The `viabilitymetrics` Package: A Brief Introduction

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Contents

Overview

Installation

The package can be installed using the following functions:

```
# Install from CRAN
install.packages('viabilitymetrics', dependencies=TRUE)

# Install development version from Github
devtools::install_github("aravind-j/viabilitymetrics")
```

Then the package can be loaded using the function

```
library(viabilitymetrics)
```

Viability constants

Index	Species	K_E	C_W	C_H	C_Q	Reference
1	*Abelmoschus esculentus**	6.659	2.448	0.0329	0.000478	Daniel et al. (2013)
2	*Acer platanoides**	7.22	4.23	0.0329	0.000478	Dickie et al. (1991)
3	*Agastache rugosa*	6.93	4.255	0.0329	0.00048	Lee et al. (2017)
4	*Agathus australis*	6.36	3.64	0.0329	0.000478	Dickie and Smith (1995)
5	*Allium cepa*	6.975	3.47	0.04	0.000428	Ellis and Roberts (1981)
6	*Allium cepa**	9.083	5.81	0.0329	0.000478	Ellis et al. (1990)
7	*Arabidopsis thaliana*	8.35	5.15	0.0563	8.39e-05	Hay et al. (2003)
8	*Arachis hypogaea*	6.718	4.089	0.0329	0.000478	Ellis et al. (1990)
9	*Arachis hypogaea*	6.177	3.426	0.0304	0.000453	Usberti and Gomes (1998)
10	*Araucaria columnaris*	5.66	2.68	0.033	0.000478	Tompsett (1984); Tompsett (1992)
11	*Araucaria cunninghamii*	7.49	3.73	0.033	0.000478	Tompsett (1992)
12	*Balfourodendron riedelianum*	2.867	9.77e-13	1.344e-12	1.165e-13	Ignácio (2013)
13	*Beta vulgaris*	9.373	5.152	0.0372	0.000467	Ellis and Hong (2007)
14	*Beta vulgaris**	8.943	4.723	0.0329	0.000478	Ellis et al. (1990)
15	*Borago officinalis*	6.748	2.42	0.0665	0.000478	Ghaderi-Far et al. (2010)
16	*Brachiaria brizantha* (Intact seed)	6.488	4.48	0.0475	0.001292	Usberti (2007)
17	*Brachiaria brizantha* (Scarified seed)	8.795	4.852	0.02114	0.000733	Usberti (2007)
18	*Brassica juncea**	7.768	4.56	0.0329	0.000478	Ellis et al. (1989)
19	*Brassica napus**	7.718	4.54	0.0329	0.000478	Ellis et al. (1989)
20	*Brassica napus*	5.654	2.5	0.04387	1.438e-05	Alivand et al. (2013)
21	*Capsicum annum**	7.767	4.67	0.0329	0.000478	Demir et al. (2009)
22	*Celosia argentea**	4.957	1.188	0.0329	0.000478	Daniel et al. (2012)
23	*Chenopodium quinoa**	8.58	5.02	0.0329	0.000478	Ellis et al. (1988)

Index	Species	K_E	C_W	C_H	C_Q	Reference
24	*Cicer arietinum*	8.901	4.847	0.0329	0.000478	Ellis et al. (1982); Dickie et al. (1990)
25	*Cicer arietinum*	8.502	4.602	0.0295	0.000491	Ellis (1988)
26	*Citrullus lanatus**	4.86	1.59	0.0329	0.000478	Demir et al. (2011)
27	*Cucumis melo**	6.11	2.59	0.0329	0.000478	Demir et al. (2011)
28	*Cucumis melo*	7.299	3.707	0.0367	0.000473	Kuo (1991)
29	*Cucumis sativus**	5.35	2.03	0.0329	0.000478	Demir et al. (2011)
30	*Cucurbita pepo*	6.913	3.604	0.04	4e-04	Hong et al. (1996)
31	*Cucurbita pepo* subsp. *pepo* convar. *pepo* var. *styriaca*	3.402	3.215	0.131	0.00264	Ghaderi-Far et al. (2010)
32	*Dactylis glomerata*	4.715	0.554	0.03	2e-04	Reza (2014a)
33	*Dalbergia nigra*	5.199	4.524	0.08175	0.001641	Chaves and Usberti (2004)
34	*Delphinium ambiguum*	7.67	3.12	0.04	4e-04	Hong et al. (1996)
35	*Descurainia sophia*	4	0.179	0.03	0.000445	Reza (2014b)
36	*Digitalis purpurea**	7.49	5.61	0.0329	0.000478	Hong et al. (1996)
37	*Dimorphandra mollis*	6.282	3.838	0.05405	0.001316	Chaves and Usberti (2004)
38	*Dioscorea dumetorum*	5.859	-3.06	-7e-04	-7e-04	Daniel et al. (2003)
39	*Dioscorea togoensis*	4.505	-1.646	-0.02	-0.00011	Daniel et al. (2003)
40	*Dipterocarpus alatus*	5.92	2.69	0.033	0.000478	Tompsett (1992)
41	*Dipterocarpus intricatus*	6.18	2.77	0.033	0.000478	Tompsett (1992)
42	*Dracocephalum moldavica*	3.837	0.2	0.03	2e-04	Reza (2014b)
43	*Eleusine coracana*	7.88	4.181	0.0254	0.000489	Ellis and Hong (2007)
44	*Eleusine coracana**	9.508	5.08	0.0329	0.000478	Ellis et al. (1989)
45	*Elytrigia elongate*	6	1.642	0.03	2e-04	Reza (2014a)
46	*Entandophragma angolense*	4.6	2.21	0.033	0.000478	Tompsett (1992)
47	*Eragrostis tef**	10.1	6.01	0.0329	0.000478	Ellis et al. (1989)
48	*Eragrostis tef* cv. Muri	9.727	5.185	0.0329	0.00054	Zewdie and Ellis (1991)
49	*Eragrostis tef* cvs.	9.927	5.185	0.0329	0.00054	Zewdie and Ellis (1991)
50	*Eruca sativa*	4.33	0.4574	0.03	0.000304	Reza (2014b)
51	*Euphorbia bussei**	7.3	3.96	0.0329	0.000478	Muthoka et al. (2009)
52	*Eucalyptus erythrocorys*	8.81	4.97	0.0412	0.000379	Crawford et al. (2013)
53	*Eucalyptus grandis*	9.661	6.467	0.03498	0.000233	Fantinatti and Usberti (2007)
54	*Euphorbia heterochroma**	8.9	6.89	0.0329	0.000478	Muthoka et al. (2009)
55	*Euphorbia heterophylla**	7.4	4.36	0.0329	0.000478	Muthoka et al. (2009)
56	*Euphorbia pseudoburuana**	10.1	7.81	0.0329	0.000478	Muthoka et al. (2009)

Index	Species	K_E	C_W	C_H	C_Q	Reference
57	*Euphorbia quinquecostata**	10.2	8.09	0.0329	0.000478	Muthoka et al. (2009)
58	*Festuca ovina*	4.366	0.5	0.03	2e-04	Reza (2014a)
59	*Glycine max*	7.525	4.086	0.0329	0.000478	Ellis et al. (1982); Dickie et al. (1990)
60	*Glycine max*	7.292	3.996	0.0295	0.000491	Ellis (1988)
61	*Gossypium hirsutum*	9.24	5.19	0.03965	0.000426	Usberti et al. (2006)
62	*Guizotia abyssinica**	7.578	4.78	0.0329	0.000478	Ellis et al. (1989)
63	*Guizotia abyssinica*	7.494	4.257	0.0372	0.00048	Zewdie and Ellis (1991)
64	*Gypsophila elegans*	9.6	5.36	0.04	4e-04	Hong et al. (1996)
65	*Helianthus annuus**	6.74	4.16	0.0329	0.000478	Ellis et al. (1988)
66	*Hordeum vulgare*	9.144	5.342	0.0329	0.000478	Ellis and Roberts (1980); Dickie et al. (1990)
67	*Khaya senegalensis*	4.76	2.15	0.033	0.000478	Tompsett (1992)
68	*Lactuca sativa*	7.938	5.25	0.0329	0.000478	Ellis et al. (1989)
69	*Lactuca sativa**	6.895	4.2	0.0329	0.000478	Kraak and Vos (1987); Dickie et al. (1990)
70	*Lallemantia royleana*	4.725	2.324	0.02544	1.068e-05	Baladi and Balouchi (2016)
71	*Linum usitatissimum**	7.76	4.86	0.0329	0.000478	Ellis et al. (1988)
72	*Linum usitatissimum* cv. Norman	5.201	2.59	0.03613	1.5e-05	Balouchi et al. (2017)
73	*Linum usitatissimum* cv. Urmia	4.474	2.185	0.01467	0.000161	Balouchi et al. (2017)
74	*Liquidambar styraciflua*	6.553	3.033	0.0081	0.00151	Bonner (1994)
75	*Liquidambar styraciflua*	6.385	2.706	0.0306	0.000967	Bonner (1994)
76	*Lupinus polyphyllus*	6.217	2.761	0.04	4e-04	Dickie and Bowyer (1985)
77	*Lycopersicon esculentum*	6.502	3.181	0.0324	0.000431	Kruse et al. (2005)
78	*Lycopersicon esculentum*	4.544	2.683	-0.05018	0.001266	Sinício et al. (2009)
79	*Malus domestica*	7.316	4.119	0.04	0.00042	Dickie (1988)
80	*Melilotus officinalis*	4.21	0.2	0.03	2e-04	Reza (2014b)
81	*Nigella sativa*	4.97	1.253	0.0516	0.000478	Ghaderi-Far et al. (2010)
82	*Orobanche aegyptiaca*	6.434	0.0356	0.066	1e-05	Kebreab and Murdoch (1999)
83	*Orobanche crenata*	6.447	0.0356	0.066	1e-05	Kebreab and Murdoch (1999)
84	*Orobanche minor*	6.126	0.0356	0.066	1e-05	Kebreab and Murdoch (1999)
85	*Oryza glaberrima*	9.406	5.043	0.0375	0.000471	Ellis and Hong (2007)
86	*Oryza glaberrima**	6.871	5.51	0.0329	0.000478	Bam et al. (2008)
87	*Oryza sativa*	8.242	4.345	0.0307	0.000501	Ellis and Hong (2007)
88	*Oryza sativa**	8.668	5.03	0.0329	0.000478	Ellis et al. (1989)

Index	Species	K_E	C_W	C_H	C_Q	Reference
89	*Oryza sativa* ssp. *indica**	8.81	4.904	0.0329	0.000478	Ellis et al. (1992)
90	*Oryza sativa* ssp. *japonica**	8.416	4.904	0.0329	0.000478	Ellis et al. (1992)
91	*Oryza sativa* ssp. *japonica**	6.628	5.51	0.0329	0.000478	Bam et al. (2008)
92	*Oryza sativa* ssp. *javanica**	8.736	4.904	0.0329	0.000478	Ellis et al. (1992)
93	*Papaver nudicaule*	6.838	4.101	0.027	0.000313	Belletti et al. (1991)
94	*Paspalum scrobiculatum*	8.066	4.449	0.0266	0.000526	Ellis and Hong (2007)
95	*Pennisetum glaucum**	8.728	4.86	0.0329	0.000478	Ellis et al. (1989)
96	*Pennisetum purpureum* × *P. glaucum* (Cutting type)	7.735	4.658	0.01969	0.000403	Pozitano and Usberti (2009)
97	*Pennisetum purpureum* × *P. glaucum* (Grazing type)	8.825	4.522	0.03655	3e-04	Pozitano and Usberti (2009)
98	*Pennisetum purpureum* × *P. glaucum* (Original type)	8.417	5.037	0.02309	0.000436	Pozitano and Usberti (2009)
99	*Pennisetum typhoides*	8.442	5.035	0.025	0.000443	Ellis and Hong (2007)
100	*Phaseolus vulgaris**	9.09	4.761	0.0329	0.000478	Ellis et al. (1990)
101	*Phaseolus vulgaris*	9.08	5.2	0.0057	0.00079	Wilson and McDonald (1989)
102	*Phleum pratense*	9.571	5.262	0.04	4e-04	Hong et al. (1996)
103	*Phleum pratense* cv. Erecta*	8.678	4.75	0.0329	0.000478	Ellis et al. (1989)
104	*Phleum pratense* cv. S325*	8.138	4.75	0.0329	0.000478	Ellis et al. (1989)
105	*Pinus elliottii*	5.588	1.449	0.0326	0.00101	Bonner (1994)
106	*Pinus elliottii*	5.246	0.9832	0.0508	0.000571	Bonner (1994)
107	*Pinus occidentalis*	5.047	1.678	0.0206	0.00126	Bonner (1994)
108	*Pinus occidentalis*	5.101	1.674	0.0354	0.000838	Bonner (1994)
109	*Pinus taeda*	3.618	-0.2567	0.00064	0.00122	Bonner (1994)
110	*Pinus taeda*	3.278	-0.73	0.0348	0.000328	Bonner (1994)
111	*Pinus taeda*	8.838	5.981	0.1034	0.0005476	Fantinatti and Usberti (2007)
112	*Pisum sativum**	9.858	5.39	0.0329	0.000478	Ellis et al. (1989)
113	*Pongamia pinnata*	5.75	3.26	0.04	3e-04	Kundu (2008)
114	*Ranunculus sceleratus*	6.98	5.01	0.0329	0.000428	Hong et al. (1996)
115	*Saccharum* spp.	8.805	5.168	5.168	0.000581	Ellis and Hong (2007)
116	*Salvia officinalis*	5	1.49	0.0329	2e-04	Reza (2014b)

Index	Species	K_E	C_W	C_H	C_Q	Reference
117	*Satureja hortensis*	4.46	0.391	0.0329	0.000478	Reza (2014b)
118	*Secale cereale*	6.361	2.059	0.03	0.000201	Reza (2014a)
119	*Secale montanum*	4.431	0.472	0.03	0.000201	Reza (2014a)
120	*Secale montanum*	6.114	2.577	0.03856	0.00013	Dehghan and Sharif-Zadeh (2015)
121	*Sesamum indicum*	7.19	4.02	0.04	0.000428	Ellis et al. (1986)
122	*Setaria italica*	8.657	4.968	0.0304	0.000504	Ellis and Hong (2007)
123	*Setaria italica**	8.678	4.95	0.0329	0.000478	Ellis et al. (1989)
124	*Solanum macrocarpon*	5.166	3.009	0.094	0.0019	Daniel et al. (2011)
125	*Solanum tuberosum*	7.923	5.063	0.0325	0.000432	Ellis and Hong (2007)
126	*Sorghum bicolor*	2.49	-0.3002	0.00725	-0.00057	Ali (2014)
127	*Sorghum bicolor*	9.472	5.426	0.0324	0.000478	Ellis and Hong (2007)
128	*Sorghum bicolor*	10.59	6.305	0.041	0.000349	Kuo et al. (1990)
129	*Sorghum bicolor*	2.49	-0.3002	0.00725	-0.00057	Tabatabaei (2014)
130	*Swietinia humilis*	5.393	2.391	0.0329	0.000478	Dickie et al. (1990)
131	*Tagetes patula*	12.22	3.114	0.2769	0.002212	Simões et al. (2008)
132	*Terminalia brassii*	5.016	2.161	0.0329	0.000478	Tompsett (1986); Tompsett (1992)
133	*Thymus daenensis*	5	0.753	0.0347	2e-04	Reza (2014b)
134	*Thymus transcaspicus*	5.065	0.0641	0.03	2e-04	Reza (2014b)
135	*Trifolium subterraneum*	7.21	3.51	0.04	4e-04	Hong et al. (1996)
136	*Triticum aestivum*	9.043	5.183	0.0351	0.000475	Ellis and Hong (2007)
137	*Triticum aestivum**	9.42	5.859	0.0329	0.000478	Ellis et al. (1990)
138	*Ulmus carpinifolia*	5.83	3.035	0.0329	0.000478	Tompsett (1986); Tompsett (1992)
139	*Vigna radiata**	10.86	6.27	0.0329	0.000478	Ellis et al. (1989)
140	*Vigna unguiculata*	9.401	5.118	0.0329	0.000478	Ellis et al. (1982); Dickie et al. (1990)
141	*Vigna unguiculata*	9.102	4.967	0.0295	0.000491	Ellis (1988)
142	*Xanthorrhoea preissii*	8.77	5.29	0.0382	0.000472	Crawford et al. (2013)
143	*Zea mays*	10.56	6.366	0.0332	0.000577	Ellis and Hong (2007)
144	*Zea mays**	8.579	4.91	0.0329	0.000478	Hong et al. (1996)
145	*Chenopodium quinoa*	2.93	0.51	0.019	0.00031	Mammadi and Afshari (2018)
146	*Cicer arientinum*	8.507	4.524	0.0486	0.00028	Moeinzadeh et al. (2018)
147	*Lens culinaris*	4.292	1.493	0.0244	0.00014	Moeinzadeh et al. (2018)
148	*Lallemantia royleana*	4.725	2.324	0.02544	1.068e-05	(**???**)
149	*Dendrocalamus membranaceus*	4.261	-1.395	-0.03352	-0.00026	Rawat and Thapliyal (2003)
150	*Delphinium elatum* (based on normal seedlings)*	7.777	4.623	0.0329	0.000478	Kwong et al. (2001)

Index	Species	K_E	C_W	C_H	C_Q	Reference
151	*Delphinium elatum* (based on radicle emergence)*	9.857	6.536	0.0329	0.000478	Kwong et al. (2001)
152	*Salvia splendens* (based on normal seedlings)*	9.883	6.678	0.0329	0.000478	Kwong et al. (2001)
153	*Salvia splendens* (based on radicle emergence)*	9.923	6.674	0.0329	0.000478	Kwong et al. (2001)
154	*Ceiba pentandra**	8	3.71	0.0329	0.000478	Lima and Ellis (2005)
155	*Dalbergia spruceana**	6.71	3.35	0.0329	0.000478	Lima and Ellis (2005)
156	*Cedrela odorata*	6.9	3.8	0.0291	0.000468	Lima and Ellis (2005)
157	*Tabebuia alba*	6.1	3.46	0.0291	0.000468	Lima and Ellis (2005)
158	*Mentha pulegium**	4.312	0.61	0.0329	0.000478	Eisvand et al. (2013)
159	*Mentha longifolia**	4.06	0.0082	0.0329	0.000478	Eisvand et al. (2013)
160	*Teucrium polium**	4.72	0.2978	0.0329	0.000478	Eisvand et al. (2013)
161	*Salvia virgata**	4.29	0.222	0.0329	0.000478	Eisvand et al. (2013)
162	*Thymus daenensis**	5.148	0.242	0.0329	0.000478	Eisvand et al. (2013)
163	*Thymus fedtschenkoi*	7.18	2.68	0.03	2e-04	Eisvand et al. (2013)

* Viability constants are derived from storage experiment at a single temperature. C_H and C_Q here are the universal temperature coefficients (0.0329 and 0.000478 respectively).

Citing `viabilitymetrics`

```
To cite the R package 'viabilitymetrics' in publications use:

  Aravind, J., Radhamani, J., Vimala Devi, S., Jacob, S. R., and
  Kalyani Srinivasan (2019).  viabilitymetrics: Seed Viability
  Calculations and Curve Fitting. R package version 0.0.0.9100,
  https://aravind-j.github.io/viabilitymetrics/.

A BibTeX entry for LaTeX users is

  @Manual{,
    title = {viabilitymetrics: Seed Viability Calculations and Curve Fitting},
    author = {J. Aravind and J. Radhamani and S. {Vimala Devi} and Sherry Rachel Jacob and {Kalyani Sri
    year = {2019},
    note = {R package version 0.0.0.9100},
    note = {https://aravind-j.github.io/viabilitymetrics/},
  }

This free and open-source software implements academic research by
the authors and co-workers. If you use it, please support the
project by citing the package.
```

Session Info

```
sessionInfo()
```

```
R Under development (unstable) (2019-09-07 r77160)
Platform: x86_64-w64-mingw32/x64 (64-bit)
Running under: Windows 10 x64 (build 17763)

Matrix products: default

locale:
[1] LC_COLLATE=English_India.1252  LC_CTYPE=English_India.1252
[3] LC_MONETARY=English_India.1252 LC_NUMERIC=C
[5] LC_TIME=English_India.1252

attached base packages:
[1] stats     graphics  grDevices utils     datasets  methods   base

other attached packages:
[1] viabilitymetrics_0.0.0.9100 RefManageR_1.2.12
[3] readxl_1.3.1                stringi_1.4.3

loaded via a namespace (and not attached):
 [1] httr_1.4.1         pkgload_1.0.2      tidyr_0.8.3
 [4] jsonlite_1.6       Rdpack_0.11-0      assertthat_0.2.1
 [7] pander_0.6.3       cellranger_1.1.0   yaml_2.2.0
[10] remotes_2.1.0      sessioninfo_1.1.1  pillar_1.4.2
[13] backports_1.1.4    lattice_0.20-38    glue_1.3.1
[16] digest_0.6.20      colorspace_1.4-1   htmltools_0.3.6
[19] Matrix_1.2-17      plyr_1.8.4         pkgconfig_2.0.2
[22] devtools_2.2.0     bibtex_0.4.2       broom_0.5.2
[25] purrr_0.3.2        scales_1.0.0       processx_3.4.1
[28] tibble_2.1.3       generics_0.0.2     ggplot2_3.2.1
[31] relimp_1.0-5       usethis_1.5.1      ellipsis_0.2.0.1
[34] DT_0.8             withr_2.1.2        nnet_7.3-12
[37] lazyeval_0.2.2     cli_1.1.0          magrittr_1.5
[40] crayon_1.3.4       memoise_1.1.0      evaluate_0.14
[43] ps_1.3.0           fs_1.3.1           nlme_3.1-141
[46] MASS_7.3-51.4      xml2_1.2.2         pkgbuild_1.0.5
[49] gnm_1.1-0          tools_3.7.0        data.table_1.12.2
[52] prettyunits_1.0.2 minpack.lm_1.2-1  gbRd_0.4-11
[55] stringr_1.4.0      munsell_0.5.0      callr_3.3.1
[58] packrat_0.5.0      pkgdown_1.4.0      compiler_3.7.0
[61] rlang_0.4.0        grid_3.7.0         rstudioapi_0.10
[64] htmlwidgets_1.3    qvcalc_1.0.0       rmarkdown_1.15
[67] testthat_2.2.1     gtable_0.3.0       roxygen2_6.1.1
[70] R6_2.4.0           lubridate_1.7.4    knitr_1.24
[73] dplyr_0.8.3        commonmark_1.7     rprojroot_1.3-2
[76] desc_1.2.0         Rcpp_1.0.2         xfun_0.9
[79] tidyselect_0.2.5
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