Supplementary material:

Table 1: Reduction	in redundancy				
Total no. of ESTs	No. of ESTs forming contigs (%)	No. of contigs	No. of singletons (%)	No. of assembled sequences	Reduction in Redundancy (%)
25,495	22652 (88.84%)	2843	7001 (27.46%)	9844	61.39%

 Table 2: Gene ontology based functional annotation and classification of Contigs-SSRs of Humulus Lupulus.

Gene ontology (Biological process)	SSRESTs (numbers)	Gene ontology (Molecular function)	SSR-ESTS (number)	GeneOntology(Cellular Component)	SSRESTs (numbers)
Abscisic acid biosynthetic process	1	Acetate-coa ligase activity	1	Actin cytoskeleton	1
Abscisic acid mediated signalling pathway	2	Acetolactate synthase activity	1	Anchored to membrane	1
Acetyl-coa biosynthetic process from pyruvate	2	Acid phosphatase activity	1	Apoplast	18
Actin filament depolymerization	1	Acyl carrier activity	2	ATP binding cassette transporter	1
Actin nucleation	1	Acyl-coa dehydrogenase activity	1	Catalytic activity	1
Actin polymerization	1	Adenylylsulfate kinase activity	3	Cell plate	1
Activation of protein kinase C activity by GPCR	1	Alanine-glyoxylate transaminase activity	1	Cell surface	1
Aerobic respiration	3	Alcohol dehydrogenase(nad) activity	1	Cell wall	43
Aging	2	Allene-oxide cyclase activity	1	Central vacuole	2
	2		2		73
Amino acid transport		Alpha-amylase activity		Chloroplast	
Ammonia assimilation cycle	3	Alpha-galactosidase activity	1	Chloroplast envelope	2
Anther dehiscence	2	Amino acid transmembrane transporter	3	Chloroplast photosystem II	5
Anthocyanin metabolic process	1	Amino acid binding	2	Chloroplast thykaloid membrane	6
Anti-apoptosis	1	Ammonia-lysate activity	1	CUL4 RING ubiquitin ligase complex	1
Arginine process to glutamate	1	Anchored to membrane	1	Cytoplasm	12
Aromatic amino acid family biosynthetic process	2	Antioxidant activity	1	Cytoplasmic large ribosomal unit	6
Asparagine biosynthetic process	2	Aspargine synthase	1	Cytosol	56
ATP biosynthetic process	1	Atp binding	28	Cytosolic large ribosomal unit	10
ATP synthesis coupled proton transport	14	Atpase activity	9	Cytosolic small ribosomal subunit	8
	3		1	-	1
Auxin mediated signalling		Beta-amylase activity		Early endosome membrane	
Auxin polar transport	2	Beta-galactosidase activity	1	Endomembrane system	33
Base-excision repair	1	Binding	6	Endoplasmic reticulum	10
Brassinosteroid biosynthetic process	11	Caffeate o-methyltransferase activity	2	Extracellular region	1
Calcium mediated signalling	6	Calcium channel activity	1	Extrinisic to membrane	1
Carbohydrate biosynthetic process	1	Calcium ion binding	5	Extrinsic to vaculor membrane	1
Carbohydrate metabolic process	6	Calmodulin binding	5	Integral to membrane	3
Carboxylic acid metabolic process	1	Carbohydrate transporter	1	Intracellular	2
Carotenoid biosynthetic process	3	Carbon sulfur lyase activity	2	Intrinsic to endoplasmic reticulum	1
Cell death	1	Carboxypeptidase activity	1	Membrane	8
	1		6		7
Cell proliferation		Catalytic activity		Mitochondrial respiratory complex	
Cell redox homeostatis	7	Cellulose synthase activity	2	Mitochondrion	8
Cell wall loosening	1	Chalcone isomerase activity	2	Nuclear envelope	1
Cell wall modification	3	Chaperone binding	1	Nuclear speck	2
Cell wall organization	2	Chitin binding	1	Nucleic acid binding	1
Cell wall thickening	1	Chitinase activity	1	Nucleolus	3
Cellular copper ion homeostatis	1	Chloroallyl aldehyde dehydrogenase	2	Nucleosome	1
Cellular iron homeostatsis	1	Chlorophyll binding	1	Nucleus	15
Cellular metabolic process	1	Chromatin dna binding	1	Peroxisome	1
Cellular respiration	1	Cobalt ion binding	1	Plasma membrane	2
-	2	-	1		1
Cellular response to cold		Conjugate hydrolase activity		Plastid large ribosomal unit	-
Cellular response to ethylene stimulus	1	Copper chaperone activity	4	SCAR complex	1
Cellular response to fatty acid	1	Copper ion binding	9	Vacuole	3
Cellular response to nitrogen starvation	1	Cyclic nucleotide binding	2		
Cellular response to phosphate starvation	1	Cyclin-dependent protein kinase reg.	1		
Cellular response to selenium ion	3	Cystathionine beta-lyase activity	1		
Cellular response to water deprivation	2	Cysteine synthase activity	1		
Chlorophyll biosynthetic process	2	Cysteine-type endopeptidase activity	2		
Chloroplast thylakoid membrane	1	Cytochrome-b5 reductase activity	2		
	3	Diacylglycerol kinase activity	1		
Cinnamic acid biosynthetic process					
Copper ion transport	1	Dihydrolate reductase activity	1		
Cytokinesis	1	Dna binding	15		
De-etiolation	1	Dna photolyase activity	1		
Defense response	3	Dna-directed rna polymerase activity	2		
Defense response to bacterium	4	Double-stranded rna binding	4		
Development process	2	Electron carrier activity	5		
DNA duplex unwinding	1	Endopeptidase inhibitor activity	1		
DNA mediated transformation	1	Enzyme inhibitor activity	1		
DNA repair	1	Epoxide hydrolase activity	1		
•			1		
Double-strand break repair	1	Fatty-acyl-coa binding			
Embroyo development in seed dormancy	14	Fatty-acyl-coa reductase activity	1		
Endocytic recycling	1	Fk506 binding	1		
Entrainment of circadian clock	1	Flavin adenine dinucleoide binding	1		
Ethylene biosynthetic process	1	Glutamate synthase(nadh) activity	2		
Extracellular transport	1	Glutathione transferase activity	1		
	1	Glycerol-3-phosphate o-acytransferase	1		
Fatty acid beta-oxidation					
-			8		
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Gene ontology(Biological process)	SSR-ESTs (numbers)	Gene ontology(Molecular function)	SSR-ESTS (numbers)	Gene ontology (Cellular component)	SSR-EST (numbers
Abscisic acid mediated signalling pathway	3	Acetate-coa ligase activity	1	Anchored to membrane	4
Acetate metabolic process	1	Acetolactate synthase activity	1	Apoplast	14
Actin cytoskeleton organization	3	Acid phosphatase activity	1	Axon	1
Activation of protein kinase C	1	Acyl carrier activity	2	CCAAT-binding factor complex	1
Aerenchyma formation	1	Acyl-coa dehydrogenase activity	1	Cell surface	1
Aerobic respiration	1	Adenylylsulfate kinase activity	3 1	Cell wall	23
Aging	4	Alanine-glyoxylate transaminase activity	1	Cellular bud neck	1 78
Aluminium ion transport		Alcohol dehydrogenase(nad) activity	1	Chloroplast	
Amino acid catabolic process	1	Allene-oxide cyclase activity	2	Chloroplast photosystem II	6
Amino acid import Amino acid tansport	1	Alpha-amylase activity	1	Chloroplast stroma	1
	1 2	Alpha-galactosidase activity Amino acid transmembrane transporter	3	Chloroplast stromal thylakoid	1
Ammonia assimilation cycle	2		2	Chloroplast thylakoid lumen Chromosome	2
Anther dehiscence	1	Amino acid binding Ammonia-lysate activity	1	Clathrin vesicle coat	1
Anti-apoptosis					
Aspargine biosynthetic process	1	Anchored to membrane	1	CUL4 RING ubiquitin ligase complex	2
ATP synthesis coupled proton	4	Antioxidant activity	1	Cytoplasm	21
Auxin mediated signaling pathway	3	Aspargine synthase	1	Cytosol	38
Auxin polar transport		Atp binding	28 9	Cytosolic large ribosomal subunit	6
Biosynthetic process	4	Atpase activity		Cytosolic small ribosomal subunit	5
Branched chain family amino acid biosynthetic	1	Beta-amylase activity	1	DNA-directed RNA polymerase II,core	1
Brassinosteroid biosynthetic process	5	Beta-galactosidase activity	1	Endosome membrane	4
Brassinosteroid mediated signalling pathway	3	Binding	6	Extracellular space	3
Cadmium ion transport	1	Caffeate o-methyltransferase activity	2	FACT complex	1
Calcium-mediated signalling	5	Calcium channel activity	1	Golgi membrane	4
Carbohydrate ,metabolic process	1	Calcium ion binding	5	Integral to membrane	4
Carbohydrate biosynthetic process	1	Calmodulin binding	5	Intracelluar	4
Carbohydrate metabolic process	7	Carbohydrate tranmembrane transporter	1	Intracellular cyclic nucleotide activated	1
Carbohydrate transport	2	Carbon sulfur lyase activity	2	Membrane	11
Carbon fixation	1	Carboxypeptidase activity	1	Mitochondrial matrix	2
Carboxylic acid metabolic process	1	Catalytic activity	6	Mitochondrial respiratory chain comp.	5
Carotene catabolic process	1	Cellulose synthase activity	2	Mitochondrion	12
Cation transport	1	Chalcone isomerase activity	2	Nuclear speck	2
Cell death	1	Chaperone binding	1	Nucleus	35
Cell fate specification	2	Chitin binding	1	Peroxisome	1
Cell fate specification	1	Chitinase activity	1	Plant-type cell wall	3
Cell redox homeostasis	3	Chloroallyl aldehyde dehydrogenase	2	Plasma membrane	21
Cell tip growth	1	Chlorophyll binding	1	Plasmodesma	4
Cell wall modification	1	Chromatin dna binding	1	Plastid	1
Cell wall thickening	3	Cobalt ion binding	1	Serine/threonine phosphatase complex	3
Cellular iron ion homeostatis	7	Conjugate hydrolase activity	1	Ubiquitin-protein ligase activity	2
Cellular localization	1	Copper chaperone activity	4	Vacuole membrane	2
Cellular metabolic process	3	Copper ion binding	9	1,3-beta-D-glucan synthase complex	1
Cellular respiration	1	Cyclic nucleotide binding	2		
Cellular response to cold	1	Cyclin-dependent protein kinase regulator	1		
Cellular response to ethylene stimulus	5	Cystathionine beta-lyase activity	1		
Cellular response to hydrogen peroxide	1	Cysteine synthase activity	1		
Cellular response to iron ion	1	Cysteine-type endopeptidase activity	2		
Cellular response to nitrogen starvation	1	Cytochrome-b5 reductase activity	2		
Cellular response to phosphate starvation	1	Diacylglycerol kinase activity	1		
Cellular respose to sulfate starvation	1	Dihydrolate reductase activity	1		
Chlorophyll biosynthetic process	1	Dna binding	15		
Chloroplast organization	3	Dna photolyase activity	1		
Cholestrol metabolic process	1	Dna-directed rna polymerase activity	2		
Coenzyme A biosynthetic process	1	Double-stranded rna binding	4		
Cold acclimation	1	Electron carrier activity	5		
Cotyledon development	2	Endopeptidase inhibitor activity	1		
Cyanide catabolic process	2	Enzyme inhibitor activity	1		
Cytochrome complex assembly	1	Epoxide hydrolase activity	1		
Cytochrome complex assembly	1	Fatty-acyl-coa binding	1		
Cytokinin transport	1	Fatty-acyl-coa reductase activity	1		
De-etiolation	1	Fk506 binding	1		
	1	FR506 binding Flavin adenine dinucleoide binding	1		
Defense response Defense response to bacterium	2 8	Glutamate synthase(nadh) activity	1 2		
Defense response to bacterium	8		2		
Defense response to fungus	2	Glutathione transferase activity	1		
Defense response to insect		Glycerol-3-phosphate o-acytransferase	8		
DNA duplex unwinding	1	Gtp binding Homo binding			
DNA repair	2	Heme binding	6 1		
DNA replication	1	Histidine-trna ligase activity	-		
DNA topological change	1	Hydrogen ion transporting atp synthase	4		
Electron transport chain	1	Hydrolase activity	1		
Embroyo development	5	Inorganic anion transporter activity	1		
Embroyo development ending in seed dormancy	6	Intracellular cyclic nucleotide activated	1		
Embryo sac development	1	Inositol monophosphatase activity	1		
Endocytic recyling	2	Isopentenyl-diphosphate delta-isomerase	1		
Entrainment of circadian clock	1	Kinase activity	4		
Establishment of cell polarity	5	Lipase activity	1		
Ethylene mediated signalling pathway	1	Lipid binding	5		
Far-red light signalling pathway	1	Lipoxygenase activity	1		
Fatty acid biosynthetic process	3	L-malate dehydrogenase activity	1		
Fatty acid metabolic process	1	Long-chain fatty acid-coa ligase activity	1		
Fatty-acyl-coa biosynthetic process	1	L-tyrosine:2-oxoglutarate aminotransferase	1		
Flavonoid biosynthetic process	5	Manganese ion binding	6		
G1 phase of mitotic cell cycle	1	Map kinase activity	1		
Growth	1	Metal ion binding	5		
Heat acclimation	1	Metalloendopeptidase activity	1		
Histydyl-trna aminoacylation	1	Mitochondrial respiratory chain complex	2		
Hyperosmotic salinity response	8	Mitochondrial respiratory chain complex Mrna binding	2		
Inositol triphosphate metabolic process	2	Nucleic acid binding	4		

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Ion transport
Jasmonic acid biosynthetic process
Lewis a epitope biosynthetic process
Lignin biosynthetic process
Lipid metabolic process
Lipid storage
Lipid transport
L-methionine biosynthetic process
L-serine biosynthetic process
Male gamete generation
Meiotic chromosome segregration Metabolic process
Mrna modification
Multicellular organismal development
Negative regulation of abscisic acid mediated
Negative regulation of transcription,DNA
Nuclear mrna splicing, via spliceosome
Nucleocytoplasmic transport
Nucleotide-excision repair
Oxidation-reduction process
Peptidyl-histidine phosphorylation
Peptidyl-proline modification
Phosphatidyglycerol biosynthetic process Photoinhibition
Photoreactive repair
Photorespiration
Photosynthesis
Plant-type cell wall loosening
Plant-type hypersensitive response
Pollen germination
Pollen sperm cell differentiation
Porphyrin-containing compound metabolic process
Post-translational protein modification
Potassium ion transport
Production of ta-sirnas involved in RNA
Protein folding Protein import into chloroplast thykaloid
Protein phosphorylation
Protein targeting to mitochondrion
Protein targeting to vacuole
Protein transport
Protein ubiquitination involved in ubiquitin-
Proteolysis
Purine base transport
Regulation of abscisic acid mediated signalling
Regulation of cell cycle
Regulation of double fertilization forming a zygote
Regulation of transcription,DNA-dependent
Regulation to translation Response to abscisic acid stimulus
Response to auxin stimulus
Response to brassinosteroid stimulus
Response to cadmium ion
Response to cold
Response to cold Response to endoplasmic reticulum stress
Response to endoplasmic reticulum stress Response to far red light Response to jasmonic acid
Response to endoplasmic reticulum stress Response to far red light Response to jasmonic acid Response to karrikin
Response to endoplasmic reticulum stress Response to far red light Response to jasmonic acid Response to karrikin Response to metal ion
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	Iucleotide binding Iucleotide-sugar transmembrane
	xidoreductase activity
	antothenate kinase activity
	eptidyl-prolyl cis trans isomerase activity
	henylalanine ammonia-lyase activity
	hosphatidylinositol-4,5-biophosphate
	hosphoglycerate dehydrogenase activity
	hosphoric diester hydrolase activity
	olygalacturonase activity
	olynucleotide 5'-hydroxyl-kinase activity
	-p-bond-hydrolysis-driven protein
	olygalacturonate 4-alpha- related
	otassium ion transmembrane transporter
	roline dehydrogenase activity
	rotein binding
	rotein disulfide oxidoreductase activity
	rotein disulfide isomerase activity
	rotein homodimerization activity
	rotein transporter activity
	rotein serine/threonine phosphatase
	urine base transmembrane transporter
	rna-binding
	equence specific dna binding
	erine o-acetyltransferase activity
	erine racemase activity
s	erine-type endopeptidase inhibitor
	equence-specific signalling pathway
s	ignal transducer activity
s	mall conjugating proten ligase activity
S	norna binding
s	teroid binding
s	trictosidine synthase activity
	tructural constitute of ribosome
	uccinate dehydrogenase (ubiquinone)
s	ugar:hydrogen symporter activity
	ransferase activity
Т	ranslation initiation factor activity
	ransmembrane transporter activity
	riglyceride lipase activity
Т	riose-phosphate isomerase activity
U	Ibiquinol-cytochrome-c reductase
	Ibiquitin binding
	Ibiquitin protein ligase activity
U	Jracil phosphoribosyltransferase activity
V	acuole
V	Vater channel activity
Z	inc ion binding
	,3-beta-d-glucan synthase activity
	-acylglycerol-3-phosphate o-
	-cis-epoxycarotenoid dioxgenase activity

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