

SUPPLEMENTARY MATERIAL

An Invitation to Open Innovation in Malaria Drug Discovery: 47 Quality Starting Points From the (TCAMS)

Félix Calderón,^{*, †} David Barros,[†] José María Bueno,[†] José Miguel Coterón,[†] Esther Fernández,[†] Francisco Javier Gamo,[†] José Luís Lavandera,[†] María Luisa León,[†] Simon J. F. Macdonald,[‡] Araceli Mallo,[†] Pilar Manzano,[†] Esther Porras,[†] José María Fiandor,^{*, †} and Julia Castro^{*, †}

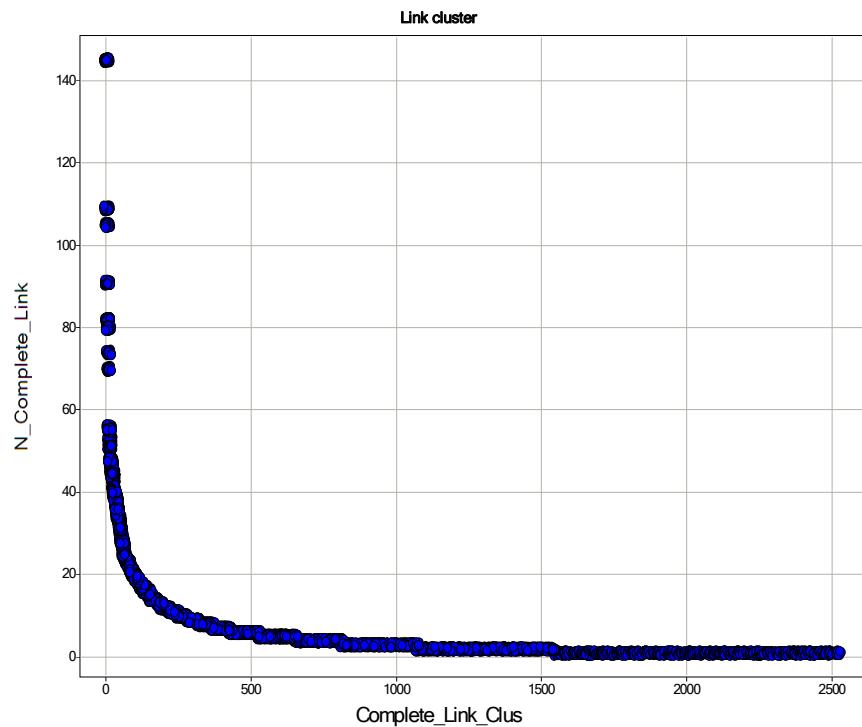
[†]Tres Cantos Medicines Development Campus, GlaxoSmithKline, Severo Ochoa 2, 28760 Tres Cantos, Spain

[‡]Medicines for Malaria Venture (MMV), 20, route de Pré-Bois-PO Box 1826, 1215 Geneva 15, Switzerland

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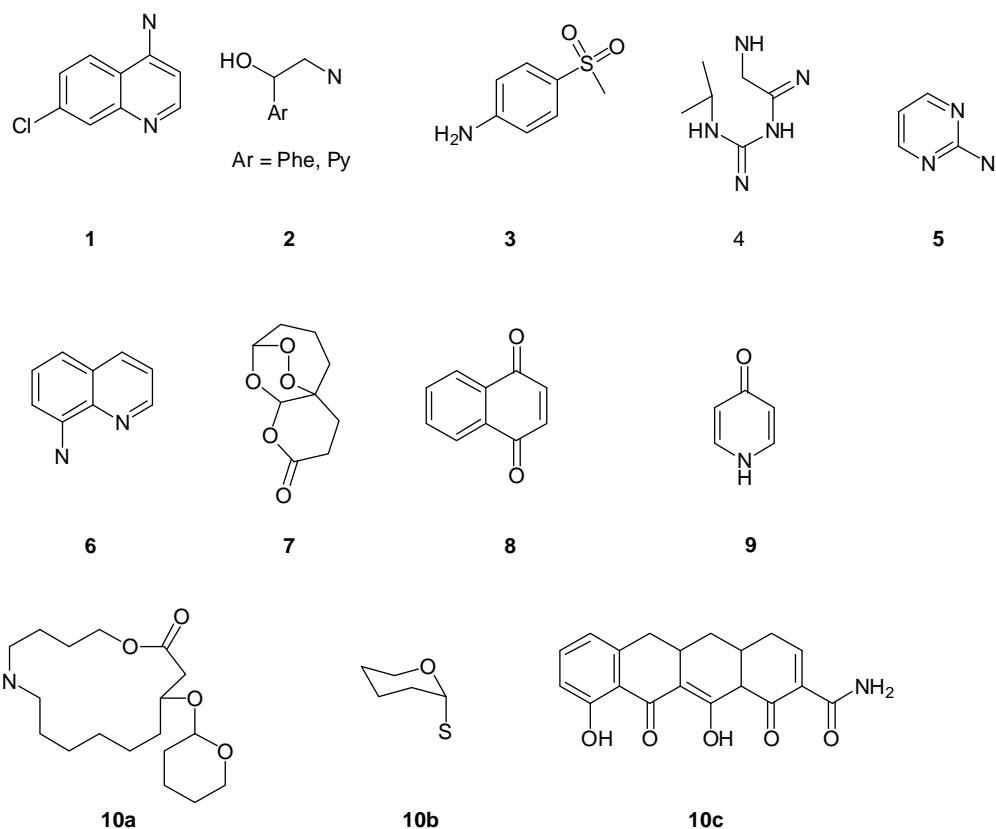
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1. Overview of the cluster analysis



A graph showing the number of clusters (Complete Link Clus) vs. the number of compounds in each cluster (N_Complete_Link) showing that after carrying out the clustering process on TCAMS, most clusters contain less than 20 compounds with many clusters only containing one compound.

2.- known antimalarials Scaffolds examined



Chloro-aminoquinolines **1** (chloroquine, amodiaquine, piperaquine), aminoalcohols **2** (quinine, quinidine, mefloquine, halofantrine, lumefantrine), sulfonamides and sulfones **3** (sulfadoxine, sulfalene, dapsone), biguanides **4** (proguanil, chlorproguanil), diaminopyrimidine **5** (pyrimethamine), 8-aminoquinoline **6** (primaquine), sesquiterpene lactones **7** (artemisinin, arteether, artemether, artesunate, dihydroartemisinin), naphthoquinone **8** (atovaquone), quinolone **9** and antibiotics **10a-c** (azythromycin, clindamycin, doxycycline, tetracycline)

3.- Experimental Details

Pf XC₅₀'s, *Pf* IC₅₀'s and toxicities in a HepG2 cell line (Cytox) were determined according to reference 12; cLogP was calculated using Daylight software.

Plasmodium falciparum Hypoxanthine Assay

Equipment and Materials Instrument Cell Harvester TOMTEC (Perkin Elmer), Instrument Microbeta counter Wallac (Perkin Elmer), 96 well cell culture plates, flat bottom with lid, tissue culture treated, polystyrene, sterile (Costar, Catalog # 3599), 96 well cell culture plates, V-bottom with lid, tissue culture treated, polystyrene, sterile (Costar, Catalog # 3894), printed Filtermat A, glass fibre filter (Wallac, Catalog # 1450-421), MeltiLex A melt-on scintillator sheets (PerkinElmer, Catalog # 1450-441).

Biological and Molecular Reagents Red blood cells ABStorage 4°C (source Spanish Red Cross Blood Bank), *Plasmodium falciparum* 3D7A strain (source MR4)

Chemical Reagents Hypoxanthine (Fluka, Catalog Number 56700, molecular weight 136.11), 3H-hypoxanthine (Amersham Biosciences, Catalog Number TRK74) - safety relevant information (known hazards, MSDS) radiolabelled. RPMI-1640 medium (Sigma Catalog Number R5886), 25mM HEPES and NaHCO₃ without L-glutamine, Albumax II (Gibco, Catalog Number 11021-037), L-glutamine, (Merck, Catalog Number 1.00229).

Solutions Albumax II 100g/L, D-sucrose 40g/L, L-glutamine 6g/L, hypoxanthine 15 mM (100x), hypoxanthine 2 g/L (guideline add NaOH to dissolve).

Experimental protocol Sensitivity of *P. falciparum* infected erythrocytes to the drugs was determined using a modification of the in vitro 3H-hypoxanthine incorporation method (see Desjardins, R.E., Canfield, C. J., Haynes, J.D. and Chulay J.D. Quantitative assessment of antimalarial activity in vitro by a semiautomated microdilution technique Antimicrob. Agents Chemother. 1979, 16, 710-718). This assay relies on the parasite incorporation of labeled hypoxanthine that is proportional to *P. falciparum* growth. A culture of parasitized red blood cells (RBC) of strain 3D7A with a 0.5% parasitemia and 2% hematocrit in RPMI-1640, albumax and 5uM hypoxanthine was exposed to 2-fold serial dilutions of the compound. Plates were incubated 24h at 37°C, 5% CO₂, 5% O₂, 95% N₂. After 24h of incubation, 3H-hypoxanthine was added and plates were incubated for additional 24h. After that period, plates were harvested on glass fiber filters using a TOMTEC Cell harvester 96. Filters were dried and melt-on scintillator sheets used to determine the incorporation of 3H-hypoxanthine. Radioactivity was measured using a microbeta counter. Data are normalized using the incorporation of the

positive control, (parasitized red blood cells without drug). IC50s (50% inhibitory concentrations) values were determined using Excel and Grafit 5 software. The assays were performed in three independent experiments, and standard deviation has been calculated.

Data Management, Plate Setup / Control Values, Concentration Response Curve - Control Curves (up to 4 CRCs)

Test agent chloroquine diphosphate salt (# Sigma C-6628), starting conc. (M) 50 ng/mL, dilution factor applied dilution factor:2, no. points in each CRC 9, locations on test 5 plate variable, expected activity value IC50= 15 ng/mL. Test agent “atovaquone”, starting Conc. (M) 60 ng/mL, dilution factor applied dilution factor: 3, no. points in each CRC 9 dilutions, locations on test plate variable, expected activity value IC50=0.2 ng/mL.

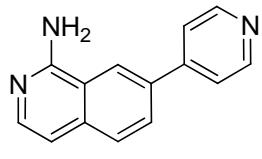
Microsome Assay

930 uL of microsomes 0.645mg/mL(0.5mg/mL), 6uL of compound at 100uM (0.5uM), 150uL of NADPH (2mM) and 108uL MgCl (55mg/mL) were incubated at 37°C. Remove 100 uL aliquots at 0, 5, 10, 15, 20, 25, and 30 minutes and place into a 96-deepwell plate containing 200 uL (2 volumes) of Stop Solution with Internal Standard. Precipitate protein by centrifugation (37000 rpm, 15minutes) and analyse by HPLC.

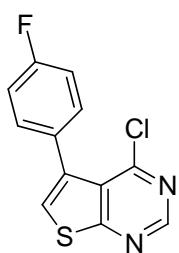
hERG Dofetilide Binding Assay

The FP assay uses membranes from CHO cells stably expressing hERG and measures the binding of a fluorescent ligand (Cy3b dofetilide). This is a high-throughput 384 well plate-based assay. Test compounds that bind to hERG compete with the fluorescent compound and to decrease the FP signal.

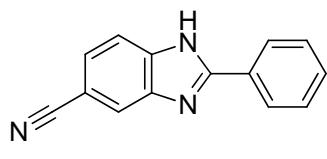
4. Ligand efficiency structures



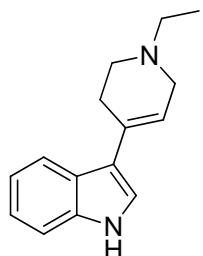
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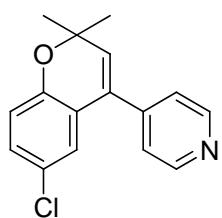
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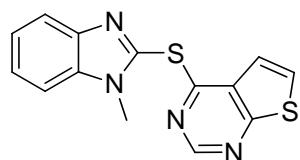
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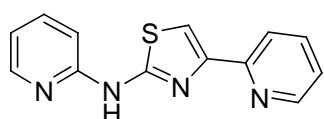
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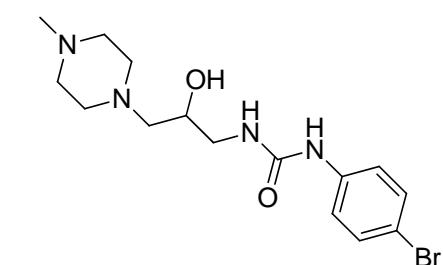
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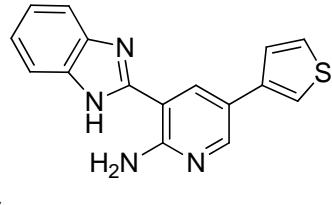
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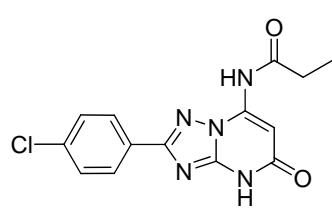
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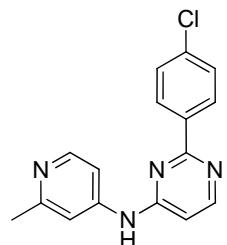
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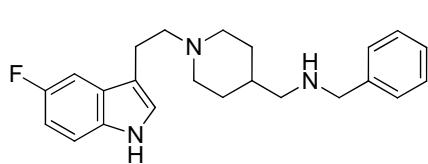
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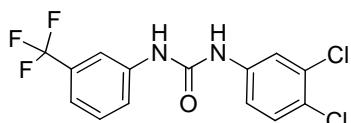
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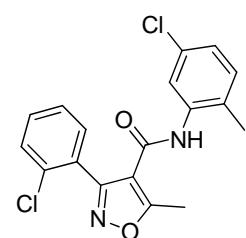
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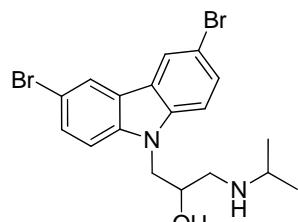
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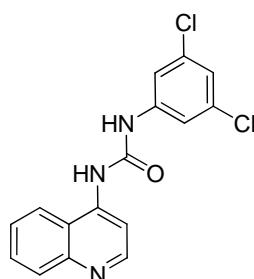
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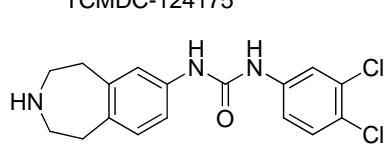
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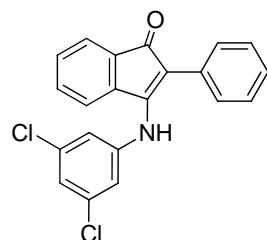
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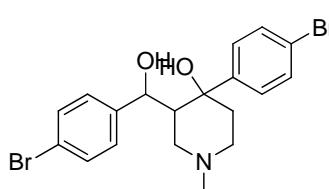
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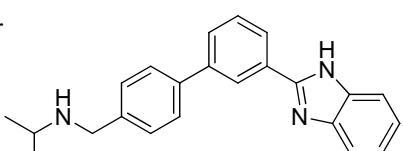
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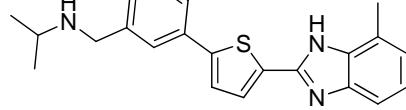
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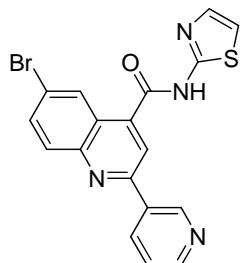
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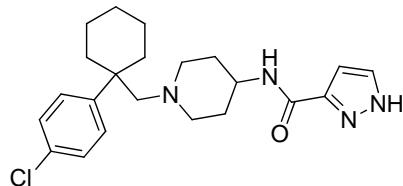
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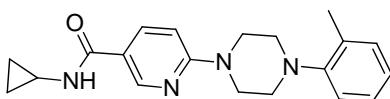
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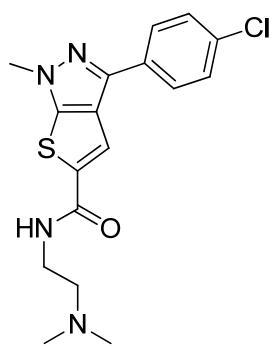
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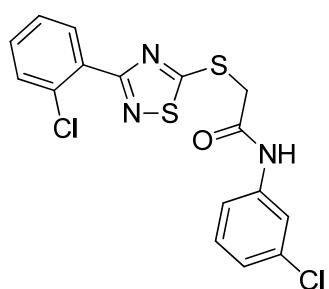
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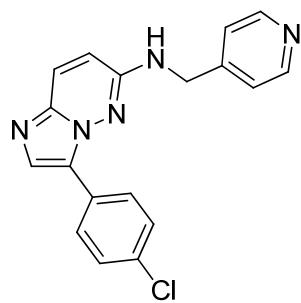
TCMDC-134578



TCMDC-123580



TCMDC-124548



TCMDC-136682

5. Embedded XL spreadsheets

TCMDC-132803	0.405	6.39	46	23	6.875	2	1	28	369.5093	40.71	14	OC(=O)C(F)(F).CC(C)CNCCc1ccc(cc1)-c1ccc(cc1)-c1nc2cccc(C)c2[nH]1
TCMDC-132804	0.818	6.09	46	23	6.018	2	1	27	351.4509	40.71	14	OC(=O)C(F)(F).Cc1cccc2n([nH]c12)-c1ccc(c1)-c1ccc(CNCC#C)c1
TCMDC-132825	0.766	6.12	46	23	5.204	3	1	28	370.4974	52.74	16	OC(=O)C(F)(F).CNCCNCc1cccc(c1)-c1ccc(c1)-c1nc2cccc(C)c2[nH]1
TCMDC-132831	0.798	6.1	46	23	5.204	3	1	28	370.4974	52.74	16	OC(=O)C(F)(F).CNCCNCc1cccc(c1)-c1ccc(c1)-c1nc2cccc(C)c2[nH]1
TCMDC-132837	0.67	6.17	46	23	5.204	3	1	28	370.4974	52.74	16	OC(=O)C(F)(F).CNCCNCc1cccc(c1)-c1ccc(c1)-c1nc2cccc(C)c2[nH]1
TCMDC-132839	0.743	6.13	46	23	4.705	3	1	27	356.4706	52.74	16	OC(=O)C(F)(F).CNCCNCc1cccc(c1)-c1ccc(cc1)-c1nc2cccc2[nH]1
TCMDC-136673	0.7	6.15	47	16	5.284	1	2	27	377.877	45.46	13	CN(C)c1cccc(c1)-c1nc2ccc(NC3ccc(Cl)c3)nn12
TCMDC-136674	0.928	6.03	47	16	3.005	1	3	24	319.3416	55.11	16	Fc1ccc(CNc2ccc3ncc(-c4cccn4)n3n2)cc1
TCMDC-136675	0.834	6.08	47	16	4.167	1	2	28	378.4051	60.68	13	COc1ccc(cc1OC)-c1nc2ccc(NC3ccc(F)c3)nn12
TCMDC-136676	1.084	5.96	47	16	3.963	2	3	25	334.3525	62.45	13	Oc1cccc(c1)-c1nc2ccc(NC3ccc(Cl)c3)nn12
TCMDC-136677	0.698	6.16	47	16	4.863	2	3	33	483.4006	74.56	12	CN(C)CCNC(=O)c1cccc(c1)-c1nc2ccc(NC3ccc(Cl)c3)nn12
TCMDC-136678	0.913	6.04	47	16	4.863	2	3	33	483.4006	74.56	12	CN(C)CCNC(=O)c1ccc(cc1)-c1nc2ccc(NC3ccc(Cl)c3)nn12
TCMDC-136681	0.866	6.06	47	16	3.918	1	3	28	385.3476	64.34	16	FC(F)(F)Oc1cccc(c1)-c1nc2ccc(NC3ccncc3)nn12
TCMDC-136682	0.891	6.05	47	16	3.514	1	3	24	335.7966	55.11	16	C1c1ccc(cc1)-c1nc2ccc(NC3ccncc3)nn12
TCMDC-136684	0.588	6.23	47	16	4.505	2	3	33	442.564	74.56	12	CN(C)CCNC(=O)c1cccc(c1)-c1nc2ccc(NC3ccc(Cl)c3)nn12
TCMDC-136685	0.578	6.24	47	16	3.579	2	4	32	463.4384	111.61	15	NS(=O)(=O)c1ccc(CNc2ccc3ncc(-c4cccc4)OC(F)(F)c4)nn3n2)cc1
TCMDC-124515	0.785	6.11	47	16	1.898	2	5	29	404.4524	126.17	15	NS(=O)(=O)c1ccc(CNc2ccc3ncc(-c4cccc4)CHN)nn3n2)cc1
TCMDC-136686	0.284	6.55	47	16	3.175	2	4	28	413.8874	102.38	15	NS(=O)(=O)c1ccc(CNc2ccc3ncc(-c4cccc4)CC)nn3n2)cc1
TCMDC-136687	0.796	6.1	47	16	2.469	2	4	29	409.4681	111.61	15	COc1ccc(cc1)-c1nc2ccc(NC3ccc(Cl)c3)S(N)(=O)=O)nn12
TCMDC-136688	0.867	6.06	47	16	1.844	2	5	29	410.4562	124.5	15	COc1ccc(cc1)-c1nc2ccc(NC3ccc(Cl)c3)S(N)(=O)=O)nn12
TCMDC-136689	0.834	6.08	47	16	5.433	1	2	35	482.5075	57.93	12	CN1CCN(CC1)c1ccc(CNc2ccc3ncc(-c4cccc4)OC(F)(F)c4)nn3n2)cc1

LIGAND EFFICIENCY SET										
TCAMS-ID	Fast-track series	Ie	Ile	3D7 XC50	PXC50	number of comp. in cluster	clogP	MW	PSA	Total Score Fast track
TCMDC-138929	series 43	0.53	4.72	0.249	6.6	8	1.883	221.28	51.8	16
TCMDC-125317	series 26	0.52	2.83	0.331	6.48	7	3.649	264.71	25.78	16
TCMDC-137223	series 24	0.5	2.88	0.698	6.16	6	3.276	219.26	52.47	16
TCMDC-124447	similar scaffold as series 6	0.48	2.79	1.028	5.99	17	3.204	226.35	19.03	13
TCMDC-131771	new	0.46	1.92	0.43	6.37	5	4.453	271.76	22.12	11
TCMDC-124514	series 44	0.46	2.99	0.191	6.72	6	3.729	298.4	43.6	16

TCMDC-124275	new	0.45	3.23	1.15	5.94	9	2.712	254.33	50.7	13
TCMDC-134635	series 39	0.43	5.94	0.149	6.83	7	0.889	371.32	67.84	16
TCMDC-133557	series 45	0.4	2.44	0.851	6.07	17	3.631	292.38	67.59	16
TCMDC-125473	series 40	0.39	4.77	0.57	6.24	6	1.473	317.76	92.15	16
TCMDC-141398	new	0.39	1.57	1.04	5.98	6	4.415	296.78	50.7	10
TCMDC-131984	series 6	0.38	2.9	0.033	7.48	5	4.585	365.54	31.06	17
TCMDC-124202	similar scaffold as series 2	0.38	0.26	0.735	6.13	15	5.871	349.15	41.13	13

TCMDC-124175	same scaffold as series 27	0.38	2.66	0.192	6.72	8	4.062	361.24	55.13	13
TCMDC-124100	new	0.38	1.02	0.451	6.35	5	5.326	440.2	37.19	10
TCMDC-139375	same scaffold as series 4	0.38	0.69	0.745	6.13	10	5.438	332.2	54.02	13
TCMDC-133731	similar scaffold as series 2	0.37	1.68	0.532	6.27	10	4.586	350.27	53.16	13
TCMDC-125500	new	0.35	0.27	0.372	6.43	9	6.162	366.25	29.1	11
TCMDC-132076	new	0.35	2.01	0.731	6.14	8	4.125	455.21	43.7	12

TCMDC-132550	series 46	0.35	0.88	0.231	6.64	23	5.757	341.49	40.71	16
TCMDC-132743	same scaffold as series 24	0.35	0.27	0.231	6.64	39	6.372	361.54	40.71	14
TCMDC-125215	series 42	0.35	2.79	0.403	6.39	6	3.596	411.29	67.77	15
TCMDC-124828	series 38	0.35	2.27	0.084	7.08	7	4.807	401	61.02	18
TCMDC-134578	series 41	0.35	3.15	0.459	6.34	21	3.189	336.48	48.47	19
TCMDC-123580	series 48	0.35	2.6	0.665	6.18	10	3.577	362.91	50.16	16

TCMDC-124548 new 0.35 1.14 0.787 6.1 8 4.964 396.32 54.88 13

TCMDC-136682 series 47 0.35 2.54 0.891 6.05 16 3.514 335.82 55.11 16