCAGTAATGTGACT   744
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Psy1-B1e GAAAATGGAGCTAGTTTCATTTTCACTTCAGATCGTCAGAAAGGGCATGCCCACATTTTGCATCAGTTAA   794
Psy1-B1f GAAAATGGAGCTAGTTTCATTTTCACTTCAGATCGTCAGAAAGGGCATGCCCACATTTTGCATCAGTTAA   794
Psy1-B1g GAAAATGGAGCTAGTTTCATTTTCACTTCAGATCGTCAGAAAGGGCATGCCCACATTTTGCATCAGTTAA   794
Psy1-B1h GAAAATGGAGCTAGTTTCATTTTCACTTCAGATCGTCAGAAAGGGCATGCCCACATTTTGCATCAGTTAA   794
Psy1-B1i GAAAATGGAGCTAGTTTCATTTTCACTTCAGATCGTCAGAAAGGGCATGCCCACATTTTGCATCAGTTAA   794
Psy1-B1j GAAAATGGAGCTAGTTTCATTTTCACTTCAGATCGTCAGAAAGGGCATGCCCACATTTTGCATCAGTTAA   794
Psy1-B1k GAAAATTGAACTAGTTTCACATTCATTTCAGATCGTCAGAAAGGGCATGCCCACATTTTGCATCAGTTAA   802
Psy1-B1l GAAAATGGAGCTAGTTTCATTTTCACTTCAGATCGTCAGAAAGGGCATGCCCACATTTTGCATCAGTTAA   794
Psy1-B1m GAA------------TTCATTTTCACTTCAGATCGTCAGAAAGGGCATGCCCACATTTTGCATCAGTTAA   804
Psy1-S1a GAAAATTGAACTAGTTTCATATTCATTTCAGATCCTCAGAAAGGGCATGCCCACATTTTGCATCAGTTAA   803
Psy1-S1b GAAAATGGAGCTAGTTTCAGTTTCACTTCAGATCGTCAGAAAGGGCATGCCCAAATTTTGCATCAGTTAA   814
Psy1-S1c GAA------------TTCATTTTCACTTCAGACCGTCAGAAAGGGCATGCCCACATTTTGCATCAGTTAA   788

Psy1-B1a ATTGCTACATATTGTATTTAACAGCAACTTGCAAGAAT-CTTTGACACTCCCCAAGATTATTGGCCACTT   863
Psy1-B1b ATTGCTACATATTGTATTTAACAGCAACTTGCAAGAAT-CTTTGACACTCCCCAAGATTATTGGCCACTT   863
Psy1-B1c ATTGCTGCATA-----TTTAACAGCAACTTGCAAGAATATTTTGAAACTCCCCAAGAAAATCGGCCACTT   869
Psy1-B1d ATTGCTACATA-----TTTAACAGCAACTTGCAAGAATATTTTGAAACTCCCCAAGAAATCGGCCACTT   897
Psy1-B1e ATTGCTACATATTGTATTTAACAGCAACTTGCAAGAAT-CTTTGACACTCCCCAAGATTATTGGCCACTT   863
Psy1-B1f ATTGCTACATATTGTATTTAACAGCAACTTGCAAGAAT-CTTTGACACTCCCCAAGATTATTGGCCACTT   863
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Fig. A2. *(Continued)*.

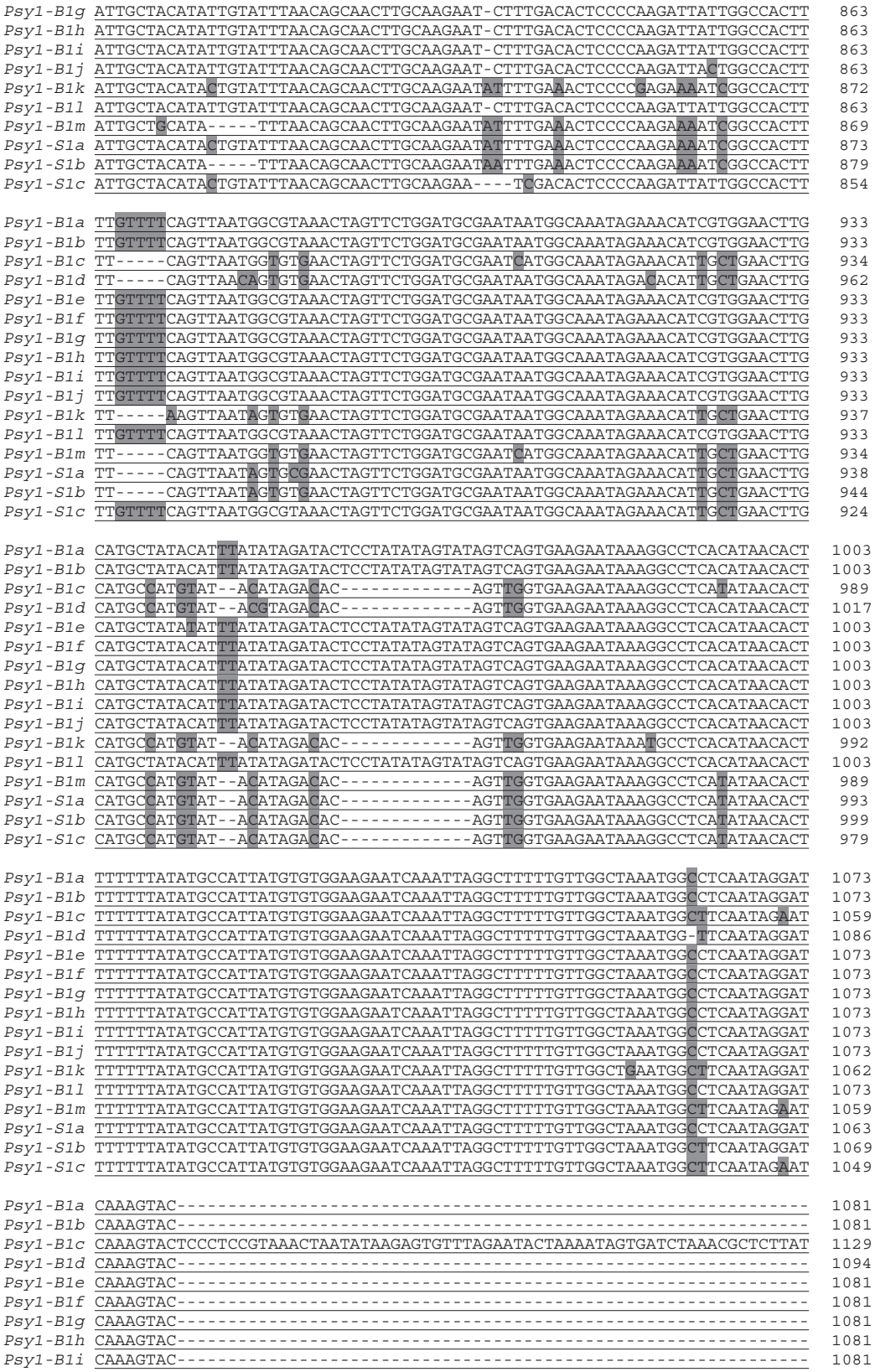

Fig. A2. *(Continued).*

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Psy1-B1j CAAAGTAC----------                                                    1081
Psy1-B1k CAAAGTAC----------                                                    1070
Psy1-B1l CAAAGTAC----------                                                    1081
Psy1-B1m CAAAGTACTCCCTCCGTAAACTAATATAAGAGTGTTTAGAATACTAAAATAGTGATCTAAACGCTCTTAT 1129
Psy1-S1a CAAAGTAC----------                                                    1071
Psy1-S1b CAAAGTAC----------                                                    1077
Psy1-S1c CAAAGTAC----------                                                    1057

Psy1-B1a ----------ATGAGAAAAGTTTGCAAGAACATATTCCTCA--CTACTTAAGGAATGTG           1128
Psy1-B1b ----------ATGAGAAAAGTTTGCAAGAACATATTCCTCA--CTACTTAAGGAATGTG           1128
Psy1-B1c ATTAGTTTACAGAGGGAGTACATGATAAAAGGTTGCAAGAACATATTCCTCAAATTACTTAAGGAATGTG 1199
Psy1-B1d ----------ATGAGAAAAGGTTGCAAGAACAAATTCCTCA--CTACTTAAGGAATGTG           1141
Psy1-B1e ----------ATGAGAA----------TTCCTCA--CTACTTAAGGAATGTG                  1111
Psy1-B1f ----------ATGAGAAAAGTTTGCAAGAACATATTCCTCA--CTACTTAAGGAATGTG           1128
Psy1-B1g ----------ATGAGAAAAGTTTGCAAGAACATATTCCTCA--CTACTTAAGGAATGTG           1128
Psy1-B1h ----------ATGAGAAAAGTTTGCAAGAACATATTCCTCA--CTACTTAAGGAATGTG           1128
Psy1-B1i ----------ATGAGAAAAGTTTGCAAGAACATATTCCTCA--CTACTTAAGGAATGTG           1128
Psy1-B1j ----------ATGAGAAAAGTTTGCAAGAACATATTCCTCA--CTACTTAAGGAATGTG           1128
Psy1-B1k ----------ATGAGAAAAGGTTGCAGGAACATATTCCTCA--CTACTTAAGGAATGTG           1117
Psy1-B1l ----------ATGAGAAAAGTTTGCAAGAACATATTCCTCA--CTACTT----------           1118
Psy1-B1m ATTAGTTTACAGAGGGAGTACATGATAAAAGGTTGCAAGAACATATTCCTCAAATTACTTAAGGAATGTG 1199
Psy1-S1a ----------ATGAGAAAGGGTTGCAAGAACAAATTCCTCA--CTACTTAAGGAATGTG           1118
Psy1-S1b ----------ATGAGAAAAGGTTGCAAGAACAAATTCCTCA--CTACTTAAGGAATGTG           1124
Psy1-S1c ----------ATGAGAAAAGGTTGGAAGAACAAATTCCTCA--CTACTTAAGGAATGTG           1104

Psy1-B1a AACCTGAGG-TTCTGTCAGTTCTAAATGAGATATACTCTAGGCATCGAACACTTTCAGAATCTGATGTAT 1197
Psy1-B1b AACCTGAGG-TTCTGTCAGTTCTAAATGAGATATACTCTAGGCATCGAACACTTTCAGAATCTGATGTAT 1197
Psy1-B1c AATCTGAGGGTTGTGTCAGTTCTAAATGAGATATACTCTAGGCATCAATCACTTTCAGAATCTGATGTAT 1269
Psy1-B1d AATCTGAGGGTTGTGTCAGTTCTAAATGAGATATACTCTAGGCATCGATCACTTTCAGAATCTGATGTAC 1211
Psy1-B1e AACCTGAGG-TTCTGTCAGTTCTAAATGAGATATACTCTAGGCATCGAACACTTTCAGAATCTGATGTAT 1180
Psy1-B1f AACCTGAGG-TTCTGTCAGTTCTAAATGAGATATACTCTAGGCATCGAACACTTTCAGAATCTGATGTAT 1197
Psy1-B1g AACCTGAGG-TTCTGTCAGTTCTAAATGAGATATACTCTAGGCATCGAACACTTTCAGAATCTGATGTAT 1197
Psy1-B1h AACCTGAGG-TTCTGTCAGTTCTAAATGAGATATACTCTAGGCATCGAACACTTTCAGAATCTGATGTAT 1197
Psy1-B1i AACCTGAGG-TTCTGTCAGTTCTAAATGAGATATACTCTAGGCATCGAACACTTTCAGAATCTGATGTAT 1197
Psy1-B1j AACCTGAGG-TTCTGTCAGTTCTAAATGAGATATACTCTAGGCATCGAACACTTTCAGAATCTGATGTAT 1197
Psy1-B1k AACCTGAGG-TTCTGTCAGTTCTAAATGAGATATACTATAGGCATCGTTCACTTTCAGAATCTGATGTAT 1186
Psy1-B1l ------------CTGTCAGTTCTAAATGAGATATACTCTAGGCATCGAACACTTTCAGAATCTGATGTAT 1176
Psy1-B1m AATCTGAGGGTTGTGTCAGTTCTAAATGAGATATACTCTAGGCATCAATCACTTTCAGAATCTGATGTAT 1269
Psy1-S1a AATCTGAGGGTTCTGTCAGTTCTAAATGAGATATACTCTAGTCATCGAACACTTTCAGAATCTGATGTAT 1188
Psy1-S1b AATCTGAGGGTTCTGTCAGTTCTAAATGAGATATACTCTAGGCATCGATCACTTTCAGAATCTGATGTAT 1194
Psy1-S1c AATCTGAGGGTTCTGTCAGTTCTAAATGAGATATACTCTAGGCATCGTTCACTTTCAGAATCTGATGTAT 1174

Psy1-B1a AGCATCATTTGTGCAGTGTGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAACGCGTCGCACATCA 1267
Psy1-B1b AGCATCATTTGTGCAGTGTGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAACGCGTCGCACATCA 1267
Psy1-B1c AGCATCATT-GTTCAGTATGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAATGCGTCGCACATTA 1338
Psy1-B1d AGCATCCTTTGTGCAGTGTGGTGCAGGAGGACAGACGAGCTGGTGGACGGGCCGAACGCGTCGCACATCA 1281
Psy1-B1e AGCATCATT-GTTCAGTATGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAACGCGTCGCACATCA 1249
Psy1-B1f AGCATCATTTGTGCAGTGTGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAACGCGTCGCACATCA 1267
Psy1-B1g AGCATCATTTGTGCAGTGTGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAACGCGTCGCACATCA 1267
Psy1-B1h AGCATCATTTGTGCAGTGTGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAACGCGTCGCACATCA 1267
Psy1-B1i AGCATCATTTGTGCAGTGTGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAACGCGTCGCACATCA 1267
Psy1-B1j AGCATCATTTGTGCAGTGTGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAACGCGTCGCACATCA 1267
Psy1-B1k AGCATCATTTGTCCAGTGTGGTGTAGGAGGACAGACGAGCTGGTGGACGGTCCGAACGCGTCGCACATCA 1256
Psy1-B1l AGCATCATTTGTGCAGTGTGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAACGCGTCGCACATCA 1246
Psy1-B1m AGCATCATT-GTTCAGTATGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCCAATGCGTCGCACATTA 1338
Psy1-S1a AGCATCATTTGTCCAGTGTGGTGCAGGAGGACAGACGAGCTGGTGGACGGGCCGAACGCGTCGCACATCA 1258
Psy1-S1b AGCATCGTTTGTCCAGTGTGGTGCAGGAGGACAGACGAGCTGGTGGACGGTCCGAACGCGTCGCACATCA 1264
Psy1-S1c AGCATCATTTGTCCAGTGTGGTGCAGGAGGACGGACGAGCTGGTGGACGGGCCGAACGCGTCGCACATCA 1244

Psy1-B1a CGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCT 1337
Psy1-B1b CGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCT 1337
Psy1-B1c CGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCT 1408
Psy1-B1d CGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCT 1351
Psy1-B1e CACCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGGCCCTACGACATGCT 1319
Psy1-B1f CGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCT 1337
Psy1-B1g CGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCT 1337
Psy1-B1h CGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCT 1337
Psy1-B1i CGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCT 1337
Psy1-B1j CGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCT 1337
Psy1-B1k CGCCGCAGGCGCTGGACCGGTGGGAAAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCT 1326
Psy1-B1l CGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCT 1316
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Fig. A2. *(Continued)*.

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Psy1-B1m CGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCT  1408
Psy1-S1a CGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCT  1328
Psy1-S1b CGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCT  1334
Psy1-S1c CGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGGAGGACCTCTTCGCCGGGCGCCCCTACGACATGCT  1314

Psy1-B1a CGACGCCGCGCTCTCCGACACCATCACCAAGTTCCCCATAGATATTCAGGTACCAGCTCGCCGGTGCATA  1407
Psy1-B1b CGACGCCGCGCTCTCCGACACCATCACCAAGTTCCCCATAGATATTCAGGTACCAGCTCGCCGGTGCATA  1407
Psy1-B1c CGACGCCGCACTCTCTGACACCATCACCAAGTTCCCCATAGATATTCAGGTACCAGCTCGCCGGTGCATA  1478
Psy1-B1d CGACGCCGCGCTCTCCGACACCATCACCAAGTTCCCCATAGATATTCAGGTACCAGCTCGCCGGTGCATA  1421
Psy1-B1e CGACGCCGCGCTCTCCGACACCATCACCAAGTTCCCCATAGATATTCAGGTACCAGCCAGCC----CATA  1385
Psy1-B1f CGACGCCGCGCTCTCCGACACCATCACCAAGTTCCCCATAGATATTCAGGTACCAGCTCGCCGGTGCATA  1407
Psy1-B1g CGACGCCGCGCTCTCCGACACCATCACCAAGTTCCCCATAGATATTCAGGTACCAGCTCGCCGGTGCATA  1407
Psy1-B1h CGACGCCGCGCTCTCCGACACCATCACCAAGTTCCCCATAGATATTCAGGTACCAGCTCGCCCGTGCATA  1407
Psy1-B1i CGACGCCGCGCTCTCCGACACCATCACCAAGTTCCCCATAGATATTCAGGTACCAGCTCGCCGGTGCATA  1407
Psy1-B1j CGACGCCGCGCTCTCCGACACCATCACCAAGTTCCCCATAGATATTCAGGTACCAGCTCGCCGGTGCATA  1407
Psy1-B1k CGACGCCGCGCTCTCCGACACCATCACCAAGTTCCCCATTGATATTCAGGTACCAGCTCGCCGGTGCATA  1396
Psy1-B1l CGACGCCGCGCTCTCCGACACCATCACCAAGTTCCCCATAGATATTCAGGTACCAGCTCGCCGGTGCATA  1386
Psy1-B1m CGACGCCGCACTCTCTGACACCATCACCAAGTTCCCCATAGATATTCAGGTACCAGCTCGCCGGTGCATA  1478
Psy1-S1a CGACGCCGCGCTCTCCGACACCATCACCAAGTTCCCCATTGATATTCAGGTACCAGCTCGCCGGTGCATA  1398
Psy1-S1b CGACGCCGCGCTCTCCGACACCATCACCAAGTTCCCCATTGATATTCAGGTACCAGCTCGCCGGTGCATA  1404
Psy1-S1c CGACGCCGCGCTCTCCGACACCATCACCAAGTTCCCCATTGATATTCAGGTACCAGCTCGCCGGTGCATA  1384

Psy1-B1a ATTGTT-CAGTCCACATTGTATGATTCTGGTAGAAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATC  1476
Psy1-B1b ATTGTT-CAGTCCACATTGTATGATTCTGGTAGAAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATC  1476
Psy1-B1c ATTGTT-CAGTCCACATTGTATGACTCTGGTCGAAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATC  1547
Psy1-B1d ATTGTT-CAGTCCACATTGTATGATTCTGGTAGAAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATC  1490
Psy1-B1e ATTGTT-CAGTCCACATTGTATGATTCTGGTGGAA---CAGAGTGGTGGTGGATATTCCCTGTCAGCATC  1451
Psy1-B1f ATTGTT-CAGTCCACATTGTATGATTCTGGTAGAAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATC  1476
Psy1-B1g ATTGTT-CAGTCCACATTGTATGATTCTGGTAGAAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATC  1476
Psy1-B1h ATTGTT-CAGTCCACATTGTATGATTCTGGTAGAAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATC  1476
Psy1-B1i ATTGTT-CAGTCCACATTGTATGATTCTGGTAGAAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATC  1476
Psy1-B1j ATTGTT-CAGTCCACATTGTATGATTCTGGTAGAAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATC  1476
Psy1-B1k ATTGTT-CAGTCCACATTGTATGATTCTGGTAGAAGAACAGAGTGGTGATGGATATTCCCTGTCAGCATC  1465
Psy1-B1l ATTGTT-CAGTCCACATTGTATGATTCTGGTAGAAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATC  1455
Psy1-B1m ATTGTT-CAGTCCACATTGTATGACTCTGGTCGAAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATC  1547
Psy1-S1a ATTGTTTCAGTCCACATTGTATGATTCTGGTAGAAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATC  1468
Psy1-S1b ATTGTT-CAGTCCACATTGTATGATTCTGGTAGAAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATC  1473
Psy1-S1c ATTGTT-CAGTCCGCATTGTATGATTCTGGTAGAAGAACAGAGTGGTGGTGGATATTCCCTGTCAGCATC  1453

Psy1-B1a AGATTCTCCCTAGACCTCACAATCTCAGTGCAAGATGACCGGAAAGTCCGTGATTGGTCAAAATTGTTTC  1546
Psy1-B1b AGATTCTCCCTAGACCTCACAATCTCAGTGCAAGATGACCGGAAAGTCCGTGATTGGTCAAAATTGTTTC  1546
Psy1-B1c AGATTCTCCCTAGACCTCACAATCTCAGTGCAAGATGACCGGAAAGTCGATGATTGGTCAAAATTGTTTC  1617
Psy1-B1d AGATTCCCCCTAGACCTCACAATCTCAGTGCAAGATGACCGGAAAGTCGATGATTGGTCAAAATTGTTTC  1560
Psy1-B1e AGATTGCCCCTAGACCTCACAATCTCAGTGCAAGATGACCGGAAAGTCGATGATTGGTCAAAATTGTTTC  1521
Psy1-B1f AGATTCTCCCTAGACCTCACAATCTCAGTGCAAGATGACCGGAAAGTCCGTGATTGGTCAAAATTGTTTC  1546
Psy1-B1g AGATTCTCCCTAGACCTCACAATCTCAGTGCAAGATGACCGGAAAGTCCATGATTGGTCAAAATTGTTTC  1546
Psy1-B1h AGATTCTCCCTAGACCTCACAATCTCAGTGCAAGATGACCGGAAAGTCCATGATTGGTCAAAATTGTTTC  1546
Psy1-B1i AGATTCTCCCTAGACCTCACAATCTCAGTGCAAGATGACCGGAAAGTCCGTGATTGGTCAAAATTGTTTC  1546
Psy1-B1j AGATTCTCCCTAGACCTCACAATCTCAGTGCAAGATGACCGGAAAGTCCGTGATTGGTCAAAATTGTTTC  1546
Psy1-B1k AGATTCCCCCTAGACCTCACAATCTCAGTGCAAGATGACCGGAAAGTCGATGATTGGTCAAAATTGTTTC  1535
Psy1-B1l AGATTCTCCCTAGACCTCACAATCTCAGTGCAAGATGACCGGAAAGTCCGTGATTGGTCAAAATTGTTTC  1525
Psy1-B1m AGATTCTCCCTAGACCTCACAATCTCAGTGCAAGATGACCGGAAAGTCGATGATTGGTCAAAATTGTTTC  1617
Psy1-S1a AGATTCCCCC-AGACCTCACAATCTCAGTGCAAGATGACCGGAAAGTCGATGATTGGTCAAAATTGTTTC  1537
Psy1-S1b AGATTCCCCCTAGACCTCACAATCTCAGTGCAAGATGACCGGAAAGTCGATGATTGGTCAAAATTGTTTC  1543
Psy1-S1c AGATTCCCCC-AGACCTCACAATCTCAGTGCAAGATGACCGGAAAGTCGATGATTGGTCAGAATTGTTTC  1522

Psy1-B1a GTTTGTCGGCCTTTTATTAGTCTCTGATGCTGTTATTGAGTTGTATGAACTTTTCACACATTGTAGTGGG  1616
Psy1-B1b GTTTGTCGGCCTTTTATTAGTCTCTGATGCTGTTATTGAGTTGTATGAACTTTTCACACATTGTAGTGGG  1616
Psy1-B1c GTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTATTGAGCTGTATGCACTTTTCACACATTGTAGTGGG  1687
Psy1-B1d GTTTGTCGGCCTTTTATTGGTCTCTGATGCTGTTATTGAGCTGTATGAACTTTTCACACATTGTAGTGGG  1630
Psy1-B1e GTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTGTTGAGCCGTATGAACTTTTCACACATTGTAGTGGG  1591
Psy1-B1f GTTTGTCGGCCTTTTATTAGTCTCTGATGCTGTTATTGAGTTGTATGAACTTTTCACACATTGTAGTGGG  1616
Psy1-B1g GTTTGTCGGCCTTTTATTAGTCTCTGATGCTGTTATTGAGTTGTATGAACTTTTCACACATTGTAGTGGG  1616
Psy1-B1h GTTTGTCGGCCTTTTATTAGTCTCTGATGCTGTTATTGAGTTGTATGAACTTTTCACACATTGTAGTGGG  1616
Psy1-B1i GTTTGTCGGCCTTTTATTAGTCTCTGATGCTGTTATTGAGTTGTATGAACTTTTCACACATTGTAGTGGG  1616
Psy1-B1j GTTTGTCGGCCTTTTATTAGTCTCTGATGCTGTTATTGAGTTGTATGAACTTTTCACACATTGTAGTGGG  1616
Psy1-B1k GTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTATTGAGCTGTATGAACTTTTCACACATTGTAGTGGG  1605
Psy1-B1l GTTTGTCGGCCTTTTATTAGTCTCTGATGCTGTTATTGAGTTGTATGAACTTTTCACACATTGTAGTGGG  1595
Psy1-B1m GTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTATTGAGCTGTATGCACTTTTCACACATTGTAGTGGG  1687
Psy1-S1a GTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTATTGAGCTGTATGAACTTTTCACACATTGTAGTGGG  1607
Psy1-S1b GTTTGTCGGCCTTTTGTTGGTCTCTGATGCTGTTATTGAGCTGTATGAACTTTTCACACATTGTAGTGGG  1613
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Fig. A2. *(Continued).*

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Psy1-S1c GTTTGTCGGCCTTTTGTTGGTCTCTGATGCTGTTATTGAGCTGTATGAACTTTTCACACATTGTAGTGGG  1592

Psy1-B1a GGCTTATCCAGTTGACTAGACG-TATAGTGGGAA--------TCATCTGGTCAAAGATATGTTTAATCAA  1677
Psy1-B1b GGCTTATCCAGTTGACTAGACG-TATAGTGGGAA--------TCATCTGGTCAAAGATATGTTTAATCAA  1677
Psy1-B1c GGCTTATCCAGTTGACTAGACG-TATAGTGGGAAACTGGGAATCATCTGGTCAAAGATATGTTTAATCAA  1756
Psy1-B1d GGCTTATCCAGTTGACTAGACG-TATAGTGGGAAACTGGGAATCATCTGGTCAAAGATATGTTTAATCAA  1699
Psy1-B1e GGCTTATCCAGTTTACTAGACG-C-TATAGTGAA--------TCGTCTGGTCAAAGATATGTTTAATCAA  1651
Psy1-B1f GGCTTATCCAGTTGACTAGACG-TATAGTGGGAA--------TCATCTGGTCAAAGATATGTTTAATCAA  1677
Psy1-B1g GGCTTATCCAGTTGACTAGACG-TATAGTGGGAA--------TCATCTGGTCAAAGATATGTTTAATCAA  1677
Psy1-B1h GGCTTATCCAGTTGACTAGACG-TATAGTGGGAA--------TCATCTGGTCAAAGATATGTTTAATCAA  1677
Psy1-B1i GGCTTATCCAGTTGACTAGACG-TATAGTGGGAA--------TCATCTGGTCAAAGATATGTTTAATCAA  1677
Psy1-B1j GGCTTATCCAGTTGACTAGACG-TATAGTGGGAA--------TCATCTGGTCAAAGATATGTTTAATCAA  1677
Psy1-B1k TGCTTATCCAGTTGACTAGACTCTATAGTGGGAAACTGGGAGTCATCTGGTCAAAGATATGTTTAATCAA  1675
Psy1-B1l GGCTTATCCAGTTGACTAGACG-TATAGTGGGAA--------TCATCTGGTCAAAGATATGTTTAATCAA  1656
Psy1-B1m GGCTTATCCAGTTGACTAGACG-TATAGTGGGAAACTGGGAATCATCTGGTCAAAGATATGTTTAATCAA  1756
Psy1-S1a GGCTTATCCAGTTGACTAGACTCTATAGTGGGAAACTGGGAATCATCTGGTCAAAGATATGTTTAATCAA  1677
Psy1-S1b GGCTTATCCAGTTGACTAGACTCTATAGTGGGAAACTGGGAATTATCTGGTCAAAGATATGTTTAATCAA  1683
Psy1-S1c GGCTTATCCAGTTGACTAGACG-TATAGTGGGAAACTGGGAATCATCTGGTCAAAGATATGTTTAATCAA  1661

Psy1-B1a AGTGGGGAAATTATAGGGAGAA-TTTTCAATAAGAATTA---GTCCTGAACATGCCAAGAACAAGCAGGA  1743
Psy1-B1b AGTGGGGAAATTATAGGGAGAA-TTTTCAATAAGAATTA---GTCCTGAACATGCCAAGAACAAGCAGGA  1743
Psy1-B1c ACTAGGGAAATTATAGAAAAG-CTTTTCTATAATAAATA---GTCATGAACATAGCAAGAACAAAAAAGA  1822
Psy1-B1d ACTAGGGAAATTATAGAAAAG-CTTTTCTATAATAAATA---GTCATGAACATAGCAAGAACAAAAAAGA  1765
Psy1-B1e AGTGGGGAAATTATAGGGAGAACTTTTCAGTAAGTATTA---TTCCCAAACATACCTAGAACAAACAGGA  1718
Psy1-B1f AGTGGGGAAATTATAGGGAGAA-TTTTCAATAAGAATTA---GTCCTGAACATGCCAAGAACAAGCAGGA  1743
Psy1-B1g AGTGGGGAAATTATAGGGAGAA-TTTTCAATAAGAATTA---GTCCTGAACATGCCAAGAACAAGCAGGA  1743
Psy1-B1h AGTGGGGAAATTATAGGGAGAA-TTTTCAATAAGAATTA---GTCCTGAACATGCCAAGAACAAGCAGGA  1743
Psy1-B1i AGTGGGGAAATTATAGGGAGAA-TTTTCAATAAGAATTA---GTCCTGAACATGCCAAGAACAAGCAGGA  1743
Psy1-B1j AGTGGGGAAATTATAGGGAGAA-TTTTCAATAAGAATTA---GTCCTGAACATGCCAAGAACAAGCAGGA  1743
Psy1-B1k ACTAGGGAAATTATAGAAAGACTTTTCTATAAGAAATAATAGTCATGAACATAGCAAGAACAAAAAAGA  1745
Psy1-B1l AGTGGGGAAATTATAGGGAGAA-TTTTCAATAAGAATTA---GTCCTGAACATGCCAAGAACAAGCAGGA  1722
Psy1-B1m ACTAGGGAAATTATAGAAAAG-CTTTTCTATAATAAATA---GTCATGAACATAGCAAGAACAAAAAAGA  1822
Psy1-S1a ACTAGGGAAATTATAGAAAAT-CTTTTCTATAATAAATA---GTCATGAACATAGCAAGAACAAAAAAGA  1743
Psy1-S1b ACTAGGGAAATTATAGAAAAT-CTTTTCTATAATAAATA---GTCATGAACATAGCAAGAACAAAAAAGA  1749
Psy1-S1c ACTAGGGAAATTATAGAAAAGACTTTTCTATAAGAAATAATAGTCATGAACATAGCAAGAACAAAAAAGA  1731

Psy1-B1a ACTTGGAGATGATGTAGAAGGAGAAATGAAAACATGAATTATTGGG------------------------  1789
Psy1-B1b ACTTGGAGATGATGTAGAAGGAGAAATGAAAACATGAATTATTGGG------------------------  1789
Psy1-B1c ACTTGGCAACGATCCAGAGGTATAACAGGAATCAGGGGAAGTCTAA-----------------------  1868
Psy1-B1d ACTTGGCAACGATCTAGAGGTATAACAGGAATCAGGGGAAGTCTAAGGCTCTGTTTGGTTTATCGTTTCC  1835
Psy1-B1e ACTTGGAAATGATGTAGAAGGAGAAATGAAATCAGGGAGAGTCCAAGTGACTCCAGACCTGAATAATACA  1788
Psy1-B1f ACTTGGAGATGATGTAGAAGGAGAAATGAAAACATGAATTATTGGG------------------------  1789
Psy1-B1g ACTTGGAGATGATGTAGAAGGAGAAATGAAAACATGAATTATTGGG------------------------  1789
Psy1-B1h ACTTGGAGATGATGTAGAAGGAGAAATGAAAACATGAATTATTGGG------------------------  1789
Psy1-B1i ACTTGGAGATGATGTAGAAGGAGAAATGAAAACATGAATTATTGGG------------------------  1789
Psy1-B1j ACTTGGAGATGATGTAGAAGGAGAAATGAAAACATGAATTATTGGG------------------------  1789
Psy1-B1k ACTTGGCAACGATCTAGAGGTATAACAGGAATCAGGGGAAGTCTAAGGCTCTGTTTGGTTTATCGTTTCC  1815
Psy1-B1l ACTTGGAGATGATGTAGAAGGAGAAATGAAAACATGAATTATTGGG------------------------  1768
Psy1-B1m ACTTGGCAACGATCCAGAGGTATAACAGGAATCAGGGGAAGTCTAA-----------------------  1868
Psy1-S1a ACTTGGCAACGATCTAGAGGTATAACAGGAATCAGGGGAAGTCTAA-----------------------  1789
Psy1-S1b ACTTGGCAACGATCTAGAGGTATAACAGGAATCAGGGGAAGTCTAAGGCTCTGTTTGGTTTATCGTTTCC  1819
Psy1-S1c ACTTGGCAACGATCTAGAGGTATAACAGGAATCAGGGGAAGTCTAA-----------------------  1777

Psy1-B1a ------------------------------------------------------------------  1789
Psy1-B1b ------------------------------------------------------------------  1789
Psy1-B1c ------------------------------------------------------------------  1868
Psy1-B1d ATTTCAAATACCCCTGTATAACTTACAGACCTCCGCCCGTCGTTTTGCTTTCCGGCCGGAAATAGCTCTT  1905
Psy1-B1e TCATGAAA--------------------------------------------------------  1796
Psy1-B1f ------------------------------------------------------------------  1789
Psy1-B1g ------------------------------------------------------------------  1789
Psy1-B1h ------------------------------------------------------------------  1789
Psy1-B1i ------------------------------------------------------------------  1789
Psy1-B1j ------------------------------------------------------------------  1789
Psy1-B1k ATTTCAAATACCCCTCTATAACTTACAGACCTCCGCCCGTCGTTTTGCTTTCCGGCCGGAAATAGCTCTT  1885
Psy1-B1l ------------------------------------------------------------------  1768
Psy1-B1m ------------------------------------------------------------------  1868
Psy1-S1a ------------------------------------------------------------------  1789
Psy1-S1b ATTTCAAATACCCCTGTATAACTTACAGACCTCCGCCCGTCGTTTTGCTTTCCGGCCGGAAATAGCTCTT  1889
Psy1-S1c ------------------------------------------------------------------  1777

Psy1-B1a ----------------------------------------------------------------C  1790
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Fig. A2. *(Continued).*

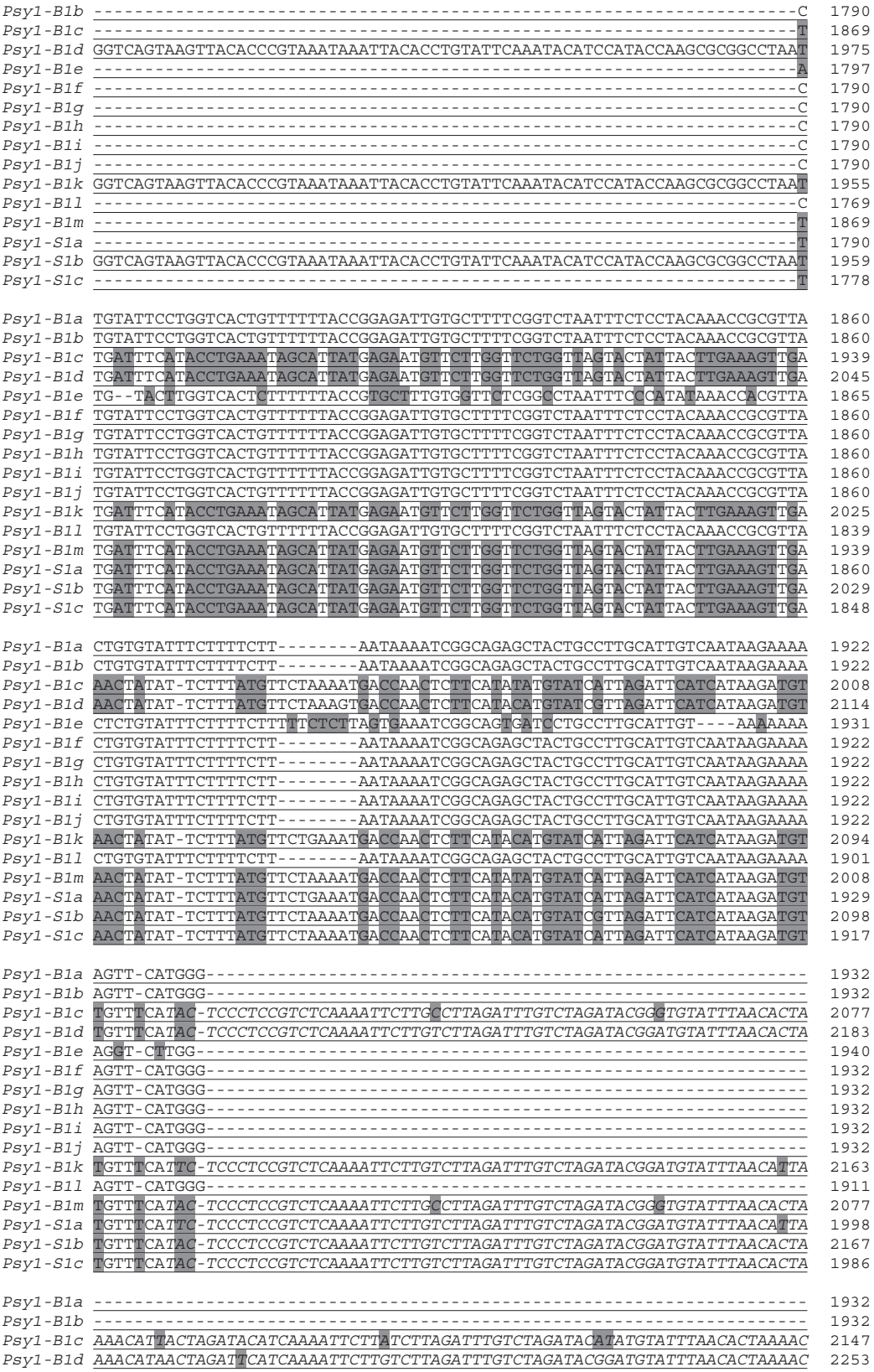


Fig. A2. *(Continued).*

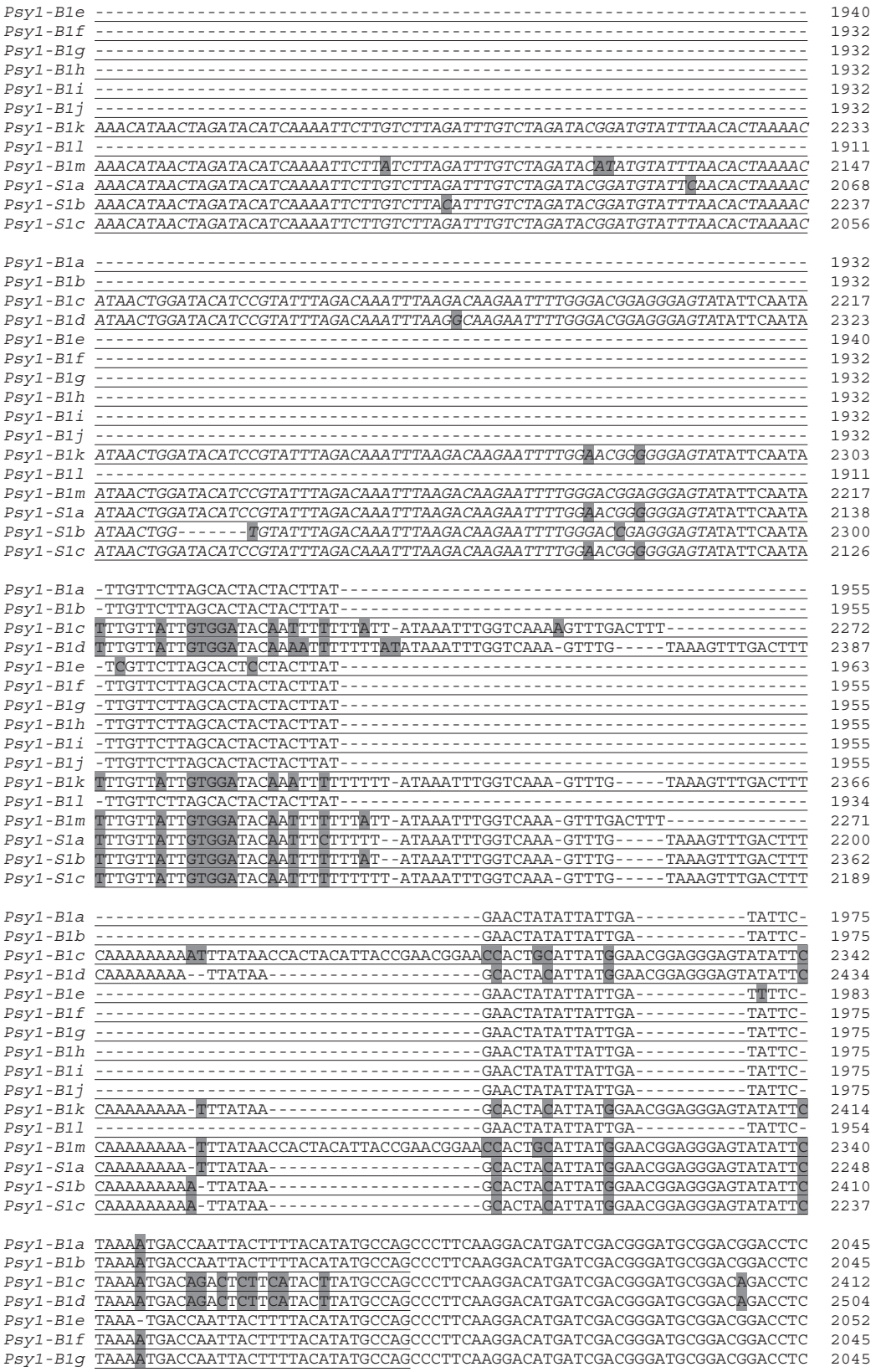


Fig. A2. *(Continued).*

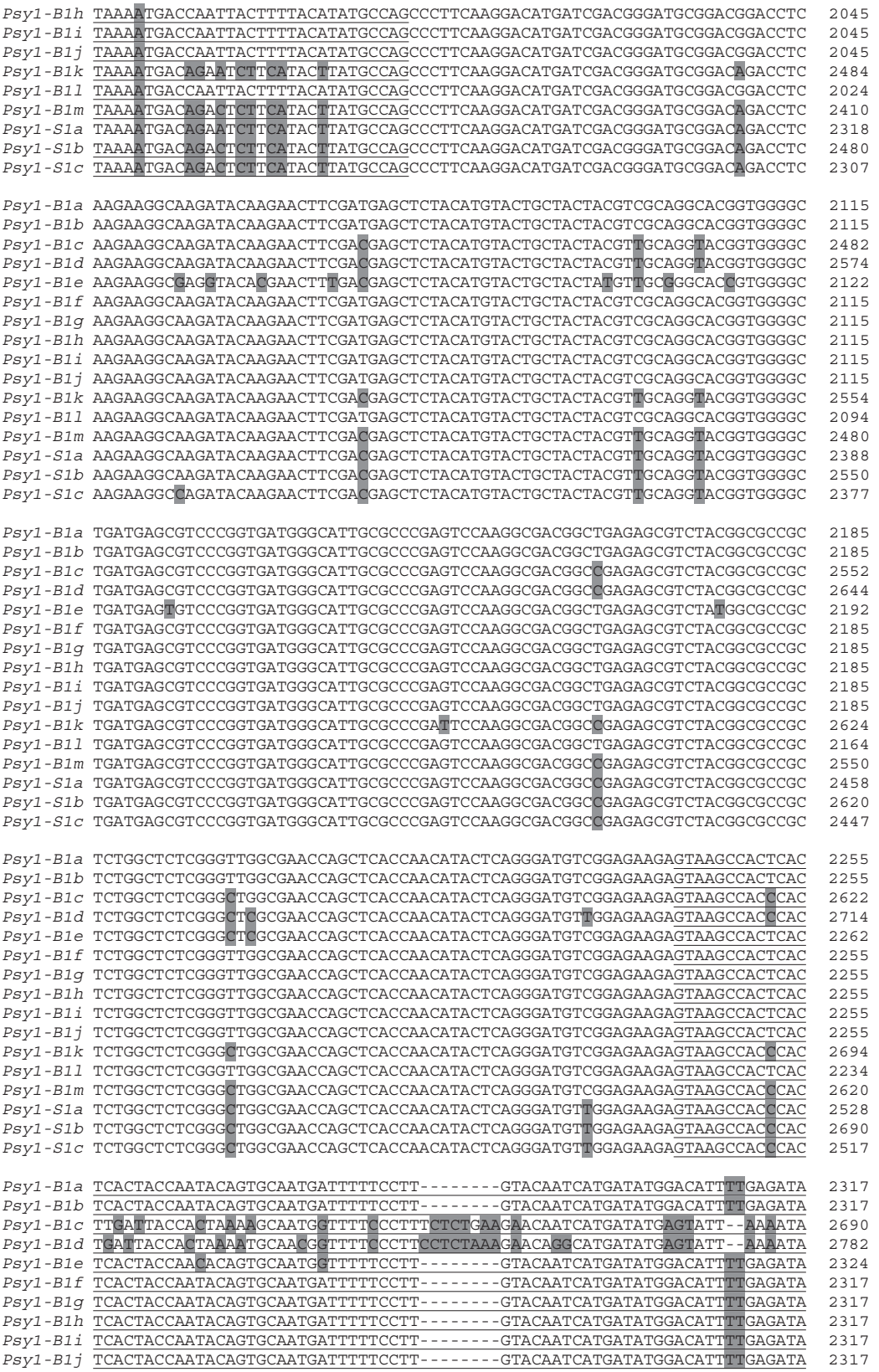
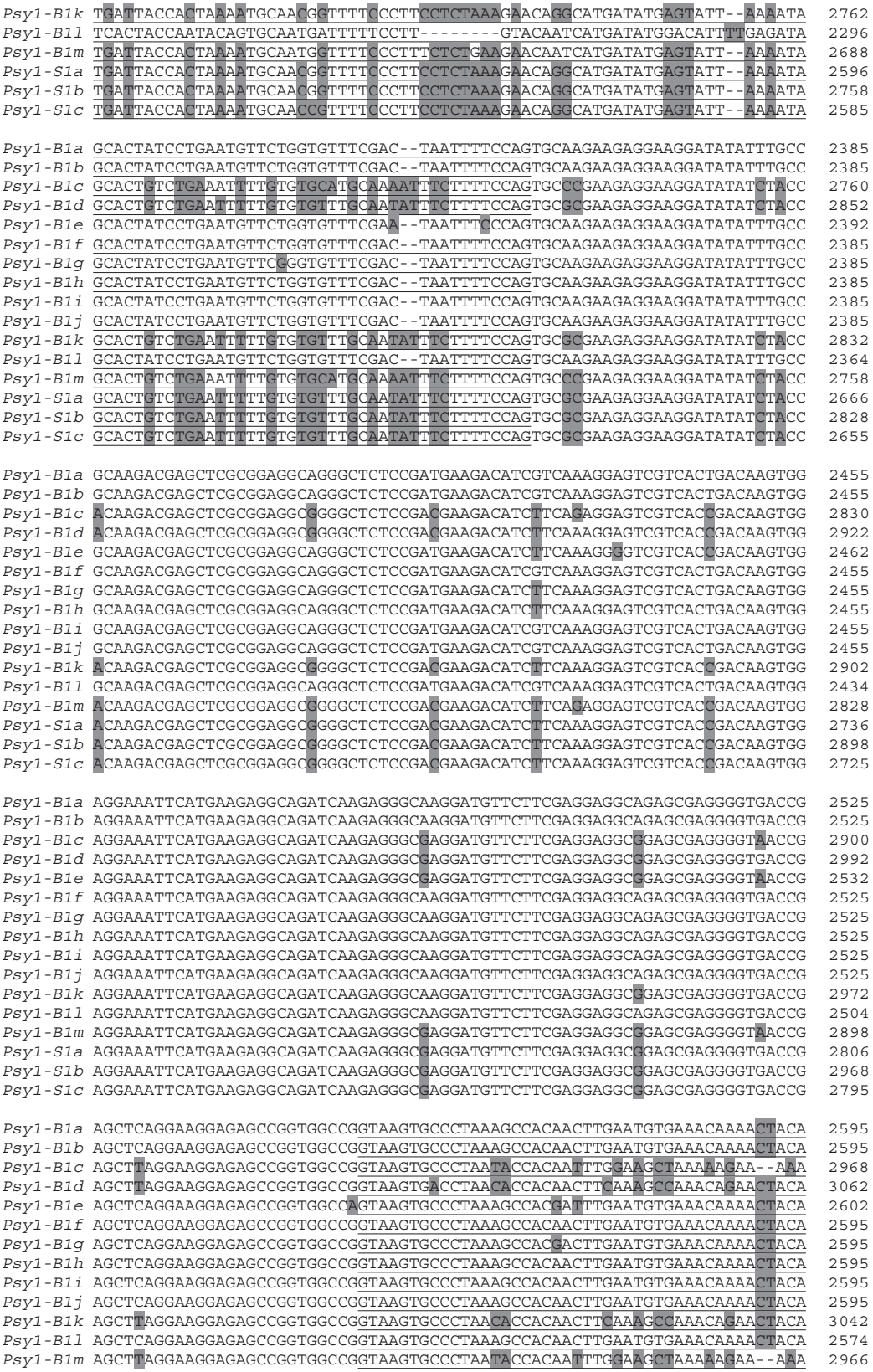


Fig. A2. *(Continued).*



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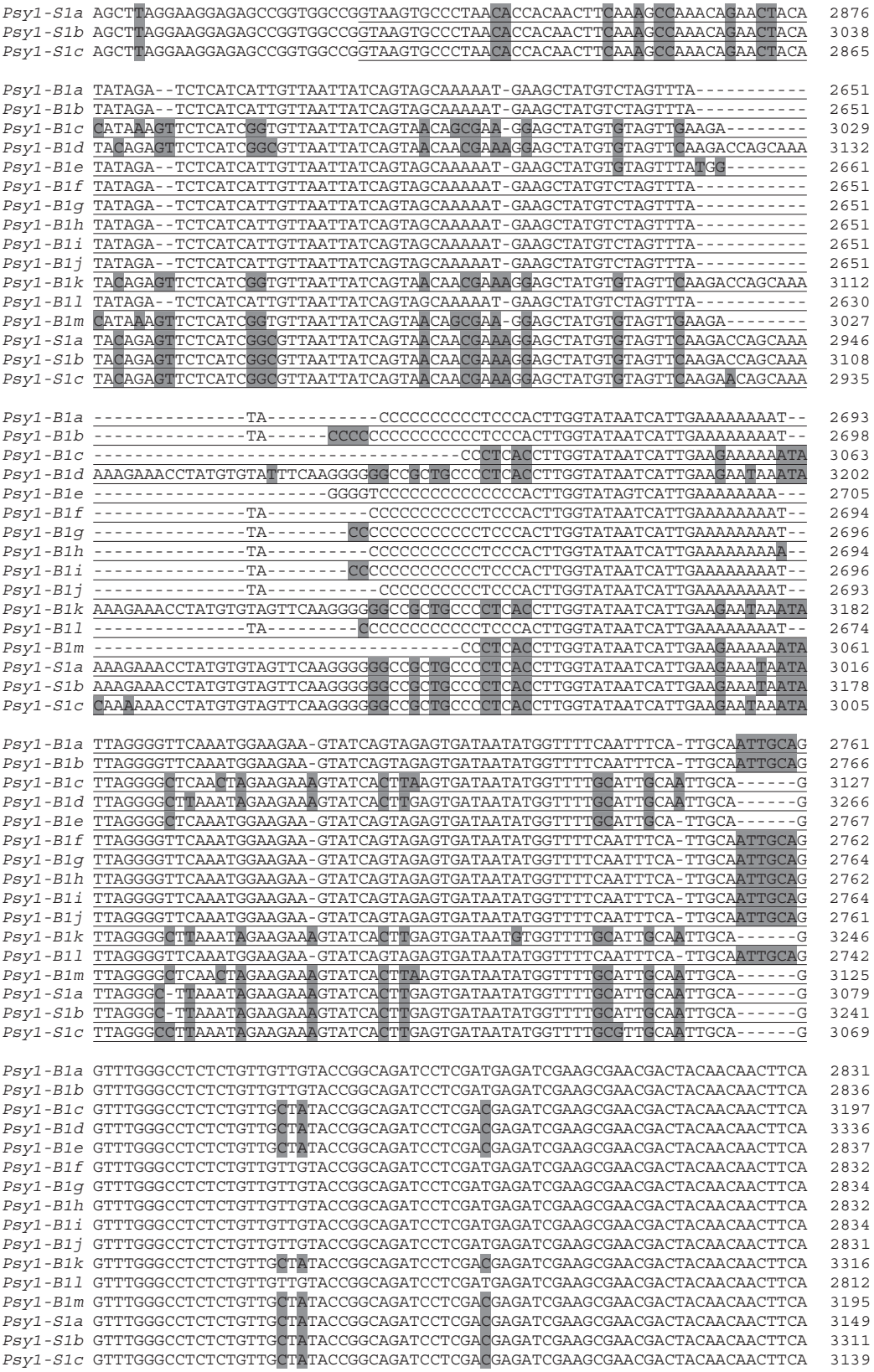
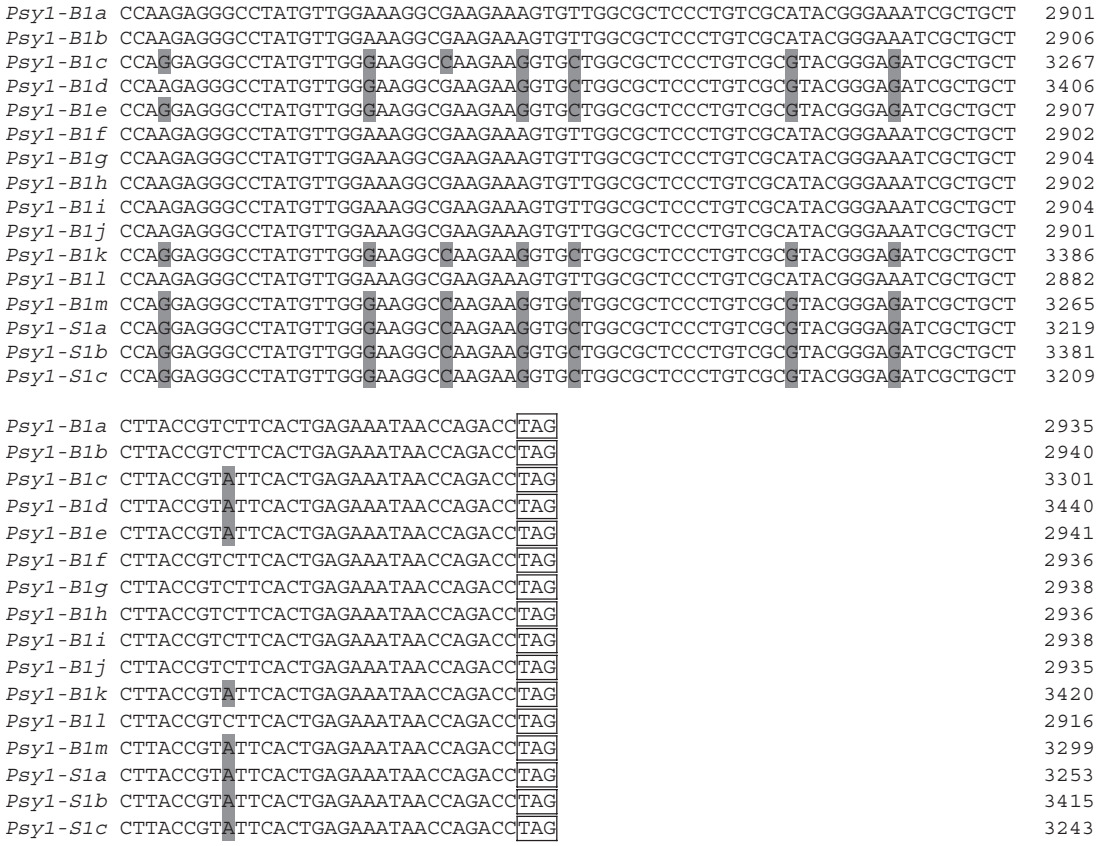


Fig. A2. *(Continued).*



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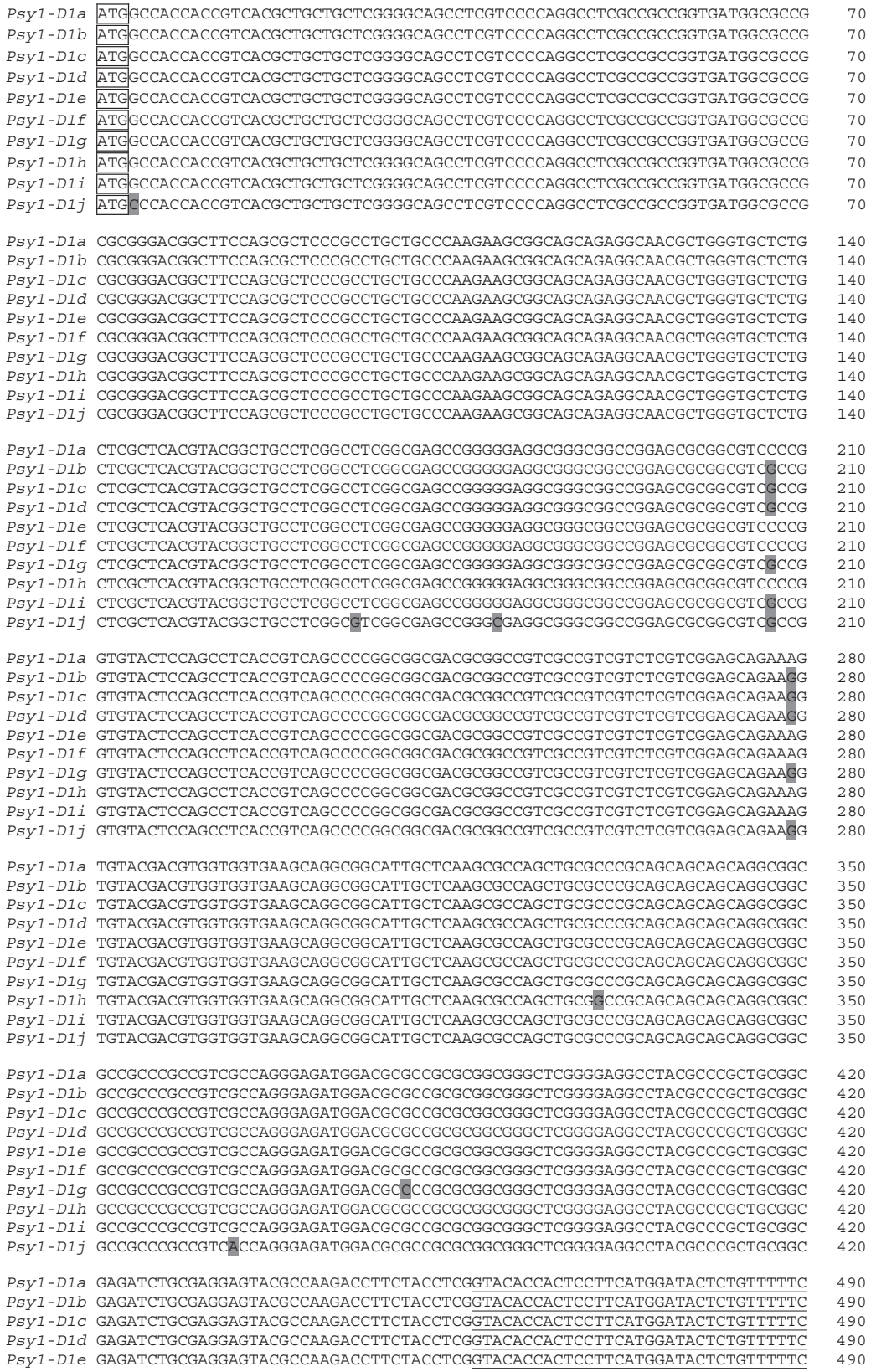

Fig. A3. Alignment of the alleles at Psy1-D1 locus.

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Psy1-D1f GAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACACCACTCCTTCATGGATACTCTGTTTTTC  490
Psy1-D1g GAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACACCACTCCTTCATGGATACTCTGTTTTTC  490
Psy1-D1h GAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACACCACTCCTTCATGGATACTCTGTTTTTC  490
Psy1-D1i GAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACACCACTCCTTCATGGATACTCTGTTTTTC  490
Psy1-D1j GAGATCTGCGAGGAGTACGCCAAGACCTTCTACCTCGGTACACCACTCCTTCATGGATACTCTGTTTTTG  490

Psy1-D1a TT------------------------------------------------------------------  492
Psy1-D1b TT------------------------------------------------------------------  492
Psy1-D1c TT------------------------------------------------------------------  492
Psy1-D1d TT------------------------------------------------------------------  492
Psy1-D1e TT------------------------------------------------------------------  492
Psy1-D1f TT------------------------------------------------------------------  492
Psy1-D1g TT------------------------------------------------------------------  492
Psy1-D1h TT------------------------------------------------------------------  492
Psy1-D1i TT------------------------------------------------------------------  492
Psy1-D1j TTTTTTTTCGAAAAGGGGATCTCCCCGGCCTCTGCATCAGAATGATGCATACGACCATCTTATTACCAAA  560

Psy1-D1a ------------------------------------------------------------------  492
Psy1-D1b ------------------------------------------------------------------  492
Psy1-D1c ------------------------------------------------------------------  492
Psy1-D1d ------------------------------------------------------------------  492
Psy1-D1e ------------------------------------------------------------------  492
Psy1-D1f ------------------------------------------------------------------  492
Psy1-D1g ------------------------------------------------------------------  492
Psy1-D1h ------------------------------------------------------------------  492
Psy1-D1i ------------------------------------------------------------------  492
Psy1-D1j ATAAAAGGTTCCAACAAGGTTCCAAAGTCTCGGACTGAAAAAGTAATAAAAAGACAGCTCATACAGAGCT  630

Psy1-D1a ----------------------------------GAACCATGGTGGCATTCTGCTGCGTGCCAAGCCG  526
Psy1-D1b ----------------------------------GAACCATGGTGGCAGTCTGCTGCGTGCCAAGCCG  526
Psy1-D1c ----------------------------------GAACCATGGTGGCAGTCTGCTGCGTGCCAAGCCG  526
Psy1-D1d ----------------------------------GAACCATGGTGGCAGTCTGCTGCGTGCCAAGCCG  526
Psy1-D1e ----------------------------------GAACCATGGTGGCATTCTGCTGCGTGCCAAGCCG  526
Psy1-D1f ----------------------------------GAACCATGGTGGCATTCTGCTGCGTGCCAAGCCG  526
Psy1-D1g ----------------------------------GAACCATGGTGGCAGTCTGCTGCGTGCCAAGCCG  526
Psy1-D1h ----------------------------------GAACCATGGTGGCATTCTGCTGCGTGCCAAGCCG  526
Psy1-D1i ----------------------------------GAACCATGGTGGCATTCTGCTGCGTGCCAAGCCG  526
Psy1-D1j AAAAGAGGCTAAACACACAGACTAGCCAAGATAAATAAACCATGGTGGCATTCTGCTGCGTGCCAAGCCG  700

Psy1-D1a GTGTTGTGCTGATCATGGAGCTCACTCGTTCATGTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACGG  596
Psy1-D1b GTGTTGTGCTGATCATGGAGCTCACTCGTTCATGTCCGGTCGTGCATGCCAGGGACCTTGCTGATGACGG  596
Psy1-D1c GTGTTGTGCTGATCATGGAGCTCACTCGTTCATGTCCGGTCGTGCATGCCAGGGACCTTGCTGATGACGG  596
Psy1-D1d GTGTTGTGCTGATCATGGAGCTCACTCGTTCATGTCCGGTCGTGCATGCCAGGGACCTTGCTGATGACGG  596
Psy1-D1e GTGTTGTGCTGATCATGGAGCTCACTCGTTCATGTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACGG  596
Psy1-D1f GTGTTGTGCTGATCATGGAGCTCACTCGTTCATGTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACGG  596
Psy1-D1g GTGTTGTGCTGATCATGGAGCTCACTCGTTGATGTCCGGTCGTGCATGGCAGGGACCTTGCTGATGACGG  596
Psy1-D1h GTGTTGTGCTGATCATGGAGCTCACTCGTTCATGTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACGG  596
Psy1-D1i GTGTTGTGCTGATCATGGAGCTCACTCGTTCATGTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACGG  596
Psy1-D1j GTGTTGTGCTGATCATGGAGCTCACTCGTTCATGTCTGGTCGTGCATGGCAGGGACCTTGCTGATGACGG  770

Psy1-D1a AGGAGCGGCGGCGCGCCATATGGGCCATCTACGGTAATCAATCTGGAACCTCACCATGCCTGGCTTGGAC  666
Psy1-D1b AGGAGCGGCGGCGCGCCATATGGGCCATCTACGGTAATCAATCTGGAACCTCACCATGCCTGGCTTGGAC  666
Psy1-D1c AGGAGCGGCGGCGCGCCATATGGGCCATCTACGGTAATCAATCTGGAACCTCACCATGCCTGGCTTGGAC  666
Psy1-D1d AGGAGCGGCGGCGCGCCATATGGGCCATCTACGGTAATCAATCTGGAACCTCACCATGCCTGGCTTGGAC  666
Psy1-D1e AGGAGCGGCGGCGCGCCATATGGGCCATCTACGGTAATCAATCTGGAACCTCACCATGCCTGGCTTGGAC  666
Psy1-D1f AGGAGCGGCGGCGCGCCATATGGGCCATCTACGGTAATCAATCTGGAACCTCACCATGCCTGGCTTGGAC  666
Psy1-D1g AGGAGCGGCGGCGCGCCATATGGGCCATCTACGGTAATCAATCTGGAACCTCACCATGCCTGGCTTGGAC  666
Psy1-D1h AGGAGCGGCGGCGCGCCATATGGGCCATCTACGGTAATCAATCTGGAACCTCACCATGCCTGGCTTGGAC  666
Psy1-D1i AGGAGCGGCGGCGCGCCATATGGGCCATCTACGGTAATCAATCTGGAACCTCACCATGCCTGGCTTGGAC  666
Psy1-D1j AGGAGCGGCGGCGCGCCATATGGGCCATCTACGGTAATCAATCTGGAACCTCACCATGCCTGGCTTGGAC  840

Psy1-D1a CCTCAATTGTTGCTCCCCTGTTGTAGTATCAGTATGTGTCACACAGTGTCAGTTAGTTTCAGTAATGTGA  736
Psy1-D1b CCTCCATTGTTGCTCCCCTGTTGTAGTATCAGTATGTGTCACACAGTGTCAGTTAGTTTCAGTAATGTGA  736
Psy1-D1c CCTCCATTGTTGCTCCCCTGTTGTAGTATCAGTATGTGTCACACAGTGTCAGTTAGTTTCAGTAATGTGA  736
Psy1-D1d CCTCCATTGTTGCTCCCCTGTTGTAGTATCAGTATGTGTCACACAGTGTCAGTTAGTTTCAGTAATGTGA  736
Psy1-D1e CCTCAATTGTTGCTCCCCTGTTGTAGTATCAGTATGTGTCACACAGTGTCAGTTAGTTTCAGTAATGTGA  736
Psy1-D1f CCTCAATTGTTGCTCCCCTGTTGTAGTATCAGTATGTGTCACACAGTGTCAGTTAGTTTCAGTAATGTGA  736
Psy1-D1g CCTCCATTGTTGCTCCCGTGTTGTAGTATCAGTATGTGTCACACAGTGTCAGTTAGTTTCAGTAATGTGA  736
Psy1-D1h CCTCAATTGTTGCTCCCCTGTTGTAGTATCAGTATGTGTCACACAGTGTCAGTTAGTTTCAGTAATGTGA  736
Psy1-D1i CCTCAATTGTTGCTCCCCTGTTGTAGTATCAGTATGTGTCACACAGTGTCAGTTAGTTTCAGTAATGTGA  736
Psy1-D1j CCTCAATTGTTGCTCCCCTGTTGTAGTATCAGTATGTGTCACACAGTGTCAGTTAGTTTCAGTAATGTGA  910
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Fig. A3. *(Continued)*.

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Psy1-D1a CTGAAAATGAAGCTAGTTTCATTTTCACTTCAAACCATCAGAAAGGGCATGCCCACATTTTGCATCAGTT  806
Psy1-D1b CTGAAAATGAAGCTAGTTTCATTTTCACTTCAGACCGTCAGAAAG----------------------  781
Psy1-D1c CTGAAAATGAAGCTAGTTTCATTTTCACTTCAGACCGTCAGAAAG----------------------  781
Psy1-D1d CTGAAAATGAAGCTAGTTTCATTTTCACTTCAGACCGTCAGAAAG----------------------  781
Psy1-D1e CTGAAAATGAAGCTAGTTTCATTTTCACTTCAAACCATCAGAAAGGGCATGCCCACATTTTGCATCAGTT  806
Psy1-D1f CTGAAAATGAAGCTAGTTTCATTTTCACTTCAAACCATCAGAAAGGGCATGCCCACATTTTGCATCAGTT  806
Psy1-D1g CTGAAAATGAAGCTAGTTTCATTTTCACTTCAGACCGTCAGAAAG----------------------  781
Psy1-D1h CTGAAAATGAAGCTAGTTTCATTTTCACTTCAAACCGTCAGAAAGGGCATGCCCACATTTTGCATCAGTT  806
Psy1-D1i CTGAAAATGAAGCTAGTTTCATTTTCACTTCAAACCATCAGAAAGGGCATGCCCACATTTTGCATCAGTT  806
Psy1-D1j CTGAAAATGAAGCTAGTTTCATTTTCACTTCAAACCGTCAGAAAGGGCATGCCCACATTTTGCATCAGTT  980

Psy1-D1a AAATTGCGACATATTTAACGGCAACTTGCAAGAATATTTTGAAACTCCCCAAGAAAATCGGCCACTTTTC  876
Psy1-D1b ------------------------------------------------------------------  781
Psy1-D1c ------------------------------------------------------------------  781
Psy1-D1d ------------------------------------------------------------------  781
Psy1-D1e AAATTGCGACATATTTAACGGCAACTTGCAAGAATATTTTGAAACTCCCCAAGAAAATCGGCCACTTTTC  876
Psy1-D1f AAATTGCGACATATTTAACGGCAACTTGCAAGAATATTTTGAAACTCCCCAAGAAAATCGGCCACTTTTC  876
Psy1-D1g ------------------------------------------------------------------  781
Psy1-D1h AAATTGCGACATATTTAACGGCAACTTGCAAGAATATTTTGAAACTCCCCAAGAAAATCGGCCACTTTTC  876
Psy1-D1i AAATTGCGACATATTTAACGGCAACTTGCAAGAATATTTTGAAACTCCCCAAGAAAATCGGCCACTTTTC  876
Psy1-D1j AAATTGCGACATATTTAACGGCAACTTGCAAGAATATTTTGAAACTCCCCAAGAAAATCGGCCACTTTTC 1050

Psy1-D1a AGTTAATGGTGTGAACTAGTTCTGGATGCGAATAATGGCAAATAGAAACATTGCTGAACTTCCATGCTAT  946
Psy1-D1b ------------------------------------------------------------------  781
Psy1-D1c ------------------------------------------------------------------  781
Psy1-D1d ------------------------------------------------------------------  781
Psy1-D1e AGTTAATGGTGTGAACTAGTTCTGGATGCGAATAATGGCAAATAGAAACATTGCTGAACTTCCATGCTAT  946
Psy1-D1f AGTTAATGGTGTGAACTAGTTCTGGATGCGAATAATGGCAAATAGAAACATTGCTGAACTTCCATGCTAT  946
Psy1-D1g ------------------------------------------------------------------  781
Psy1-D1h AGTTAATGGTGTGAACTAGTTCTGGATGCGAATAATGGCAAATAGAAACATTGCTGAACTTCCATGCTAT  946
Psy1-D1i AGTTAATGGTGTGAACTAGTTCTGGATGCGAATAATGGCAAATAGAAACATTGCTGAACTTCCATGCTAT  946
Psy1-D1j AGTTAATGGTGTGAACTAGTTCTGGATGCGAATAATGGCAAATAGAAACATTGCTGAACTTCCATGCTAT 1120

Psy1-D1a ATATACATAGATACAGTTAGTGAAGAATAAAGGCCTCATATAATACCTTTTTTTATATGCCATTATGTGTG 1016
Psy1-D1b -------TAATGTCAGTTAGTGAAGAATAAAGGCCTCATATAATAC-TTTTTTATAGGCCATTATGTATG  843
Psy1-D1c -------TAATGTCAGTTAGTGAAGAATAAAGGCCTCATATAATAC-TTTTTTATAGGCCATTATGTATG  843
Psy1-D1d -------TAATGTCAGTTAGTGAAGAATAAAGGCCTCATATAATAC-TTTTTTATAGGCCATTATGTATG  843
Psy1-D1e ATATACATAGATACAGTTAGTGAAGAATAAAGGCCTCATATAATACCTTTTTTTATATGCCATTATGTGTG 1016
Psy1-D1f ATATACATAGATACAGTTAGTGAAGAATAAAGGCCTCATATAATACCTTTTTTTATATGCCATTATGTGTG 1016
Psy1-D1g -------TAATGTCAGTTAGTGAAGAATAAAGGCCTCATATAATACTTTTTTTATATGCCATTATGTGTG  844
Psy1-D1h ATATACATAGATACAGTTAGTGAAGAATAAAGGCCTCATATAATACCTTTTTTTATATGCCATTATGTGTG 1016
Psy1-D1i ATATACATAGATACAGTTAGTGAAGAATAAAGGCCTCATATAATACCTTTTTTTATATGCCATTATGTGTG 1016
Psy1-D1j ATATACATAGATACAGTTAGTGAAGAATAAAGGCCTCATATAATACCTTTTTTTATATGCCATTATGTGTG 1190

Psy1-D1a GAAGCATCAAATTAGGCTTTTTGTTGGCTGAATGGCTTCAATAGGATCAAAGTACATGAGAAAAGGTTGC 1086
Psy1-D1b GAAGCATCAAATTAGGCTTTTTGTTGGCTGAATGGCTTCAATAGGATCAAAGTACATGAGAAAAGGTTGT  913
Psy1-D1c GAAGCATCAAATTAGGCTTTTTGTTGGCTGAATGGCTTCAATAGGATCAAAGTACATGAGAAAAGGTTGT  913
Psy1-D1d GAAGCATCAAATTAGGCTTTTTGTTGGCTGAATGGCTTCAATAGGATCAAAGTACATGAGAAAAGGTTGT  913
Psy1-D1e GAAGCATCAAATTAGGCTTTTTGTTGGCTGAATGGCTTCAATAGGATCAAAGTACATGAGAAAAGGTTGC 1086
Psy1-D1f GAAGCATCAAATTAGGCTTTTTGTTGGCTGAATGGCTTCAATAGGATCAAAGTACATGAGAAAAGGTTGC 1086
Psy1-D1g GAAGCATCAAATTAGGCTTTTTGTTGGCTGAATGGCTTCAATAGGATCAAAGTACATGAGAAAAGGTTGT  914
Psy1-D1h GAAGCATCAAATTAGGCTTTTTGTTGGCTGAATGGCTTCAATAGGATCAAAGTACATGAGAAAAGGTTGC 1086
Psy1-D1i GAAGCATCAAATTAGGCTTTTTGTTGGCTGAATGGCTTCAATAGGATCAAAGTACATGAGAAAAGGTTGC 1086
Psy1-D1j GAAGCATCAAATTAGGCTTTTTGTTGGCTGAATGGCTTCAATAGGATCAAAGTACATGAGAAAAGGTTGC 1260

Psy1-D1a AAGAACAAATTCCTCAAATTACTTAAGGAATGTGAATCTGAGGGTTCTGTCAGTTCTAAATGAGATATAC 1156
Psy1-D1b AAGAACAAATTCCTCAAATTACTTAAGGAGTGTGAATCTGAGG-TTCTGTCAGTTCTAAATGAGATATAC  982
Psy1-D1c AAGAACAAATTCCTCAAATTACTTAAGGAGTGTGAATCTGAGG-TTCTGTCAGTTCTAAATGAGATATAC  982
Psy1-D1d AAGAACAAATTCCTCAAATTACTTAAGGAGTGTGAATCTGAGG-TTCTGTCAGTTCTAAATGAGATATAC  982
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Psy1-D1f AAGAACAAATTCCTCAAATTACTTAAGGAATGTGAATCTGAGGGTTCTGTCAGTTCTAAATGAGATATAC 1156
Psy1-D1g AAGAACAAATTCCTCAAATTACTTAAGGAGTGTGAATCTGAGG-TTCTGTCAGTTCTAAATGAGATATAC  983
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Psy1-D1i AAGAACAAATTCCTCAAATTACTTAAGGAATGTGAATCTGAGGGTTCTGTCAGTTCTAAATGAGATATAC 1156
Psy1-D1j AAGAACAAATTCCTC--ACTACTTAAGGAATGTGAATCTGAGGGTTCTGTCAGTTCTAAATGAGATATAC 1328

Psy1-D1a TCTAGGCATCGATCACTTTCAGAATTTGATGTACAGCATCCTTTGTGCAGTGTGGTGTAGGAGGACAGAC 1226
Psy1-D1b TCTAGGCATCGATCACTTTCAGAATCTGATGTACAGCATCCTTTGTGCAGTGTGGTGTAGGAGGACAGAC 1052
Psy1-D1c TCTAGGCATCGATCACTTTCAGAATCTGATGTACAGCATCCTTTGTGCAGTGTGGTGTAGGAGGACAGAC 1052
Psy1-D1d TCTAGGCATCGATCACTTTCAGAATCTGATGTACAGCATCCTTTGTGCAGTGTGGTGTAGGAGGACAGAC 1052
Psy1-D1e TCTAGGCATCGATCACTTTCAGAATCTGATGTACAGCATCCTTTGTGCAGTGTGGTGTAGGAGGACAGAC 1226
Psy1-D1f TCTAGGCATCGATCACTTTCAGAATCTGATGTACAGCATCCTTTGTGCAGTGTGGTGTAGGAGGACAGAC 1226
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Fig. A3. *(Continued).*

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Psy1-D1g TCTAGGCATCGATCACTTTCAGAATCTGATGTACAGCATCCTTTGTGCAGTGTGGTGTAGGAGGACAGAC  1053
Psy1-D1h TCTAGGCATCGATCACTTTCAGAATCTGATGTGCAGCATCCTTTGTGCAGTGTGGTGTAGGAGGACAGAC  1226
Psy1-D1i TCTAGGCATCGATCACTTTCAGAATCTGATGTACAGCATCCTTTGTGCAGTGTGGTGTAGGAGGACAGAC  1226
Psy1-D1j TCTAGGCATCGATCACTTTCAGAATCTGATGTACAGCATCCTTTGTGCAGTGTGGTGTAGGAGGACAGAC  1398

Psy1-D1a GAGCTGGTGGACGGGCCGAACGCGTCGCACATCACGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGG  1296
Psy1-D1b GAGCTGGTGGACGGGCCGAACGCGTCGCACATCACGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGG  1122
Psy1-D1c GAGCTGGTGGACGGGCCGAACGCGTCGCACATCACGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGG  1122
Psy1-D1d GAGCTGGTGGACGGGCCGAACGCGTCGCACATCACGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGG  1122
Psy1-D1e GAGCTGGTGGACGGGCCGAACGCGTCGCACATCACGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGG  1296
Psy1-D1f GAGCTGGTGGACGGGCCGAACGCGTCGCACATCACGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGG  1296
Psy1-D1g GAGCTGGTGGACGGGCCGAACGCGTCGCACATCACGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGG  1123
Psy1-D1h GAGCTGGTGGACGGGCCGAACGCGTCGCACATCACGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGG  1296
Psy1-D1i GAGCTGGTGGACGGGCCGAACGCGTCGCACATCACGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGG  1296
Psy1-D1j GAGCTGGTGGACGGGCCAAACGCGTCGCACATCACGCCGCAGGCGCTGGACCGGTGGGAGAGGAGGCTGG  1468

Psy1-D1a AGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTCTCCGACACCATCACCAAGTTCCC  1366
Psy1-D1b AGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTCTCCGACACCATCACCAAGTTCCC  1192
Psy1-D1c AGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTCTCCGACACCATCACCAAGTTCCC  1192
Psy1-D1d AGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTCTCCGACACCATCACCAAGTTCCC  1192
Psy1-D1e AGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTCTCCGACACCATCACCAAGTTCCC  1366
Psy1-D1f AGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTCTCCGACACCATCACCAAGTTCCC  1366
Psy1-D1g AGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTCTCCGACACCATCACCAAGTTCCC  1193
Psy1-D1h AGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTCTCCGACACCATCACCAAGTTCCC  1366
Psy1-D1i AGGACCTCTTCGCCGGGCGCCCCTACGACATGCTCGACGCCGCGCTCTCCGACACCATCACCAAGTTCCC  1366
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Psy1-D1a CATAGATATTCAGGTACCAGCTTAGCCGGTGCACAATTGTTCAGTCCACATTGTATGATTCCGGTAGAAC  1436
Psy1-D1b CATAGATATTCAGGTACCAGCTTAGCCGGTGCACAATTGTTCAGTCCACATTGTATGATTCTGGTAGAAC  1262
Psy1-D1c CATAGATATTCAGGTACCAGCTTAGCCGGTGCACAATTGTTCAGTCCACATTGTATGATTCTGGTAGAAC  1262
Psy1-D1d CATAGATATTCAGGTACCAGCTTAGCCGGTGCACAATTGTTCAGTCCACATTGTATGATTCTGGTAGAAC  1262
Psy1-D1e CATAGATATTCAGGTACCAGCTTAGCCGGTGCACAATTGTTCAGTCCACATTGTATGATTCCGGTAGAAC  1436
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Psy1-D1i CATAGATATTCAGGTACCAGCTTAGCCGGTGCACAATTGTTCAGTCCACATTGTATGATTCCGGTAGAAC  1436
Psy1-D1j CATAGATATTCAGGTACCAGCTTAGCCGGTGCACAATTGTTCAGTCCACATTGTATGATTCCGGTAGAAC  1608

Psy1-D1a AGAGTGGTGGTGGATATTCCCTGTCAGCATCAGATTGCCCCTAGACCTCACAATCTAAGTGCAAGATGAC  1506
Psy1-D1b AGAGTGGTGGTGGATATTCCCTGTCAGCATCAGATTGCCCCTAGACCTCACAATCTAAGTGCAAGATGAC  1332
Psy1-D1c AGAGTGGTGGTGGATATTCCCTGTCAGCATCAGATTGCCCCTAGACCTCACAATCTAAGTGCAAGATGAC  1332
Psy1-D1d AGAGTGGTGGTGGATATTCCCTGTCAGCATCAGATTGCCCCTAGACCTCACAATCTAAGTGCAAGATGAC  1332
Psy1-D1e AGAGTGGTGGTGGATATTCCCTGTCAGCATCAGATTGCCCCTAGACCTCACAATCTAAGTGCAAGATGAC  1506
Psy1-D1f AGAGTGGTGGTGGATATTCCCTGTCAGCATCAGATTGCCCCTAGACCTCACAATCTAAGTGCAAGATGAC  1506
Psy1-D1g AGAGTGGTGGTGGATATTCCCTGTCAGCATCAGATTGCCCCTAGACCTCACAATCTAAGTGCAAGATGAC  1332
Psy1-D1h AGAGTGGTGGTGGATATTCCCTGTCAGCATCAGATTGCCCCTAGACCTCACAATCTAAGTGCAAGATGAC  1506
Psy1-D1i AGAGTGGTGGTGGATATTCCCTGTCAGCATCAGATTGCCCCTAGACCTCACAATCTAAGTGCAAGATGAC  1506
Psy1-D1j AGAGTGGTGGTGGATATTCCCTGTCAGCATCAGATTGCCCCTAGACCTCACAATCTAAGTGCAAGATGAC  1678

Psy1-D1a CAGAAAGTCCATGATTGGTCAAAATTGTTTCGTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTGTTGA  1576
Psy1-D1b CAGAAAGTCCATGATTGGTCAAAATTGTTTCGTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTGTTGA  1402
Psy1-D1c CAGAAAGTCCATGATTGGTCAAAATTGTTTCGTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTGTTGA  1402
Psy1-D1d CAGAAAGTCCATGATTGGTCAAAATTGTTTCGTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTGTTGA  1402
Psy1-D1e CAGAAAGTCCATGATTGGTCAAAATTGTTTCGTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTGTTGA  1576
Psy1-D1f CAGAAAGTCCATGATTGGTCAAAATTGTTTCGTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTGTTGA  1576
Psy1-D1g CAGAAAGTCCATGATTGGTCAAAATTGTTTCGTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTGTTGA  1402
Psy1-D1h CAGAAAGTCCATGATTGGTCAAAATTGTTTCGTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTGTTGA  1576
Psy1-D1i CAGAAAGTCCATGATTGGTCAAAATTGTTTCGTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTGTTGA  1576
Psy1-D1j CAGAAAGTCCATGATTGGTCAAAATTGTTTCGTTTGTCGGCCTTTTGTTAGTCTCTGATGCTGTTGTTGA  1748

Psy1-D1a GCCGTATGAACTTTTCACACATTGTAGTGGGGGCTTATCCAATTGACTAGACGCTATAGTGGGAATCGTC  1646
Psy1-D1b GCCGTATGAACTTTTCACACATTGTAGTGGGGGCTTATCCAATTGACTAGACGCTATAGTGGGAATCGTC  1472
Psy1-D1c GCCGTATGAACTTTTCACACATTGTAGTGGGGGCTTATCCAATTGACTAGACGCTATAGTGGGAATCGTC  1472
Psy1-D1d GCCGTATGAACTTTTCACACATTGTAGTGGGGGCTTATCCAATTGACTAGACGCTATAGTGGGAATCGTC  1472
Psy1-D1e GCCGTATGAACTTTTCACACATTGTAGTGGGGGCTTATCCAATTGACTAGACGCTATAGTGGGAATCGTC  1646
Psy1-D1f GCCGTATGAACTTTTCACACATTGTAGTGGGGGCTTATCCAATTGACTAGACGCTATAGTGGGAATCGTC  1646
Psy1-D1g GCCGTATGAACTTTTCACACATTGTAGTGGGGGCTTATCCAATTGACTAGACGCTATAGTGGGAATCGTC  1472
Psy1-D1h GCCGTATGAACTTTTCACACATTGTAGTGGGGGCTTATCCAATTGACTAGACGCTATAGTGGGAATCGTC  1646
Psy1-D1i GCCGTATGAACTTTTCACACATTGTAGTGGGGGCTTATCCAATTGACTAGACGCTATAGTGGGAATCGTC  1646
Psy1-D1j GCCGTATGAACTTTTCACACATTGTAGTGGGGGCTTATCCAATTGACTAGACGCTATAGTGGGAATCGTC  1818

Psy1-D1a TGGTCAAAGATATGTTTGATCAAAGTGGGAAAATTATAGGGAGAACTTTTCAGTAAGTATTATTCCCGAA  1716
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Fig. A3. *(Continued)*.

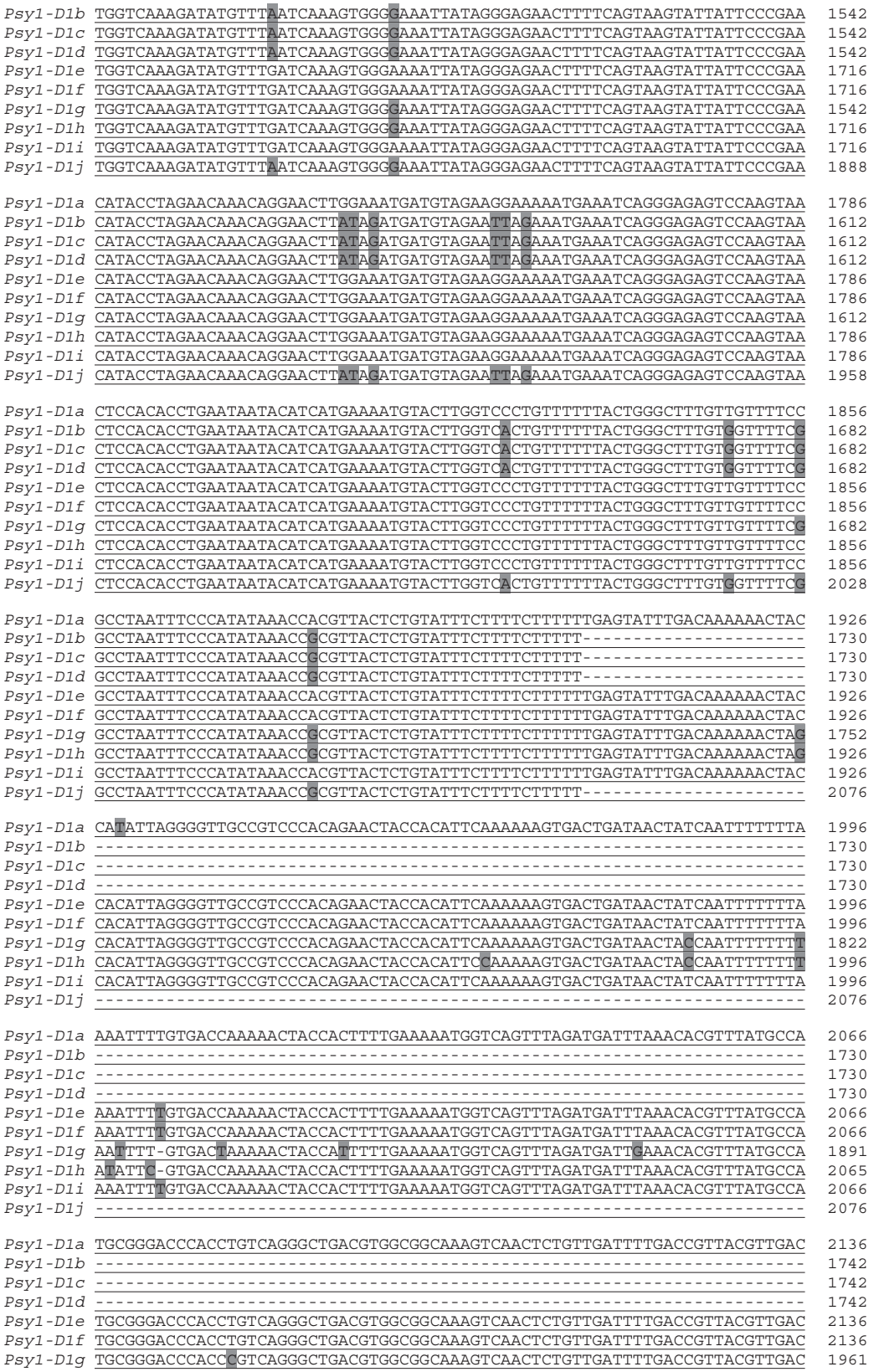

Fig. A3. *(Continued).*

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Psy1-D1h TGCGGGACCCACCCGTCAGGGCTGACGTGGCGGCAAAGTCAACTCTGTTGATTTTGACCGTTACGTTGAC  2135
Psy1-D1i TGCGGGACCCACCTGTCAGGGCTGACGTGGCGGCAAAGTCAACTCTGTTGATTTTGACCGTTACGTTGAC  2136
Psy1-D1j ------------------------------------------------------------------------  2088

Psy1-D1a CGTTATTACAAGTGGGAGCCACCTGTCAGCATCACTCTTCTTCTTCCTCCTCTCTCTCTTTTTGGCATTT  2206
Psy1-D1b ------------------------------------------------------------------------  1742
Psy1-D1c ------------------------------------------------------------------------  1742
Psy1-D1d ------------------------------------------------------------------------  1742
Psy1-D1e CGTTATTACAAGTGGGACCCACCTGTCAGCATCACTCTTCTTCTTCCTCCTCTCTCTCTTTTTGGCATTT  2206
Psy1-D1f CGTTATTACAAGTGGGACCCACCTGTCAGCATCACTCTTCTTCTTCCTCCTCTCTCTCTTTTTGGCATTT  2206
Psy1-D1g CGTTATTACAAGTGGGACCCACCTGTCAGCATCACTCTTCTTCTTCCTCCTCTCTCTCTTTTTGGCATTT  2031
Psy1-D1h CGTTATTACAAGTGGGACCCACCTGTCAGCATCACTCTTCTTCTTCCTCCTCTCTCTCTTTTTGGCATTT  2205
Psy1-D1i CGTTATTACAAGTGGGACCCACCTGTCAGCATCACTCTTCTTCTTCCTCCTCTCTCTCTTTTTGGCATTT  2206
Psy1-D1j ------------------------------------------------------------------------  2088

Psy1-D1a CCTCAAACACCTCGTGTGCACTCGCAAGGCACCTCCGTCGTCCTCAACTGTCGGCGCTCACCTCTCCCCA  2276
Psy1-D1b ------------------------------------------------------------------------  1730
Psy1-D1c ------------------------------------------------------------------------  1730
Psy1-D1d ------------------------------------------------------------------------  1730
Psy1-D1e CCTCAAACACCTCGTGTGCACTCGCAAGGCACCTCCGTCGTCCTCAACTGTCGGCGCTCACCTCTCCCCA  2276
Psy1-D1f CCTCAAACACCTCGTGTGCACTCGCAAGGCACCTCCGTCGTCCTCAACTGTCGGCGCTCACCTCTCCCCA  2276
Psy1-D1g CCTCAAACACCTCGTGTGCACTCGCAAGGCACCTCCGTCGTCCTCAACTGCCGGCGCTCACCTCTCCCCA  2101
Psy1-D1h CCTCAAACACCTCGTGTGCACTCGCAAGGCACCTCCGTCGTCCTCAACTGTCGGCGCTCACCTCTCCCCA  2275
Psy1-D1i CCTCAAACACCTCGTGTGCACTCGCAAGGCACCTCCGTCGTCCTCAACTGTCGGCGCTCACCTCTCCCCA  2276
Psy1-D1j ------------------------------------------------------------------------  2076

Psy1-D1a TGCCTCGATCCCGTCTGGATCGGGAGAGCCCAAGCTGCCCAACCACTCCGGCGACCGCCTCTCCCCCTCG  2346
Psy1-D1b ------------------------------------------------------------------------  1747
Psy1-D1c ------------------------------------------------------------------------  1747
Psy1-D1d ------------------------------------------------------------------------  1747
Psy1-D1e TGCCTCGATCCCGTCTGGATCGGGAGAGCCCAAGCTGCCCAACCACTCCGGCGACCGCCTCTCCCCCTCG  2346
Psy1-D1f TGCCTCGATCCCGTCTGGATCGGGAGAGCCCAAGCTGCCCAACCACTCCGGCGACCGCCTCTCCCCCTCG  2346
Psy1-D1g TGCCTCGATCCCGTCTGGATCGGTAGAGCCCAAGCTGCCCAACCACTCCGGCAACCGCCTCTCCCCCTCG  2171
Psy1-D1h TGCCTCGATCCCGTCTGGATCGGGAGAGCCCAAGCTGCCCAACCACTCCGGCGACCGCCTCTCCCCCTCG  2345
Psy1-D1i TGCCTCGATCCCGTCTGGATCGGGAGAGCCCAAGCTGCCCAACCACTCCGGCGACCGCCTCTCCCCCTCG  2346
Psy1-D1j ------------------------------------------------------------------------  2093

Psy1-D1a CATCACTCCAGC----------------------CCTAGCTAGTACTCGCACGCACGAACCAACCTAGCTA  2395
Psy1-D1b ------------------------------------------------------------------------  1747
Psy1-D1c ------------------------------------------------------------------------  1747
Psy1-D1d ------------------------------------------------------------------------  1747
Psy1-D1e CATCACTCCAGC----------------------CCTAGCTAGTACTCGCACGCACGAACCAACCTAGCTA  2395
Psy1-D1f CATCACTCCAGC----------------------CCTAGCTAGTACTCGCACGCACGAACCAACCTAGCTA  2395
Psy1-D1g CGTCACTCCAGCGAGGTCCTCTGCCGGTGACCACCTAGCTAGTACTCGCACGCACGAACCAACCTAGCTA  2241
Psy1-D1h CATCACTCCAGC----------------------CCTAGCTAGTACTCGCACGCACGAACCAACCTAGCTA  2394
Psy1-D1i CATCACTCCAGC----------------------CCTAGCTAGTACTCGCACGCACGAACCAACCTAGCTA  2395
Psy1-D1j ------------------------------------------------------------------------  2093

Psy1-D1a GTACTCCCACAAACCTACAACGCACGCGTACGCTCAAGCATTGGCCACTAAATTCTTGTTCAAAGAATTA  2465
Psy1-D1b ------------------------------------------------------------------------  1747
Psy1-D1c ------------------------------------------------------------------------  1747
Psy1-D1d ------------------------------------------------------------------------  1747
Psy1-D1e GTACTCCCACAAACCTACAACGCACGCGTACGCTCAAGCATTGGCCACTAAATTCTTGTTCAAAGAATTA  2465
Psy1-D1f GTACTCCCACAAACCTACAACGCACGCGTACGCTCAAGCATTGGCCACTAAATTCTTGTTCAAAGAATTA  2465
Psy1-D1g GTACTACCACAAACCTACAACGCACGCGTACGCTCAAGCATTGGCCACTAAATTCTTGTTCAAAGAATTA  2311
Psy1-D1h GTACTCCCACAAACCTACAACGCACGCGTACGCTCAAGCATTGGCCACTAAATTCTTGTTCAAAGAATTA  2464
Psy1-D1i GTACTCCCACAAACCTACAACGCACGCGTACGCTCAAGCATTGGCCACTAAATTCTTGTTCAAAGAATTA  2465
Psy1-D1j ------------------------------------------------------------------------  2093

Psy1-D1a AACGACAACACACACGCACGCTGAAGCATCGGCCTTGGTTCGAGCTACCACACGAGCTCCTGGGGCTCTT  2535
Psy1-D1b ------------------------------------------------------------------------  1747
Psy1-D1c ------------------------------------------------------------------------  1747
Psy1-D1d ------------------------------------------------------------------------  1747
Psy1-D1e AACGACAACACACACGCACGCTGAAGCATCGGCCTTGGTTCGAGCTACCACACGAGCTCCTGGGGCTCTT  2535
Psy1-D1f AACGACAACACACACGCACGCTGAAGCATCGGCCTTGGTTCGAGCTACCACACGAGCTCCTGGGGCTCTT  2535
Psy1-D1g AACGGCAACACACACGCACGCTGAAGCATCGGCGTTGGTCCGAGCTACCACACGAGCTCCTAGGGCTCTT  2381
Psy1-D1h AACGGCAACACACACGCACGCTGAAGCATCGGCCTTGGTTCGAGCTACCACACGAGCTCCTGGGGCTCTT  2534
Psy1-D1i AACGACAACACACACGCACGCTGAAGCATCGGCCTTGGTTCGAGCTACCACACGAGCTCCTGGGGCTCTT  2535
Psy1-D1j ------------------------------------------------------------------------  2093

Psy1-D1a CGTCGCCCACCTCCCGTCCTCCGTGCAGTTGCAGCCGGCGCGCGAGGCCACGGCGCCGGATGCCGCCAAG  2605
Psy1-D1b ------------------------------------------------------------------------  1747
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Fig. A3. *(Continued)*.

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Psy1-D1c ------------------------------------------------------------------------  1747
Psy1-D1d ------------------------------------------------------------------------  1747
Psy1-D1e CGTCGCCCACCTCCCGTCCTCCGTGCAGTTGCAGCCGGCGCGCGAGGCCACGGCGCCGGATGCCGCCAAG  2605
Psy1-D1f CGTCGCCCACCTCCCGTCCTCCGTGCAGTTGCAGCCGGCGCGCGAGGCCACGGCGCCGGATGCCGCCAAG  2605
Psy1-D1g CGTCGCCCACCTCCCGTCCTCCGTGCAGTTGCAGCCGGCGCGCGAGGCCACGGCGCCAGATGCCGCCAAG  2451
Psy1-D1h CGTCGCCCACCTCCCGTCCTCCGTGCAGTTGCAGCCGGCGCGCGAGGCCACGGCGCCGGATGCCGCCAAG  2604
Psy1-D1i CGTCGCCCACCTCCCGTCCTCCGTGCAGTTGCAGCCGGCGCGCGAGGCCACGGCGCCGGATGCCGCCAAG  2605
Psy1-D1j ------------------------------------------------------------------------  2093

Psy1-D1a CTCGCGCGCCTCGTCGAGGAGCTGCAAGAGCGAGAGTCCCGCCTGCACACCGACTTGCTCGAGCACAAAA  2675
Psy1-D1b ------------------------------------------------------------------------  1747
Psy1-D1c ------------------------------------------------------------------------  1747
Psy1-D1d ------------------------------------------------------------------------  1747
Psy1-D1e CTCGCGCGCCTCGTCGAGGAGCTGCAAGAGCGAGAGTCCCGCCTGCACACCGACTTGCTCGAGCACAAAA  2675
Psy1-D1f CTCGCGCGCCTCGTCGAGGAGCTGCAAGAGCGAGAGTCCCGCCTGCACACCGACTTGCTCGAGCACAAAA  2675
Psy1-D1g CTCGCGCGCCTCGTCGAGGAGCTGCAAGAGTGAGAGTCCCGCCTGCGCACCGACTTGCTCGAGCACAAAA  2521
Psy1-D1h CTCGCG---CCTTGTCGAGGAGCTGCAAGAGCGAGAGTCCCGCCTGCACACCGACTTGCTCGAGCACAAAA  2672
Psy1-D1i CTCGCGCGCCTCGTCGAGGAGCTGCAAGAGCGAGAGTCCCGCCTGCACACCGACTTGCTCGAGCACAAAA  2675
Psy1-D1j ------------------------------------------------------------------------  2093

Psy1-D1a TCCTCAAGGAGACCGTCGTCGAGGAGCTGCGTCGGGTGGTGGCGTCGACGGCCTCGGAGGAAATTTCGTC  2745
Psy1-D1b ------------------------------------------------------------------------  1747
Psy1-D1c ------------------------------------------------------------------------  1747
Psy1-D1d ------------------------------------------------------------------------  1747
Psy1-D1e TCCTCAAGGAGACCGTCGTCGAGGAGCTGCGTCGGGTGGTGGCGTCGACGGCCTCGGAGGAAATTTCGTC  2745
Psy1-D1f TCCTCAAGGAGACCGTCGTCGAGGAGCTGCGTCGGGTGGTGGCGTCGACGGCCTCGGAGGAAATTTCGTC  2745
Psy1-D1g TCCTCAAGGAGACCGTCGTCGAGGAGCTGCATCGGGTGGTGGCGTCGACGGCCTCGGAGGAAATTTCGTC  2591
Psy1-D1h TCCTCAAGGAGACCGTCGTCGAGGAGCTGCGTCGGGTGGTGGCGTCGACGGCCTCGGAGGAAATTTCGTC  2742
Psy1-D1i TCCTCAAGGAGACCGTCGTCGAGGAGCTGCGTCGGGTGGTGGCGTCGACGGCCTCGGAGGAAATTTCGTC  2745
Psy1-D1j ------------------------------------------------------------------------  2093

Psy1-D1a AGCTTCGGCGGCCGCTTCCACAGCTCCAGCCACCTTGGTTGCGCCACCGTTCCTGTCCCCAACCAACGCC  2815
Psy1-D1b ------------------------------------------------------------------------  1747
Psy1-D1c ------------------------------------------------------------------------  1747
Psy1-D1d ------------------------------------------------------------------------  1747
Psy1-D1e AGCTTCGGCGGCCGCTTCCACAGCTCCAGCCACCTTGGTTGCGCCACCGTTCCTGTCCCCAACCAACGCC  2815
Psy1-D1f AGCTTCGGCGGCCGCTTCCACAGCTCCAGCCACCTTGGTTGCGCCACCGTTCCTGTCCCCAACCAACGCC  2815
Psy1-D1g AGCTTCGGCGGCCGCTTCTACAGCTCCAGCCACCTTGGTTGCGCCACCGTTCCTGTCCCCAACCAACGCC  2661
Psy1-D1h AGCTTCGGCGGCCGCTTCCACAGCTCCAGCCACCTTGGTTGCGCCACCGTTCCTGTCCCCAACCAACGCC  2812
Psy1-D1i AGCTTCGGCGGCCGCTTCCACAGCTCCAGCCACCTTGGTTGCGCCACCGTTCCTGTCCCCAACCAACGCC  2815
Psy1-D1j ------------------------------------------------------------------------  2093

Psy1-D1a AGTGACGTGCTGCGCCGGGGCGTCACCATGGAGGAGTTCGGAGCTCAAGCCCGGATGCACACAAGGTGTT  2885
Psy1-D1b ------------------------------------------------------------------------  1747
Psy1-D1c ------------------------------------------------------------------------  1747
Psy1-D1d ------------------------------------------------------------------------  1747
Psy1-D1e AGTGACGTGCTGCGCCGGGGCGTCACCATGGAGGAGTTCGGAGCTCAAGCCCGGATGCACACAAGGTGTT  2885
Psy1-D1f AGTGACGTGCTGCGCCGGGGCGTCACCATGGAGGAGTTCGGAGCTCAAGCCCGGATGCACACAAGGTGTT  2885
Psy1-D1g AGTGACGTGCTGTGCCGGGGCGTCACCATGGAGGAGTTCGGAGCTCAAGCTCGGATGCACACAAGGTGTT  2731
Psy1-D1h AGTGACGTGCTGCGCCGGGGCGTCACCATGGAGGAGTTCGGAGCTCAAGCCCGGATGCACACAAGGTGTT  2882
Psy1-D1i AGTGACGTGCTGCGCCGGGGCGTCACCATGGAGGAGTTCGGAGCTCAAGCCCGGATGCACACAAGGTGTT  2885
Psy1-D1j ------------------------------------------------------------------------  2093

Psy1-D1a CGAGGAAATGCTAGAGAAAGGAGGAGAAAGAAGAAGAGTGATGCTGACAGGTGGGCCTCACTTGTAATAA  2955
Psy1-D1b ------------------------------------------------------------------------  1730
Psy1-D1c ------------------------------------------------------------------------  1730
Psy1-D1d ------------------------------------------------------------------------  1730
Psy1-D1e CGAGGAAATGCTAGAGAAAGGAGGAGAAAGAAGAAGAGTGATGCTGACAGGTGGGCCTCACTTGTAATAA  2955
Psy1-D1f CGAGGAAATGCTAGAGAAAGGAGGAGAAAGAAGAAGAGTGATGCTGACAGGTGGGCCTCACTTGTAATAA  2955
Psy1-D1g CGAGGAAATGCCAGAGAAAGGAGGAGAAAGAAGAAGAGTGATGCTGACAGGTGGGCCTCACTTGTAATAA  2801
Psy1-D1h CGAGGAAATGCTAGAGAAAGGAGGAGAAAGAAGAAGAGTGATGCTGACAGGTGGGCCTCACTTGTAATAA  2952
Psy1-D1i CGAGGAAATGCTAGAGAAAGGAGGAGAAAGAAGAAGAGTGATGCTGACAGGTGGGCCTCACTTGTAATAA  2955
Psy1-D1j ------------------------------------------------------------------------  2076

Psy1-D1a CGGTCAATGTAACGGTCAAAATAAACAGAGTTGACTTTGCCGCCACGTCAGCCCTGACAGGTGGGTCCCG  3025
Psy1-D1b ------------------------------------------------------------------------  1730
Psy1-D1c ------------------------------------------------------------------------  1730
Psy1-D1d ------------------------------------------------------------------------  1730
Psy1-D1e CGGTCAATGTAACGGTCAAAATAAACAGAGTTGACTTTGCCGCCACGTCAGCCCTGACAGGTGGGTCCCG  3025
Psy1-D1f CGGTCAATGTAACGGTCAAAATAAACAGAGTTGACTTTGCCGCCACGTCAGCCCTGACAGGTGGGTCCCG  3025
Psy1-D1g CGGTCAATGTAACGGTCAAAATAAACAGAGTTGACTTTGCCGCCACGTCAGCCCTGACAGGTGGGTCCCG  2871
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Fig. A3. *(Continued)*.

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Psy1-D1h CGGTCAATGTAACGGTCAAAATAAACAGAGTTGACTTTGCCGCCACGTCAGCCCTGACAGGTGGGTCCCG  3022
Psy1-D1i CGGTCAATGTAACGGTCAAAATAAACAGAGTTGACTTTGCCGCCACGTCAGCCCTGACAGGTGGGTCCCG  3025
Psy1-D1j ---------------------------------------------------------------------  2076

Psy1-D1a CATGTCCC-----------------------------------GTGGTAGTTTTTAGTCACAAAAT  3056
Psy1-D1b ---------------------------------------------------------------------  1763
Psy1-D1c ---------------------------------------------------------------------  1763
Psy1-D1d ---------------------------------------------------------------------  1763
Psy1-D1e CATGTCCC-----------------------------------GTGGTAGTTTTTAGTCACAAAAT  3056
Psy1-D1f CATGTCCC-----------------------------------GTGGTAGTTTTTAGTCACAAAAT  3056
Psy1-D1g CATGTCATAAACGTGTTTAAATCATCTAAACTGACCATTTTTCAAAAGTGGTAGTTTTTAGTCACAAAAT  2941
Psy1-D1h CATGTCCC-----------------------------------GTGGTAGTTTTTAGTCACAAAAT  3053
Psy1-D1i CATGTCCC-----------------------------------GTGGTAGTTTTTAGTCACAAAAT  3056
Psy1-D1j ---------------------------------------------------------------------  2109

Psy1-D1a TAGAAATTTTTGATAGTTATCAGTCACTTTTTTGAATGTGGTAGTTCTGTGGGACGGCAACCCCTAATGT  3126
Psy1-D1b ---------------------------------------------------------------------  1730
Psy1-D1c ---------------------------------------------------------------------  1730
Psy1-D1d ---------------------------------------------------------------------  1730
Psy1-D1e TAGAAATTTTTGATAGTTATCAGTCACTTTTTTGAATGTGGTAGTTCTGTGGGACGGCAACCCCTAATGT  3126
Psy1-D1f TAGAAATTTTTGATAGTTATCAGTCACTTTTTTGAATGTGGTAGTTCTGTGGGACGGCAACCCCTAATGT  3126
Psy1-D1g TAGAAATTTTTGGTAGTTATCAGTCACTTTTTTGAATGTGGTAGTTCTGTGGGACGGCAACCCCTAATGT  3011
Psy1-D1h TAGAAATTTTTGATAGTTATCAGTCACTTTTTTGAATGTGGTAGTTCTGTGGGACGGCAACCCCTAATGT  3123
Psy1-D1i TAGAAATTTTTGATAGTTATCAGTCACTTTTTTGAATGTGGTAGTTCTGTGGGACGGCAACCCCTAATGT  3126
Psy1-D1j ---------------------------------------------------------------------  2076

Psy1-D1a GGTAGTTTTTTGTCAAATACTCTTCTTTTTC-------------------------------------  3157
Psy1-D1b ------------------------------CTCATAGTGAAATCGGCAGTGATCCTGCCTTGCATTGTAA  1770
Psy1-D1c ------------------------------CTCATAGTGAAATCGGCAGTGATCCTGCCTTGCATTGTAA  1770
Psy1-D1d ------------------------------CTCATAGTGAAATCGGCAGTGATCCTGCCTTGCATTGTAA  1770
Psy1-D1e GGTAGTTTTTTGTCAAATACTCTTCTTTTTC-------------------------------------  3157
Psy1-D1f GGTAGTTTTTTGTCAAATACTCTTCTTTTTC-------------------------------------  3157
Psy1-D1g GGTAGTTTTTTGTCAAATACTCTTCTTTTTCTCATAGTGAAATCGGCAGTGATCCTGCCTTGCATTGTAA  3081
Psy1-D1h GGTAGTTTTTTGTCAAATACTCTTCTTTTTCTCATAGTGAAATCGGCAGTGATCCTGCCTTGCATTGTAA  3193
Psy1-D1i GGTAGTTTTTTGTCAAATACTCTTCTTTTTC-------------------------------------  3157
Psy1-D1j ------------------------------CTCATAGTGAAATCGGCAGTGATCCTGCCTTGCATTGTAA  2116

Psy1-D1a -AAAAAGGTCTTGGTCGTTCTTAGCACTACTACTTATGAACTATATTATTGATTTTCTAAATGACCAATT  3226
Psy1-D1b AAAAAAGGTCTTGGTCGTTCTTAGCACTACTACTTATGAACTATATTATTGATTTTCTAAATGACCAATT  1840
Psy1-D1c AAAAAAGGTCTTGGTCGTTCTTAGCACTACTACTTATGAACTATATTATTGATTTTCTAAATGACCAATT  1840
Psy1-D1d AAAAAAGGTCTTGGTCGTTCTTAGCACTACTACTTATGAACTATATTATTGATTTTCTAAATGACCAATT  1840
Psy1-D1e -AAAAAGGTCTTGGTCGTTCTTAGCACTACTACTTATGAACTATATTATTGATTTTCTAAATGACCAATT  3226
Psy1-D1f -AAAAAGGTCTTGGTCGTTCTTAGCACTACTACTTATGAACTATATTATTGATTTTCTAAATGACCAATT  3226
Psy1-D1g AAAAAAGGTCTTGGTCGTTCTTAGCACAACTACTTATGAACTATATTATTGATTTTCTAAATGACCAATT  3151
Psy1-D1h AAAAAAGGTCTTGGTCGTTCTTAGCACTACTACTTATGAACTATATTATTGATTTTCTAAATGACCAATT  3263
Psy1-D1i -AAAAAGGTCTTGGTCGTTCTTAGCACTACTACTTATGAACTATATTATTGATTTTCTAAATGACCAATT  3226
Psy1-D1j AAAAAAGGTCTTGGTCGTTCTTAGCACTACTA---ATGAACTATATTATTGATTTTCTAAATGACCAATT  2183

Psy1-D1a ACTTTTACATATGCCAGCCCTTCAAGGACATGATCGACGGGATGCGGACGGACCTTAAGAAGGCGAGGTA  3296
Psy1-D1b ACTTTTACATATGCCAGCCCTTCAAGGACATGATCGACGGGATGCGGACGGACCTTAAGAAGGCGAGGTA  1910
Psy1-D1c ACTTTTACATATGCCAGCCCTTCAAGGACATGATCGACGGGATGCGGACGGACCTTAAGAAGGCGAGGTA  1910
Psy1-D1d ACTTTTACATATGCCAGCCCTTCAAGGACATGATCGACGGGATGCGGACGGACCTTAAGAAGGCGAGGTA  1910
Psy1-D1e ACTTTTACATATGCCAGCCCTTCAAGGACATGATCGACGGGATGCGGACGGACCTTAAGAAGGCGAGGTA  3296
Psy1-D1f ACTTTTACATATGCCAGCCCTTCAAGGACATGATCGACGGGATGCGGACGGACCTTAAGAAGGCGAGGTA  3296
Psy1-D1g ACTTTTACATATGCCAGCCCTTCAAGGACATGATCGACGGGATGCGGACGGACCTCAAGAAGGCGAGGTA  3221
Psy1-D1h ACTTTTACATATGCCAGCCCTTCAAGGACATGATCGACGGGATGCGGACGGACCTTAAGAAGGCGAGGTA  3333
Psy1-D1i ACTTTTACATATGCCAGCCCTTCAAGGACATGATCGACGGGATGCGGACGGACCTTAAGAAGGCGAGGTA  3296
Psy1-D1j ACTTTTACATATGCCAGCCCTTCAAGGACATGATCGACGGGATGCGGACGGACCTTAAGAAGGCGAGGTA  2253

Psy1-D1a CAAGAACTTTGACGAGCTCTACATGTACTGCTACTATGTTGCCGGCACCGTGGGGTTGATGAGCGTCCCG  3366
Psy1-D1b CAAGAACTTTGACGAGCTCTACATGTACTGCTACTATGTTGCCGGCACCGTGGGGTTGATGAGCGTCCCG  1980
Psy1-D1c CAAGAACTTTGACGAGCTCTACATGTACTGCTACTATGTTGCCGGCACCGTGGGGTTGATGAGCGTCCCG  1980
Psy1-D1d CAAGAACTTTGACGAGCTCTACATGTACTGCTACTATGTTGCCGGCACCGTGGGGTTGATGAGCGTCCCG  1980
Psy1-D1e CAAGAACTTTGACGAGCTCTACATGTACTGCTACTATGTTGCCGGCACCGTGGGGTTGATGAGCGTCCCG  3366
Psy1-D1f CAAGAACTTTGACGAGCTCTACATGTACTGCTACTATGTTGCCGGCACCGTGGGGTTGATGAGCGTCCCG  3366
Psy1-D1g CAAGAACTTTGACGAGCTCTACATGTACTGCTACTATGTTGCCGGCACCGTGGGGTTGATGAGCGTCCCG  3291
Psy1-D1h CAAGAACTTTGACGAGCTCTACATGTACTGCTACTATGTTGCCGGCACCGTGGGGTTGATGAGCGTCCCG  3403
Psy1-D1i CAAGAACTTTGACGAGCTCTACATGTACTGCTACTATGTTGCCGGCACCGTGGGGTTGATGAGCGTCCCG  3366
Psy1-D1j CAAGAACTTTGACGAGCTCTACATGTACTGCTACTATGTTGCCGGCACCGTGGGGTTGATGAGCGTCCCG  2323

Psy1-D1a GTGATGGGCATTGCGCCGGAGTCCAAGGCGACAGCCGAGAGCGTCTATGGCGCCGCTCTGGCTCTTGGCC  3436
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Fig. A3. *(Continued)*.

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Psy1-D1b GTGATGGGCATTGCGCCGGAGTCCAAGGCGACAGCCGAGAGCGTCTATGGCGCCGCTCTGGCTCTTGGCC  2050
Psy1-D1c GTGATGGGCATTGCGCCGGAGTCCAAGGCGACAGCCGAGAGCGTCTATGGCGCCGCTCTGGCTCTTGGCC  2050
Psy1-D1d GTGATGGGCATTGCGCCGGAGTCCAAGGCGACAGCCGAGAGCGTCTATGGCGCCGCTCTGGCTCTTGGCC  2050
Psy1-D1e GTGATGGGCATTGCGCCGGAGTCCAAGGCGACAGCCGAGAGCGTCTATGGCGCCGCTCTGGCTCTTGGCC  3436
Psy1-D1f GTGATGGGCATTGCGCCGGAGTCCAAGGCGACAGCCGAGAGCGTCTATGGCGCCGCTCTGGCTCTTGGCC  3436
Psy1-D1g GTGATGGGCATTGCGCCGGAGTCCAAGGCGACAGCCGAGAGCGTCTATGGCGCCGCTCTGGCTCTTGGCC  3361
Psy1-D1h GTGATGGGCATTGCGCCGGAGTCCAAGGCGACAGCCGAGAGCGTCTATGGCGCCGCTCTGGCTCTTGGCC  3473
Psy1-D1i GTGATGGGCATTGCGCCGGAGTCCAAGGCGACAGCCGAGAGCGTCTATGGCGCCGCTCTGGCTCTTGGCC  3436
Psy1-D1j GTGATGGGCATTGCGCCGGAGTCCAAGGCGACAGCCGAGAGCGTCTATGGCGCCGCTCTGGCTCTTGGCC  2393

Psy1-D1a TCGCGAACCAGCTCACCAACATACTCAGGGATGTTGGAGAAGAGTAAGCAACTCATTGACTACCAATGCA  3506
Psy1-D1b TCGCGAACCAGCTCACCAACATACTCAGGGATGTTGGAGAAGAGTAAGCAACTCATTGACTACCAATGCA  2120
Psy1-D1c TCGCGAACCAGCTCACCAACATACTCAGGGATGTTGGAGAAGAGTAAGCAACTCATTGACTACCAATGCA  2120
Psy1-D1d TCGCGAACCAGCTCACCAACATACTCAGGGATGTTGGAGAAGAGTAAGCAACTCATTGACTACCAATGCA  2120
Psy1-D1e TCGCGAACCAGCTCACCAACATACTCAGGGATGTTGGAGAAGAGTAAGCAACTCATTGACTACCAATGCA  3506
Psy1-D1f TCGCGAACCAGCTCACCAACATACTCAGGGATGTTGGAGAAGAGTAAGCAACTCATTGACTACCAATGCA  3506
Psy1-D1g TCGCGAACCAGCTCACCAACATACTCAGGGATGTTGGAGAAGAGTAAGCAACTCATTGACTACCAATGCA  3431
Psy1-D1h TCGCGAACCAGCTCACCAACATACTCAGGGATGTTGGAGAAGAGTAAGCAACTCATTGACTACCAATGCA  3543
Psy1-D1i TCGCGAACCAGCTCACCAACATACTCAGGGATGTTGGAGAAGAGTAAGCAACTCATTGACTACCAATGCA  3506
Psy1-D1j TCGCGAACCAGCTCACCAACATACTCAGGGATGTTGGAGAAGAGTAAGCAACTCATTGACTACCAATGCA  2463

Psy1-D1a ATTGCAGTGCAATGGTTTTCCATTGTACAATCATGATACGGATATTTTCAGATAGCACTATCCTGAATTT  3576
Psy1-D1b ATTGCAGTGCAATGGTTTTCCATTGTACAATCATGATATGGATATTTTCAGATAGCACTATCCTGAATTT  2190
Psy1-D1c ATTGCAGTGCAATGGTTTTCCATTGTACAATCATGATATGGATATTTTCAGATAGCACTATCCTGAATTT  2190
Psy1-D1d ATTGCAGTGCAATGGTTTTCCATTGTACAATCATGATATGGATATTTTCAGATAGCACTATCCTGAATTT  2190
Psy1-D1e ATTGCAGTGCAATGGTTTTCCATTGTACAATCATGATACGGATATTTTCAGATAGCACTATCCTGAATTT  3576
Psy1-D1f ATTGCAGTGCAATGGTTTTCCATTGTACAATCATGATACGGATATTTTCAGATAGCACTATCCTGAATTT  3576
Psy1-D1g ATTGCAATGCAATGGTTTTCCATTGTACAATCATTATATGGATATTTTCAGATAGCACTATCCTGAATTT  3501
Psy1-D1h ATTGCAGTGCAATGGTTTTCCATTGTACAATCATGATACGGATATTTTCAGATAGCACTATCCTGAATTT  3613
Psy1-D1i ATTGCAGTGCAATGGTTTTCCATTGTACAATCATGATACGGATATTTTCAGATAGCACTATCCTGAATTT  3576
Psy1-D1j ATTGCAGTGCAATGGTTTTCCATTGTACAATCATGATACGGATATTTTCAGATAGCACTATCCTGAATTT  2533

Psy1-D1a TCTGGTGTTTGGAATAATTTGCAGTGCAAGAAGAGGGAGGATATATTTGCCACAAGACGAGCTTGCGGAG  3646
Psy1-D1b TCTGGTGTTTGGAATAATTTGCAGTGCAAGAAGAGGGAGGATATATTTGCCACAAGACGAGCTTGCGGAG  2260
Psy1-D1c TCTGGTGTTTGGAATAATTTGCAGTGCAAGAAGAGGGAGGATATATTTGCCACAAGACGAGCTTGCGGAG  2260
Psy1-D1d TCTGGTGTTTGGAATAATTTGCAGTGCAAGAAGAGGGAGGATATATTTGCCACAAGACGAGCTTGCGGAG  2260
Psy1-D1e TCTGGTGTTTGGAATAATTTGCAGTGCAAGAAGAGGGAGGATATATTTGCCACAAGACGAGCTTGCGGAG  3646
Psy1-D1f TCTGGTGTTTGGAATAATTTGCAGTGCAAGAAGAGGGAGGATATATTTGCCACAAGACGAGCTTGCGGAG  3646
Psy1-D1g TCTGGTGTTTGGAATAATTTGCAGTGCAAGAAGAGGGAGGATATATTTACCACAAGACGAGCTTGCGGAG  3571
Psy1-D1h TCTGGTGTTTGGAATAATTTGCAGTGCAAGAAGAGGGAGGATATATTTGCCACAAGACGAGCTTGCGGAG  3683
Psy1-D1i TCTGGTGTTTGGAATAATTTGCAGTGCAAGAAGAGGGAGGATATATTTGCCACAAGACGAGCTTGCGGAG  3646
Psy1-D1j TCTGGTGTTTGGAATAATTTGCAGTGCAAGAAGAGGGAGGATATATTTGCCACAAGACGAGCTTGCGGAG  2603

Psy1-D1a GCGGGGCTCTCCGATGAAGACATCTTCAAAGGAGTCGTCACCGACAAGTGGAGGAAATTCATGAAGAGGC  3716
Psy1-D1b GCGGGGCTCTCCGATGAAGACATCTTCAAAGGAGTCGTCACCGACAAGTGGAGGAAATTCATGAAGAGGC  2330
Psy1-D1c GCGGGGCTCTCCGATGAAGACATCTTCAAAGGAGTCGTCACCGACAAGTGGAGGAAATTCATGAAGAGGC  2330
Psy1-D1d GCGGGGCTCTCCGATGAAGACATCTTCAAAGGAGTCGTCACCGACAAGTGGAGGAAATTCATGAAGAGGC  2330
Psy1-D1e GCGGGGCTCTCCGATGAAGACATCTTCAAAGGAGTCGTCACCGACAAGTGGAGGAAATTCATGAAGAGGC  3716
Psy1-D1f GCGGGGCTCTCCGATGAAGACATCTTCAAAGGAGTCGTCACCGACAAGTGGAGGAAATTCATGAAGAGGC  3716
Psy1-D1g GCGGGGCTCTCCGATGAAGACATCTTCAAAGGAGTCGTCACCGACAAGTGGAGGAAATTCATGAAGAGGC  3641
Psy1-D1h GCGGGGCTCTCCGATGAAGACATCTTCAAAGGAGTCGTCACCGACAAGTGGAGGAAATTCATGAAGAGGC  3753
Psy1-D1i GCGGGGCTCTCCGATGAAGACATCTTCAAAGGAGTCGTCACCGACAAGTGGAGGAAATTCATGAAGAGGC  3716
Psy1-D1j GCGGGGCTCTCCGATGAAGACATCTTCAAAGGAGTCGTCACCGACAAGTGGAGGAAATTCATGAAGAGGC  2673

Psy1-D1a AGATCAAGAGGGCGAGGATGTTCTTCGAGGAGGCGGAGCGAGGGGTGACTGAGCTTAGGAAGGAGAGCCG  3786
Psy1-D1b AGATCAAGAGGGCGAGGATGTTCTTCGAGGAGGCGGAGCGAGGGGTGACTGAGCTTAGGAAGGAGAGCCG  2400
Psy1-D1c AGATCAAGAGGGCGAGGATGTTCTTCGAGGAGGCGGAGCGAGGGGTGACTGAGCTTAGGAAGGAGAGCCG  2400
Psy1-D1d AGATCAAGAGGGCGAGGATGTTCTTCGAGGAGGCGGAGCGAGGGGTGACTGAGCTTAGGAAGGAGAGCCG  2400
Psy1-D1e AGATCAAGAGGGCGAGGATGTTCTTCGAGGAGGCGGAGCGAGGGGTGACTGAGCTTAGGAAGGAGAGCCG  3786
Psy1-D1f AGATCAAGAGGGCGAGGATGTTCTTCGAGGAGGCGGAGCGAGGGGTGACTGAGCTTAGGAAGGAGAGCCG  3786
Psy1-D1g AGATCAAGAGGGCGAGGATGTTCTTTGAGGAGGCGGAGCGAGGGGTGACTGAGCTTAGGAAGGAGAGCCG  3711
Psy1-D1h AGATCAAGAGGGCGAGGATGTTCTTCGAGGAGGCGGAGCGAGGGGTGACTGAGCTTAGGAAGGAGAGCCG  3823
Psy1-D1i AGATCAAGAGGGCGAGGATGTTCTTCGAGGAGGCGGAGCGAGGGGTGACTGAGCTTAGGAAGGAGAGCCG  3786
Psy1-D1j AGATCAAGAGGGCGAGGATGTTCTTCGAGGAGGCGGAGCGAGGGGTGACTGAGCTTAGGAAGGAGAGCCG  2743

Psy1-D1a GTGGCCGGTAAGTGCCCTAAAGCCACGACTTGAATGTGAAACAAAACTACATATAGATCTCTCATCATTG  3856
Psy1-D1b GTGGCCGGTAAGTGCCCTAAAGCCACGACTTGAATGTGAAACAAAACTACATATAGATCTCTCGTCATTG  2470
Psy1-D1c GTGGCCGGTAAGTGCCCTAAAGCCACGACTTGAATGTGAAACAAAACTACATATAGATCTCTCGTCATTG  2470
Psy1-D1d GTGGCCGGTAAGTGCCCTAAAGCCACGACTTGAATGTGAAACAAAACTACATATAGATCTCTCGTCATTG  2470
Psy1-D1e GTGGCCGGTAAGTGCCCTAAAGCCACGACTTGAATGTGAAACAAAACTACATATAGATCTCTCATCATTG  3856
Psy1-D1f GTGGCCGGTAAGTGCCCTAAAGCCACGACTTGAATGTGAAACAAAACTACATATAGATCTCTCATCATTG  3856
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Fig. A3. *(Continued)*.

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Psy1-D1g GTGGCCGGTAAGTGCCCTATAGCCACGACTTGGATGTGAAACAAAACTACATATAGATCTCTCATCATTG  3781
Psy1-D1h GTGGCCGGTAAGTGCCCTAAAGCCACGACTTGAATGTGAAACAAAACTACATATAGATCTCTCATCATTG  3893
Psy1-D1i GTGGCCGGTAAGTGCCCTAAAGCCACGACTTGAATGTGAAACAAAACTACATATAGATCTCTCATCATTG  3856
Psy1-D1j GTGGCCGGTAAGTGCCCTAAAGCCACGACTTGAATGTGAAACAAAACTACATATAGATCTCTCATCATTG  2813

Psy1-D1a TTAATTATCAGTAGCAAAAATGATGCTACGTGTAGTTCATGGGGGGTCGCCTCCCACACCTTGGTATAAT  3926
Psy1-D1b TTAATTATCAGTAGCAAAAATGATGCTACGTGTAGTTCATGGGGGGTCGCCTCCCCCACCTTGGTATAAT  2540
Psy1-D1c TTAATTATCAGTAGCAAAAATGATGCTACGTGTAGTTCATGGGGGGTCGCCTCCCCCACCTTGGTATAAT  2540
Psy1-D1d TTAATTATCAGTAGCAAAAATGATGCTACGTGTAGTTCATGGGGG-TCGCCTCCCCCACCTTGGTATAAT  2539
Psy1-D1e TTAATTATCAGTAGCAAAAATGATGCTACGTGTAGTTCATGGGGGGTCGCCTCCCACACCTTGGTATAAT  3926
Psy1-D1f TTAATTATCAGTAGCAAAAATGATGCTACGTGTAGTTCATGGGGGGTCGCCTCCCACACCTTGGTATAAT  3926
Psy1-D1g TTAATTATCAGTAGCAAAAATGATGCTACGTGTAGTTCATGGGGGGTCGCCTCCCCCACCTTGGTATAAT  3851
Psy1-D1h TTAATTATCAGTAGCAAAAATGATGCTACGTGTAGTTCATGGGGGGTCGCCTCCCCCACCTTGGTATAAT  3963
Psy1-D1i TTAATTATCAGTAGCAAAAATGATGCTACGTGTAGTTCATGGGGGGTCGCCTCCCACACCTTGGTATAAT  3926
Psy1-D1j TTAATTATCAGTAGCAAAAATGATGCTACGTGTAGTTCATGGGGGGTCGCCTCCCCCACCTTGGTATAAT  2883

Psy1-D1a AATCATTGAAAAAAAATTAGGGGCTCAAATGGAAGATAATATGGTTTTGCATTGCATTGCAATTGCAGGT  3996
Psy1-D1b AATCATTGAAAAAAAATTAGGGGCTCAAATGGAAGATAATATGGTTT-GCATTGCATTGCAATTGTAGGT  2609
Psy1-D1c AATCATTGAAAAAAAATTAGGGGCTCAAATGGAAGATAATATGGTTT-GCATTGCATTGCAATTGTAGGT  2609
Psy1-D1d AATCATTGAAAAAAAATTAGGGGCTCAAATGGAAGATAATATGGTTT-GCATTGCATTGCAATTGTAGGT  2608
Psy1-D1e AATCATTGAAAAAAAATTAGGGGCTCAAATGGAAGATAATATGGTTTTGCATTGCATTGCAATTGCAGGT  3996
Psy1-D1f AATCATTGAAAAAAAATTAGGGGCTCAAATGGAAGATAATATGGTTTTGCATTGCATTGCAATTGCAGGT  3996
Psy1-D1g AATCATTGAAAAAAAATTAGGGGCTCAAATGGAAGATAATATGGTTTTGCATTGCATTGCAATTGCAGGT  3921
Psy1-D1h AATCATTGAAAAAAAATTAGGGGCTCAAATGGAAGATAATATGGTTTTGCATTGCATTGCAATTGCAGGT  4033
Psy1-D1i AATCATTGAAAAAAAATTAGGGGCTCAAATGGAAGATAATATGGTTTTGCATTGCATTGCAATTGCAGGT  3996
Psy1-D1j AATCATTGAAAAAAAATTAGGGGCTCAAATGGAAGATAATATGGTTTTGCATTGCATTGCAATTGCAGGT  2953

Psy1-D1a TTGGGCCTCTCTGTTGTTGTACCGGCAGATCCTCGATGAGATCGAAGCGAATGACTACAACAACTTCACC  4066
Psy1-D1b TTGGGCCTCTCTGTTGTTGTACCGGCAGATCCTCGATGAGATCGAAGCGAATGACTACAACAACTTCACC  2679
Psy1-D1c TTGGGCCTCTCTGTTGTTGTACCGGCAGATCCTCGATGAGATCGAAGCGAATGACTACAACAACTTCACC  2679
Psy1-D1d TTGGGCCTCTCTGTTGTTGTACCGGCAGATCCTCGATGAGATCGAAGCGAATGACTACAACAACTTCACC  2678
Psy1-D1e TTGGGCCTCTCTGTTGTTGTACCGGCAGATCCTCGATGAGATCGAAGCGAATGACTACAACAACTTCACC  4066
Psy1-D1f TTGGGCCTCTCTGTTGTTGTACCGGCAGATCCTCGATGAGATCGAAGCGAATGACTACAACAACTTCACC  4066
Psy1-D1g TTGGGCCTCTCTGTTGTTGTACCGGCAGATCCTCGATGAGATCGAAGCGAATGACTACAACAACTTCACC  3991
Psy1-D1h TTGGGCCTCTCTGTTGTTGTACCGGCAGATCCTCGATGAGATCGAAGCGAATGACTACAACAACTTCACC  4103
Psy1-D1i TTGGGCCTCTCTGTTGTTGTACCGGCAGATCCTCGATGAGATCGAAGCGAATGACTACAACAACTTCACC  4066
Psy1-D1j TTGGGCCTCTCTGTTGTTGTACCGGCAGATCCTCGATGAGATCGAAGCGAATGACTACAACAACTTCACC  3023

Psy1-D1a AAGAGGGCCTATGTTGGGAAGGCGAAGAAGGTGCTTGCGCTCCCTGTCGCGTACGGGAGATCGCTGCTCT  4136
Psy1-D1b AAGAGGGCCTATGTTGGAAAGGCGAAGAAGGTGCTTGCGCTCCCTGTCGCGTACGGGAGATCGCTGCTCT  2749
Psy1-D1c AAGAGGGCCTATGTTGGGAAGGCGAAGAAGGTGCTTGCGCTCCCTGTCGCGTACGGGAGATCGCTGCTCT  2749
Psy1-D1d AAGAGGGCCTATGTTGGGAAGGCGAAGAAGGTGCTTGCGCTCCCTGTCGCGTACGGGAGATCGCTGCTCT  2748
Psy1-D1e AAGAGGGCCTATGTTGGGAAGGCGAAGAAGGTGCTTGCGCTCCCTGTCGCGTACGGGAGATCGCTGCTCT  4136
Psy1-D1f AAGAGGGCCTATGTTGGGAAGGCGAAGAAGGTGCTTGCGCTCCCTGTCGCGTACGGGAGATCGCTGCTCT  4136
Psy1-D1g AAGAGGGCCTATGTTGGGAAGGCGAAGAAGGTGCTTGCGCTCCCTGTCGCGTACGGGAGATCGCTGCTCT  4061
Psy1-D1h AAGAGGGCCTATGTTGGGAAGGCGAAGAAGGTGCTTGCGCTCCCTGTCGCGTACGGGAGATCGCTGCTCT  4173
Psy1-D1i AAGAGGGCCTATGTTGGGAAGGCGAAGAAGGTGCTTGCGCTCCCTGTCGCGTACGGGAGATCGCTGCTCT  4136
Psy1-D1j AAGAGGGCCTATGTTGGGAAGGCGAAGAAGGTGCTTGCGCTCCCTGTCGCGTACGGGAGATCGCTGCTCT  3093

Psy1-D1a TACCGTATTCACTGAGAAATAACCAGACCTAG                                        4168
Psy1-D1b TACCGTATTCACTGAGAAATAACCAGACCTAG                                        2781
Psy1-D1c TACCGTATTCACTGAGAAATAACCAGACCTAG                                        2781
Psy1-D1d TACCGTATTCACTGAGAAATAACCAGACCTAG                                        2780
Psy1-D1e TACCGTATTCACTGAGAAATAACCAGACCTAG                                        4168
Psy1-D1f TACCGTATTCACTGAGAAATAACCAGACCTAG                                        4168
Psy1-D1g TACCGTATTCACTGAGAAATAACCAGACCTAG                                        4093
Psy1-D1h TACCGTATTCACTGAGAAATAACCAGACCTAG                                        4205
Psy1-D1i TACCGTATTCACTGAGAAATAACCAGACCTAG                                        4168
Psy1-D1j TACCGTATTCACTGAGAAATAACCAGACCTAG                                        3125
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Fig. A3. *(Continued)*.