

Some new combinations in Haworthia. Haworthiopsis. Tulista.

by

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Haworthia badia var. *joleneae*. IB1892

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This *NEW*, 28 A4 page, soft cover book revises Ingo Breuer's classification of the genus *Haworthia*, *sensu lato*, into three genera, *sensu stricto*. It take into account recent DNA studies, which give rise to the three genera. Each species is shown in colour, 20 to an A4 page.

The booklet has been incorporated into this issue of the journal *Alsterworthia International* so that subscribing member may have a cost free copy .

Non-members, including non-subscribing members, should apply direct to Ingo Breuer for copies of the book.

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Some new combinations in *Haworthia*, *Haworthiopsis* and *Tulista*

Ingo Breuer

Introduction.

In 2010 the author published his classification treatment for the Genus *Haworthia*. Since then the results of some important DNA research [Ramdhani et al. (2011); Daru et al. (2013); Manning et al. (2014)] for the subfamily Aloioideae has been published, which effected the classification of the subfamily significantly. The details of the research can be read in published papers - please see References page 12 - but the important changes in classification (among others) was splitting the genus *Haworthia* into 3 new genera: *Haworthia*, *Haworthiopsis* and *Tulista*. This concept is accepted by the author too. Fortunately, the members of the new genera are the members of the subgenera of the old genus *Haworthia*. Based on the DNA research publications, Rowley (2013) made the new combinations with the taxa based on the one he accepted in the former genus *Haworthia*. But not all of them could be accepted, especially in the new genus *Tulista*, where he includes the former members of *Astroloba*, as well as three members of formerly subgenus *Hexangulares*: *H. koelmaniorum*, *H. pungens* and *H. viscosa*. Later in their publication Manning et al. (2014) made the necessary combination of the three taxa and pointed out that *Astroloba* has to be a separate genus as well. Unfortunately, Rowley made also two invalid combinations which were based on a wrong basionym citation: *H. attenuata* and *H. limifolia* var. *glaucophylla*. Because of the invalid combination of *H. attenuata*, the combinations of its varieties *H. attenuata* var. *glabrata* and *H. attenuata* var. *radula*, were also invalid. This will be corrected in this paper.

The other important classification work about the genus *Haworthia* was published by Bayer and Manning in 2012. Up to that point Bayer had used 'lower names' as informal names for taxa below the rank of species which could be subspecies, varieties or forma. But the problem with such naming was that it does not conform with the ICBN and, therefore, is not accepted in scientific publications. This is the reason why Bayer decided in his new classification to use most of his informal names as varieties, which resulted in a couple of new combinations. At the

time of his publication he already knew about the results of the DNA research in which Manning was involved, nevertheless Bayer upheld *Haworthia* as the genus retaining the three subgenera *Haworthia*, *Hexangulares* and *Robustipedunculares*!

In his concept of 2010 Breuer used the 'informal rank' of 'aggregates' to group closer related taxa together, consequently the rank of all taxa below species level were changed into species rank, which of course enlarged the number of species within *Haworthia*. Both Bayer's and Breuer's classifications were based on analogical reasons, but in different ways, for their classifications, (But Breuer's naming at species level did comply with the ICBN.) The author therefore also took the decision to change his species concept too to comply with the ICBN. In general, with a few exceptions, the former aggregates were changed to species and many of the species were changed to variety rank, or in a couple of cases, their old variety level were reinstated. But in this paper are published only the names, which are necessary for the new concept. In a forthcoming publication all names will be published, the accepted ones as well as all the synonyms.

The role of DNA analysis for classification of *Haworthia* taxa.

This is a critical comment concerning one aspect of the DNA research for classification purposes in *Haworthia*. It is doubtless that the methods of DNA investigations will solve classification problems, especially when the results lead to a better interpretation of the meaning of the important morphological characters used. I am afraid that the conclusion which was made within *Haworthia* subgenus *Haworthia* are based on insufficient sample selection, because of lack of knowledge of their naturally occurrences. This was claimed in Bayer's publication (2012) too!

The DNA investigations says the elements of genus *Haworthia* are monophyletic in origin. The big problem is the meaning of morphologic characters at species level. In *Haworthia* we have a couple of very unique items, which could be recognized very easily like *H. maughanii* or *H. truncata*, and also some more recently described

species like *H. springbokvlakensis* or *H. marxi*, or *H. blackburniae* with its 'glasslike' leaves. But most of the other taxa share their characters in variation ranges which group them in such way that you would recognize them like the 'retuse-type' items or 'setose-type' etc. For classification of these taxa you need good knowledge of their natural environment as well as their observation under controlled growing conditions. I expect much better results from DNA investigation in the new genus *Haworthia*, when the selection of samples are better correlated with their natural distribution and not based only on the selections by names from samples from university gardens or nurseries.

The taxa in the new genus *Tulista* should also be from monophyletic origins, easy to recognize, and need no further intensive new investigation.

The taxa in the new genus *Haworthiopsis*, which should be polyphyletic in origin, are also relatively easy to recognize, but they need more investigation to check. You can build some groups of related items within this genus, like attenuata-type or limifolia-type etc., but these groups are quite distinct in their morphological features from each other. Only because of the 'flower-type' they are member of the same genus, but the role of this feature needs to be checked more carefully. The question is, why do taxa, which originated from different ancestors, have the same type of floral characters?

The meaning of floral features for classification purposes.

The author made morphological investigations of floral characters of many taxa of the former genus *Haworthia* (the details will be shown in a forthcoming publication with complete treatment of *Haworthia*). As a summary of the results, one can say that the groupings you can make, correspond with the new genera, as well as on infrageneric levels. In general, the flower type plays only an important role at genus level; within the genus there is not much variation. This is also valid for the seed types. In *Haworthia* and *Haworthiopsis* you have similar shapes, but the colour of the testa is different. In *Haworthia* it is a grey colour and in *Haworthiopsis* it is a black colour. The variation is in the size of the seeds and possibly in the testa structure, which REM photos shows. How the testa structures correspond with the infrageneric grouping was not investigated. The shape of seeds from the *Tulista* taxa differs a lot from that of *Haworthia* and *Haworthiopsis* and

can be recognized quite easily. But there are a couple of further characters which correspond with the subgroups. These are from the peduncle itself, the number of sterile bracts, the number of flowers, the size of pedicel and fertile bracts, the shape and size of flowers (from very narrow zygomorphic to nearly radial) and the colour of the petals (in some groups).

It is of great interest for further investigation to check if there is a correlation of floral characters (not only the flower type) and the relationship based on DNA analysis. If there is none, you must think about the usability of floral features for classification purposes at all.

There is one special case in the new genus *Haworthia* where the taxa do have quite a different flower shape from all others. The shape is nearly globose, the petals are short but broad and the colour of the petals is green or brownish, except a small whitish stripe at the margins. The names of these taxa, which belongs to the section *Haworthia*, are: *H. globosiflora*, *H. pehlemanniae*, *H. albispina* and *H. devriesii*. The areas of their occurrence are along to the boarder to the Great Karoo, but with quite larger distances from each other (except between *H. pehlemanniae* and *H. albispina*). The features of their leaf characters are also distinct. The question is, concerning the taxonomy of these items, are they genetically closely related and could they build a common group, or is the 'globose shape' only an adaption to their pollinators with their origin based on different ancestors! Based on the polyphyletic origin of the taxa in the genus *Haworthiopsis*, the author's theory is that the development of a unique flower type results from a long-term adaptation to their pollinators. If there are new results from DNA investigation which shows their close relationship, the author is willing to handle them as an entity, but till then, they are placed in three different groups.

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New Names in Haworthia, Haworthiopsis and Tulista.

- Haworthia arachnoidea* var. *angiras*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia angiras* M.Hayashi in *Haworthia Study* 14: 13 (2005).
- Haworthia arachnoidea* var. *calitzdorpensis*** (Breuer) Breuer comb. nov. Basionym: *Haworthia mucronata* var. *calitzdorpensis* Breuer in *Avonia* 21(3): 50 (2003).
- Haworthia arachnoidea* var. *joubertii*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia joubertii* M.Hayashi in *Haworthia Study* 14: 16 (2005).
- Haworthia arachnoidea* var. *laxa*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia laxa* M.Hayashi in *Haworthia Study* 14: 14 (2005).
- Haworthia arachnoidea* var. *limbata*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia limbata* M.Hayashi in *Haworthia Study* 14: 16 (2005).
- Haworthia aranea* var. *candida*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia candida* M.Hayashi in *Haworthia Study* 16: 16 (2006).
- Haworthia atrofusca* var. *enigma*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia enigma* M.Hayashi in *Haworthia Study* 7: 14 (2002).
- Haworthia badia* var. *bobii*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia bobii* M.Hayashi in *Haworthia Study* 29: 4. (2014).
- Haworthia badia* var. *joleneae*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia joleneae* M.Hayashi in *Haworthia Study* 29: 4. (2014).
- Haworthia batesiana* var. *lepida*** (G.G.Sm.) Breuer comb. et stat. nov. Basionym: *Haworthia lepida* G.G.Sm. in *J. S. African Bot.* 10: 21 (1944).
- Haworthia batesiana* var. *reddii*** (C.L.Scott) Breuer comb. et stat. nov. Basionym: *Haworthia reddii* C.L.Scott in *Cact. Succ. J. (US)* 66: 182 (1994).
- Haworthia bayeri* var. *hayashii*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia hayashii* M.Hayashi in *Haworthia Study* 7: 14 (2002).
- Haworthia bayeri* var. *jadea*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia jadea* M.Hayashi in *Haworthia Study* 12: 13 (2004).
- Haworthia blackbeardiana* var. *calaensis*** (Breuer) Breuer comb. et stat. nov. Basionym: *Haworthia calaensis* Breuer in *Alsterworthia Int. Special Issue* 7: 5 (2004).
- Haworthia blackbeardiana* var. *specksii*** (Breuer) Breuer comb. et stat. nov. Basionym: *Haworthia specksii* Breuer in *Alsterworthia Int. Special Issue* 7: 8 (2004).
- Haworthia bolusii* var. *floccosa*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia floccosa* M.Hayashi in *Haworthia Study* 10: 13 (2003).
- Haworthia caerulea* var. *pallens*** (Breuer et M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia pallens* Breuer et M.Hayashi in *Alsterworthia Int. Special Issue* 7: 7 (2004).
- Haworthia caespitosa* var. *consanguinea*** (M.B.Bayer) Breuer comb. nov. Basionym: *Haworthia mirabilis* var. *consanguinea* M.B.Bayer in *Haworthia Revisited*: 111 (1999).
- Haworthia cangoensis* var. *kogmanensis*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia kogmanensis* M.Hayashi in *Haworthia Study* 14: 14 (2005).
- Haworthia cangoensis* var. *royalis*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia royalis* M.Hayashi in *Haworthia Study* 14: 1 (2005).
- Haworthia cangoensis* var. *tradouwensis*** (Breuer) Breuer comb. et stat. nov. Basionym: *Haworthia tradouwensis* Breuer in *Avonia* 21: 57 (2003).
- Haworthia cooperi* var. *hisui*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia hisui* M.Hayashi in *Haworthia Study* 12: 10 (2004).
- Haworthia cyanea* var. *amethysta*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia amethysta* M.Hayashi in *Haworthia Study* 10: 1 (2003).
- Haworthia cyanea* var. *ianthina*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia ianthina* M.Hayashi in *Haworthia Study* 14: 12 (2005).
- Haworthia cyanea* var. *succinea*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia succinea* M.Hayashi in *Haworthia Study* 10: 14 (2003).
- Haworthia decipiens* var. *exilis*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia exilis* M.Hayashi in *Haworthia Study* 10: 12 (2003).
- Haworthia decipiens* var. *incrassa*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia incrassa* M.Hayashi in *Haworthia Study* 14: 12 (2005).
- Haworthia graminifolia* var. *derustensis*** (M.B.Bayer) Breuer comb. nov. Basionym: *Haworthia blackburniae* var. *derustensis* M.B.Bayer in *Haworthia Revisited*: 41 (1997).
- Haworthia hamata* var. *subhamata*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia subhamata* M.Hayashi in *Haworthia Study* 12: 11 (2004).
- Haworthia inconfluens* var. *crystallina*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia crystallina* M.Hayashi in *Haworthia Study* 15: 16 (2006).
- Haworthia inconfluens* var. *lockwoodii*** (Archibald) Breuer comb. et stat. nov. Basionym: *Haworthia lockwoodii* Archibald in *Fl. Pl. Africa* 20: f.792 (1940).
- Haworthia indigoa* var. *truterorum*** (Breuer et Marx) Breuer comb. et stat. nov. Basionym: *Haworthia truterorum* Breuer et Marx in *Aloe* 48: 54 (2011).
- Haworthia isabellae* var. *arabesqua*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia arabesqua* M.Hayashi in *Haworthia Study* 12: 7 (2004).
- Haworthia isabellae* var. *bella*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia bella* M.Hayashi in *Haworthia Study* 12: 8 (2004).
- Haworthia isabellae* var. *ligulata*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia ligulata* M.Hayashi in *Haworthia Study* 12: 6 (2004).
- Haworthia jansenvillensis* var. *crinita*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia crinita* M.Hayashi in *Haworthia Study* 10: 13 (2003).
- Haworthia jansenvillensis* var. *eminens*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia eminens* M.Hayashi in *Haworthia Study* 10: 13 (2003).
- Haworthia jansenvillensis* var. *flavida*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia flavida* M.Hayashi in *Haworthia Study* 10: 13 (2003).
- Haworthia jansenvillensis* var. *fluffa*** (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia fluffa* M.Hayashi in *Haworthia Study* 12: 9 (2004).
- Haworthia jansenvillensis* var. *mollis*** (M.Hayashi) Breuer

comb. et stat. nov. Basionym: *Haworthia mollis* M.Hayashi in *Haworthia Study* 10: 14 (2003).

Haworthia jansenvillensis* var. *regina (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia regina* M.Hayashi in *Haworthia Study* 10: 14 (2003).

Haworthia lapis* var. *rava (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia rava* M.Hayashi in *Haworthia Study* 14: 11 (2005).

Haworthia magnifica* var. *asperula (Haw.) Breuer comb. et stat. nov. Basionym: *Haworthia asperula* Haw. in *Phil. Mag.* 1824 :300 (1824).

Haworthia magnifica* var. *obserata (Marx) Breuer comb. et stat. nov. Basionym: *Haworthia obserata* Marx in *Alsterworthia Int.* 14: 17 (2014).

Haworthia maraisii* var. *schuldtiana (V.Poelln.) Breuer comb. et stat. nov. Basionym: *Haworthia schuldtiana* V.Poelln. in *Repert. Spec. Nov. Regni Veg.* 41. 211 (1937).

Haworthia marumiana* var. *marmorata (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia marmorata* M.Hayashi in *Haworthia Study* 15: 14 (2006).

Haworthia mirabilis* var. *depauperata (V.Poelln.) Breuer comb. nov. Basionym: *Haworthia triebneriana* var. *depauperata* V.Poelln. in *Repert. Spec. Nov. Regni Veg.* 43: 94 (1938).

Haworthia monticola* var. *bronkhorstii (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia bronkhorstii* M.Hayashi in *Haworthiad* 15: 16 (2001).

Haworthia multifolia* var. *breueri (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia breueri* M.Hayashi in *Haworthia Study* 7: 14 (2002).

Haworthia multifolia* var. *major (G.G.Sm.) Breuer comb. nov. Basionym: *Haworthia schuldtiana* var. *major* G.G.Sm. in *J. S. African Bot.* 12: 1 (1946).

Haworthia mundula* var. *calcareea (Bayer) Breuer comb. nov. Basionym: *Haworthia mirabilis* var. *calcareea* M.B.Bayer in *Haworthia Revisited*: 110 (1999).

Haworthia nortieri* var. *agnis (Battista) Breuer comb. et stat. nov. Basionym: *Haworthia agnis* Battista in *Alsterworthia Int.* 2: 9 (2002).

Haworthia nortieri* var. *montana (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia montana* M.Hayashi in *Haworthia Study* 14: 14 (2005).

Haworthia notabilis* var. *diversicolor (Triebner et V.Poelln.) comb. nov. Basionym: *Haworthia triebneriana* var. *diversicolor* Triebner et V.Poelln. in *Feddes Repert.* 47: 9 (1939).

Haworthia odetteae* var. *odyssei (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia odyssei* M.Hayashi in *Haworthia Study* 14: 11 (2005).

Haworthia paradoxa* var. *jakubii (Breuer) Breuer comb. et stat. nov. Basionym: *Haworthia jakubii* Breuer in *Alsterworthia Int. Special Issue* 7: 10 (2004).

Haworthia parksiana* var. *dentata (M.B.Bayer) Breuer comb. nov. Basionym: *Haworthia floribunda* var. *dentata* M.B.Bayer *Haworthia Revisited* 73 (1999).

Haworthia pehlemanniae* var. *albispina (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia albispina* M.Hayashi in *Haworthia Study* 8: 1 (2002).

Haworthia picta* var. *comptoniana (G.G.Sm.) Breuer comb. et stat. nov. Basionym: *Haworthia comptoniana* G.G.Sm. in *J. S. African Bot.* 11: 76 (1945).

Haworthia picturata* var. *pusilla (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia pusilla* M.Hayashi in *Haworthia Study* 12: 10 (2004).

Haworthia pilosa* var. *ciliata (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia ciliata* M.Hayashi in *Haworthia Study* 14: 11 (2005).

Haworthia pilosa* var. *lachnosa (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia lachnosa* M.Hayashi in *Haworthia Study* 16: 16 (2006).

Haworthia pringlei* var. *hastata (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia hastata* M.Hayashi in *Haworthia Study* 12: 9 (2004).

Haworthia pygmaea* var. *esterhuizenii (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia esterhuizenii* M.Hayashi in *Haworthia Study* 7: 14 (2002).

Haworthia retusa* var. *fouchei (V.Poelln.) Breuer comb. et stat. nov. Basionym: *Haworthia fouchei* V.Poelln. in *Succulenta (Netherlands)* 22: 28 (1940).

Haworthia retusa* var. *fusca (Breuer) Breuer comb. et stat. nov. Basionym: *Haworthia fusca* Breuer in *Alsterworthia Int. Special Issue* 7: 9 (2004).

Haworthia rooibergensis* var. *erii (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia erii* M.Hayashi in *Haworthia Study* 14: 11 (2005).

Haworthia rossouwii* var. *scabra (Bayer) Breuer comb. nov. Basionym: *Haworthia heidelbergensis* var. *scabra* M.B.Bayer in *Haworthia Revisited*: 82 (1999).

Haworthia rossouwii* var. *serrata (Bayer) Breuer comb. et stat. nov. Basionym: *Haworthia serrata* M.B.Bayer in *Jl. S. Afr. Bot.* 39: 249 (1973).

Haworthia salina* var. *venusta (C.L.Scott) Breuer comb. et stat. nov. Basionym: *Haworthia venusta* C.L.Scott in *Bradleya* 14: 87 (1996).

Haworthia suberecta* var. *pallidifolia (G.G.Sm.) Breuer comb. nov. Basionym: *Haworthia turgida* var. *pallidifolia* G.G.Sm. in *J. S. African Bot.* 12: 10 (1946).

Haworthia tenera* var. *cunningii (Breuer et M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia cunningii* Breuer et M.Hayashi in *Haworthia Study* 10: 4 (2003).

Haworthia tenera* var. *doldii (M.B.Bayer) Breuer comb. nov. Basionym: *Haworthia cooperi* var. *doldii* M.B.Bayer in *Haworthiad* 16: 65 (2002).

Haworthia transiens* var. *florens (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia florens* M.Hayashi in *Haworthia Study* 12: 11 (2004).

Haworthia tetryrensis* var. *pectinis (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia pectinis* M.Hayashi in *Haworthia Study* 10: 13 (2003).

Haworthia umbraticola* var. *obesa (V.Poelln.) Breuer comb. nov. Basionym: *Haworthia cymbiformis* var. *obesa* V.Poelln. in *Repert. Spec. Nov. Regni Veg.* 45: 166 (1938).

Haworthia venetia* var. *calva (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia calva* M.Hayashi in *Haworthia Study* 12: 8 (2004).

Haworthia venetia* var. *jeffreis (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia jeffreis* M.Hayashi in *Haworthia Study* 12: 10 (2004).

Haworthia venetia* var. *teres (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia teres* M.Hayashi in *Haworthia Study* 12: 7 (2004).

Haworthiopsis attenuata (Haw.) Breuer comb. nov. Basionym: *Aloe attenuata* Haw. in *Trans. Linn. Soc. London* 7: 11 (1804).

Haworthiopsis attenuata* var. *glabrata (Salm Dyck) Breuer comb. et stat. nov. Basionym: *Aloe glabrata* Salm Dyck in *Hort. Dyck.*: 325 (1834).

Haworthiopsis attenuata* var. *radula (Jacq.) Breuer comb. et stat. nov. Basionym: *Aloe radula* Jacq. in *Pl. Rar. Hort. Schoenbr.* 4: 11,

t.422 (1804).

Haworthiopsis fasciata var. browniana (V.Poelln.) Breuer comb. et stat. nov. Basionym: *Haworthia browniana* V.Poelln. in Desert Pl. Life 9: 102 (1937).

Haworthiopsis granulata var. schoemanii (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia schoemanii* M.Hayashi in Haworthia Study 9: 14 (2003).

Haworthiopsis koelmaniorum var. mcmurtryi (C.L.Scott) Breuer comb. et stat. nov. Basionym: *Haworthiopsis mcmurtryi* C.L.Scott in Cact. Succ. J. (Los Angeles) 56(2): 69. (1984).

Haworthiopsis limifolia var. glaucophylla (M.B.Bayer) Breuer comb. nov. Basionym: *Haworthia limifolia* var. *glaucophylla* M.B.Bayer in Aloe 40(2): 50 2003.

Haworthiopsis limifolia var. striata (Pilbeam) Breuer comb. nov. Basionym: *Haworthia limifolia* var. *striata* Pilbeam in Haworthia & Astroloba :87 (1983).

Haworthiopsis reinwardtii var. coarctata (Haw.) Breuer comb. et stat. nov. Basionym: *Haworthia coarctata* Haw. in Philos.Mag. 64: 301 (1824).

Haworthiopsis reinwardtii var. greenii (Baker) Baker comb. et stat. nov. Basionym: *Haworthia greenii* Baker in J. Linn. Soc. Bot. 18: 202 (1880).

Haworthiopsis reinwardtii var. olivacea (G.G.Sm.) Breuer comb. et stat. nov. Basionym: *Haworthia reinwardtii* var. *olivacea* G.G.Sm. in J. S. African Bot. 10: 142 (1944).

Haworthiopsis reinwardtii var. tenuis (G.G.Sm.) Breuer comb. nov. Basionym: *Haworthia reinwardtii* var. *tenuis* G.G.Sm. in J. S. African Bot. 14: 51 (1948).

Haworthiopsis scabra var. johanii (M.Hayashi) Breuer comb. nov. Basionym: *Haworthia scabra* var. *johanii* M.Hayashi in Haworthiad 15: 16 (2001).

Haworthiopsis scabra var. smitii (V.Poelln.) Breuer comb. et stat. nov. Basionym: *Haworthia smitii* V.Poelln. in Desert Pl. Life 10: 186 (1938).

Haworthiopsis sordida var. agavoides (Zant. et V.Poelln.)

Breuer comb. et stat. nov. Basionym: *Haworthia agavoides* Zant. et V.Poelln. in Repert. Spec. Nov. Regni Veg. 43: 232 (1938).

Haworthiopsis tessellata var. crousii (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia crousii* [spahlm. crousii] M.Hayashi in Haworthiad 15: 16 (2001).

Haworthiopsis venosa var. woolleyi (V.Poelln.) Breuer comb. et stat. nov. Basionym: *Haworthia woolleyi* V.Poelln. in Repert. Spec. Nov. Regni Veg. 42: 269 (1937).

Haworthiopsis viscosa (L.) Breuer comb. nov. Basionym: *Aloe viscosa* L. in Sp. Pl. 1: 322 (1753).

Haworthiopsis viscosa var. asperiuscula (Haw.) Breuer comb. et stat. nov. Basionym: *Haworthia asperiuscula* Haw. in Suppl. Pl. Succ.: 60 (1819).

Haworthiopsis viscosa var. beanii (G.G.Sm.) Breuer comb. et stat. nov. Basionym: *Haworthia beanii* G.G.Sm. in J. S. African Bot. 10: 137 (1944).

Tulista kingiana (V.Poelln.) Breuer comb. nov. Basionym: *Haworthia kingiana* V.Poelln. in Cact. J. 5:31 (1936).

Tulista marginata var. mortonii (Breuer) Breuer comb. et stat. nov. Basionym: *Haworthia mortonii* Breuer in Alsterworthia Int. 7: 22 (2007).

Tulista minima var. poellnitziana (Uitew.) Breuer comb. et stat. nov. Basionym: *Haworthia poellnitziana* Uitew. in Cactuss. en Vetpl. 5: 137. (1939).

Tulista opalina (M.Hayashi) Breuer comb. nov. Basionym: *Haworthia opalina* M.Hayashi in Haworthiad 15: 17 (2001).

Tulista opalina var. zenigata (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia zenigata* M.Hayashi in Haworthiad 15: 20 (2001).

Tulista pumila var. ohkuwae (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia ohkuwae* M.Hayashi in Haworthia Study 16: 13 (2006).

Tulista pumila var. sparsa (M.Hayashi) Breuer comb. et stat. nov. Basionym: *Haworthia sparsa* M.Hayashi in Haworthia Study 16: 13 (2006).

Accepted Names in Haworthia, Haworthiopsis and Tulista

Genus	Species	Status	Representative Specimen		
			Collector's No.	Location	Site location Ref.
Haworthia	angustifolia		B6984	SE of Bloukrans	3326BC
Haworthia	angustifolia var. altissima		SS1034	N of Riebeek East	3326AA
Haworthia	angustifolia var. baylissii		IB3590	Oudekraal	3325BC
Haworthia	angustifolia var. paucifolia		DMC8213	Fish River	3326BD
Haworthia	aquamarina		IB13683	Rossouwspoort.	3225CC
Haworthia	arachnoidea		IB8877	Langevallei	3319DC
Haworthia	arachnoidea var. angiras	comb. et stat. nov.	IB6591	Calitzdorp	3321BC
Haworthia	arachnoidea var. calitzdorpensis	comb. nov.	IB6595	ENE of Calitzdorp	3321BD
Haworthia	arachnoidea var. joubertii	comb. et stat. nov.	IB7140	SE of Laingsburg	3321AC
Haworthia	arachnoidea var. laxa	comb. et stat. nov.	IB7143	Ouberg	3320CB
Haworthia	arachnoidea var. limbata	comb. et stat. nov.	JDV97-87	Osplaas	3319BC
Haworthia	arachnoidea var. scabrispina		IB3752	Floriskraal Dam	3320BD
Haworthia	aranea		DMC3994	Moerasrivier	3322CB
Haworthia	aranea var. candida	comb. et stat. nov.	GM494	SW of Ladismith	3321CA
Haworthia	archeri		IB597	Laingsburg	3320BB
Haworthia	asema		IB6619	Buffelskloof	3321DB
Haworthia	atrofusca		IB371	SW of Riversdale	3421AA
Haworthia	atrofusca var. enigma	comb. et stat. nov.	IB511	N of Riversdale	3421AA
Haworthia	azurea		DMC8583	Grootpoort	3325AC
Haworthia	badia		IB6460	W of Napier	3419BD
Haworthia	badia var. bobii	comb. et stat. nov.	MBB7248	Ballyfar, Infanta	3420BC
Haworthia	badia var. joleneae	comb. et stat. nov.	IB18992	SE of Malgas	3420BC

Haworthia	batesiana		IB377	SW of Graaff Reinet	3224AB
Haworthia	batesiana var. lepida	comb. et stat. nov.	GG55066	W of Fort Brown	3326AB
Haworthia	batesiana var. reddii	comb. et stat. nov.	JDV92-113	Waterdown Dam	3226BB
Haworthia	batteniae		SS1046	S of Cradock	3225BA
Haworthia	bayeri		IB7095	Uniondale	3323CA
Haworthia	bayeri var. hayashii	comb. et stat. nov.	MH81-122	S of Oudtshoorn	3322CA
Haworthia	bayeri var. jadea	comb. et stat. nov.	GM261	Kammanassie Dam	3322CB
Haworthia	blackbeardiana		DMC5400	SE of Queenstown	3126DD
Haworthia	blackbeardiana var. calaensis	comb. et stat. nov.	IB12513	SW of Cala	3127DA
Haworthia	blackbeardiana var. specksii	comb. et stat. nov.	VDV42	S of Queenstown	3126DD
Haworthia	blackburniae		VDV34	SW of Ladismith	3321CA
Haworthia	bolusii		IB7002	Graaff Reinet	3224BC
Haworthia	bolusii var. floccosa	comb. et stat. nov.	IB12579	NE of Fullarton	3323AB
Haworthia	bolusii var. semiviva		JDV91-48	Beaufort West	3222BC
Haworthia	caerulea		SS1036	Helspoort	3326AB
Haworthia	caerulea var. pallens	comb. et stat. nov.	IB6537	Glen Craig	3326BC
Haworthia	caespitosa		IB2869	Tradouw Pass	3320DC
Haworthia	caespitosa var. consanguinea	comb. nov.	IB54	McGregor	3319DD
Haworthia	cangoensis		IB6643	N of Oudtshoorn	3322AC
Haworthia	cangoensis var. kogmanensis	comb. et stat. nov.	IB7157	Kogmanskloof	3320CC
Haworthia	cangoensis var. royalis	comb. et stat. nov.	VDV1672	N of Volmoed	3321CA
Haworthia	cangoensis var. tradouwensis	comb. et stat. nov.	IB7171	Tradouw Pass	3320DC
Haworthia	chloracantha		IB6650	Herbertsdale	3421BB
Haworthia	chloracantha var. denticulifera		IB37	Mossel Bay	3422AA
Haworthia	chloracantha var. subglauca		IB315	Great Brakrivier	3422AA
Haworthia	cooperi		SS1031	NW of Grahamstown	3326AB
Haworthia	cooperi var. dielsiana		MBB6565	W of Somerset East	3225DA
Haworthia	cooperi var. hisui	comb. et stat. nov.	DMC8249	Cookhouse	3225DB
Haworthia	cooperi var. pilifera		IB8576	E of Fort Beaufort	3326DC
Haworthia	cyanea		IB6655	NE of Prince Albert	3322AB
Haworthia	cyanea var. amethysta	comb. et stat. nov.	JDV97-74	Damplaas	3323AC
Haworthia	cyanea var. ianthina	comb. et stat. nov.	IB6576	N of Uniondale	3323CA
Haworthia	cyanea var. succinea	comb. et stat. nov.	MH03-267	Perdepoort, Willowmore	3323AB
Haworthia	cymbiformis		IB4507	Settlers Park, P.E.	3325DC
Haworthia	cymbiformis var. ramosa		GG53168	Wooldridge	3327AB
Haworthia	cymbiformis var. setulifera		JDV91-91	NE of East London	3327BB
Haworthia	decipiens		IB206	Willowmore	3323AD
Haworthia	decipiens var. exilis	comb. et stat. nov.	MBB6587	Die Bordjie	3324BC
Haworthia	decipiens var. incrassa	comb. et stat. nov.	PVB7052	NE of Willowmore	3323CB
Haworthia	devriesii		VDV643	Prince Albert	3322AA
Haworthia	dimorpha		GM646	W of Konstale	3320AD
Haworthia	elizeae		VDV563	W of Swellendam	3420AA
Haworthia	emeralda		MBB6925	Kok-se-pad, N of Kirkwood	3325AD
Haworthia	floribunda		JDV89-22	N of Heidelberg	3420BB
Haworthia	floribunda var. major		JDV91-3	S of Swellendam	3420AB
Haworthia	globifera		PVB7338	Touwsberg	3320DB
Haworthia	gordoniana		DMC11040	Zuurbron	3324DD
Haworthia	graminifolia		IB11671	Schoemanspoort	3322AC
Haworthia	graminifolia var. derustensis	comb. nov.	JDV93-24	W of De Rust	3322CB
Haworthia	groenewaldii		DMC13222	Buffeljagsrivier	3420BA
Haworthia	habdomadis		VDV83	Seweweekspoort	3321AD
Haworthia	hamata		MBB6600	Perdepoort	3325AC
Haworthia	hamata var. subhamata	comb. et stat. nov.	MBB6935	De Plaat, NE of Kabouga	3325AD
Haworthia	harryi		DMC8246	N-end of Uniondale Poort	3323CA
Haworthia	heidelbergensis		JDV87-1	Heidelberg	3420BB
Haworthia	heidelbergensis var. toonensis		JDV87-3	SW of Heidelberg	3420BB
Haworthia	herbacea		IB8888	Ribbokkop, Worcester	3319DC
Haworthia	herbacea var. flaccida		JDV96-31	Rooiberg, Robertson	3319DD
Haworthia	herbacea var. lupula		JDV94-36	Villiersdorp	3319CD
Haworthia	herbacea var. paynei		IB8848	McGregor	3319DD
Haworthia	ikra		ISI1762	Stutterheim	3227BC
Haworthia	inconfluens		IB5394	Ladismith	3321AD
Haworthia	inconfluens var. crystallina	comb. et stat. nov.	IB12419	Kleinfontein	3321DA
Haworthia	inconfluens var. lockwoodii	comb. et stat. nov.	IB6739	S of Laingsburg	3320BB
Haworthia	inconfluens var. morrisiae		VDV87	SW of Oudtshoorn	3322CA
Haworthia	incurvula		IB6539	Pluto's Vale	3326BB
Haworthia	indigoa		VDV445	NE of George	3322DA
Haworthia	indigoa var. truterorum	comb. et stat. nov.	GM676	Heimersrivier	3322CD

Haworthia	integra		IB6651	Herbertsdale	3321BC
Haworthia	integra var. standeri		JME1-98	NW of Calitzdorp	3321BC
Haworthia	intermedia		JDV87-203	N of Klaas Voogds	3319DD
Haworthia	isabellae		MBB6801	SW of Hankey	3324DD
Haworthia	isabellae var. arabesqua	comb. et stat. nov.	SS1009	Gamtoos River	3324DD
Haworthia	isabellae var. bella	comb. et stat. nov.	JDV92-136	Houtkloof	3324DB
Haworthia	isabellae var. ligulata	comb. et stat. nov.	IB12439	Hankey, Loerie	3325CC
Haworthia	jansenvillensis		IB6996	Jansenville	3324DC
Haworthia	jansenvillensis var. crinita	comb. et stat. nov.	DMC5157	Beerpoort	3323BB
Haworthia	jansenvillensis var. eminens	comb. et stat. nov.	MH03-287	Pearston	3225CA
Haworthia	jansenvillensis var. flavida	comb. et stat. nov.	IB12611	Darlington Dam	3325AA
Haworthia	jansenvillensis var. fluffa	comb. et stat. nov.	MBB6910	SE of De Plaat	3325AD
Haworthia	jansenvillensis var. mollis	comb. et stat. nov.	IB6995	Waterford	3325AB
Haworthia	jansenvillensis var. regina	comb. et stat. nov.	IB6575	N of Klipplaat	3324AB
Haworthia	joeyae		DMC6682	NE of Cookhouse	3225DB
Haworthia	lapis		DMC8600	Modderfontein	3325BB
Haworthia	lapis var. rava	comb. et stat. nov.	MBB6899	Paddafontein	3325AB
Haworthia	lazulis		MBB6852	Stonefontein	3325AB
Haworthia	leightonii		IB4735	Kayser's Beach	3327BA
Haworthia	leightonii var. davidii		IB6970	Paynes Hill	3327BA
Haworthia	longibracteata		LAV26913	Stilbay	3421AD
Haworthia	luri		IB13694	N of Addo	3325DA
Haworthia	maculata		JDV88-29	N of Brandvlei Dam	3319CB
Haworthia	maculata var. livida		JDV88-31	Lemoenpoort	3319CD
Haworthia	magnifica		JDV87-181	SW of Riversdale	3421AA
Haworthia	magnifica var. asperula	comb. et stat. nov.	JDV94-6	NE of Riversdale	3421AA
Haworthia	magnifica var. obserata	comb. et stat. nov.	GM718	Brandrivier	3321CC
Haworthia	magnifica var. splendens		JDV93-59	W of Albertinia	3421BC
Haworthia	maraisii		ISI93-38	Swellendam	3420AB
Haworthia	maraisii var. schuldiana	comb. et stat. nov.	MBB6646	N of McGregor	3420AA
Haworthia	marumiana		IB123	New Bethesda	3124DC
Haworthia	marumiana var. marmorata	comb. et stat. nov.	MH03-205	NE of Prince Albert	3221DD
Haworthia	marumiana var. viridis		MBB3620	S of Prince Albert	3322AC
Haworthia	marxii		GM623	W of Rooinek Pass	3320BC
Haworthia	maughanii		IB4820	Calitzdorp	3321DA
Haworthia	meiringii		KGW224-70	E of Bonnievale	3320CC
Haworthia	mirabilis		IB2850	Greyton	3419BA
Haworthia	mirabilis var. depauperata	comb. nov.	IB8788	Stormsvlei Pass	3420AA
Haworthia	mirabilis var. sublineata		IB8795	Bredasdorp	3420CA
Haworthia	monticola		IB4554	Uniondale	3323CA
Haworthia	monticola var. bronkhorstii	comb. et stat. nov.	JME18-94	NW of Uniondale	3323AC
Haworthia	multifolia		IB133	Springfontein	3321CC
Haworthia	multifolia var. breueri	comb. et stat. nov.	JDV90-22	Sandkraal	3321CD
Haworthia	multifolia var. major	comb. nov.	IB5539	Garcias Pass	3321CC
Haworthia	mundula		MBB6631	SW of Bredasdorp	3419DB
Haworthia	mundula var. calcarea	comb. nov.	JDV84-65	De Hoop	3420CA
Haworthia	namaquensis		MBB1674	N of Calvinia	3119BD
Haworthia	nortieri		IB12823	Vanrhyns Pass	3119AC
Haworthia	nortieri var. agnis	comb. et stat. nov.	IB12805	Vanrynsdorp	3119AC
Haworthia	nortieri var. giftbergensis		LAV26669	Giftberg	3118DC
Haworthia	nortieri var. globosiflora		IB5461	Botterkloof	3119CD
Haworthia	nortieri var. montana	comb. et stat. nov.	IB676	Ouberg	3220AD
Haworthia	notabilis		JDV87-197	NW of Robertson	3319DD
Haworthia	notabilis var. diversicolor	comb. nov.	MBB6757	SE of McGregor	3319DD
Haworthia	oculata		SS1084	N of Komdomo	3324DA
Haworthia	odetteae		DMC8604	Lootskloof	3224DD
Haworthia	odetteae var. odyssei	comb. et stat. nov.	IB12597	SE of Pearston	3225CD
Haworthia	outeniquensis		IB6645	Moreasrivier	3322CC
Haworthia	paradoxa		DMC9247	S of Vermaaklikheid	3421AC
Haworthia	paradoxa var. jakubii	comb. et stat. nov.	IB13757	Melkhoutkraal	3421AD
Haworthia	parkiana		GM284	Mossel Bay	3422AA
Haworthia	parkiana var. dentata	comb. nov.	MBB5460	N of Gouritzmond	3421BD
Haworthia	pehlemanniae		IB7125	W of Laingsburg	3320BB
Haworthia	pehlemanniae var. albispina	comb. et stat. nov.	IB11766	Koup, E of Laingsburg	3321AB
Haworthia	pellucida		IB8929	Waaipoort	3324AB
Haworthia	picta		IB6209	S of Oudtshoorn	3322CA
Haworthia	picta var. comptoniana	comb. et stat. nov.	IB6779	Georgida	3323AD
Haworthia	picta var. janvlokii		IB7111	Kammanassie Dam	3322BA

Haworthia	<i>picta</i> var. <i>tricolor</i>		GM256	Rooiberg Pass	3321DA
Haworthia	<i>picturata</i>		JDV90-76	Andrieskraal	3324DA
Haworthia	<i>picturata</i> var. <i>pusilla</i>	comb. et stat. nov.	MBB6928	E of Andrieskraal	3324DC
Haworthia	<i>pilosa</i>		MBB 6826	Rooihoek, Baviaanskloof	3324CA
Haworthia	<i>pilosa</i> var. <i>ciliata</i>	comb. et stat. nov.	MBB7017	W of De Plaat	3325BC
Haworthia	<i>pilosa</i> var. <i>lachnosa</i>	comb. et stat. nov.	PVB7128	Holrivier	3324DC
Haworthia	<i>pringlei</i>		IB6472	SW of Adelaide	3225CC
Haworthia	<i>pringlei</i> var. <i>hastata</i>	comb. et stat. nov.	MBB6561	Baviaanskrans	3225DD
Haworthia	<i>pubescens</i>		IB499	SE of Worcester	3319DC
Haworthia	<i>pulchella</i>		IB8901	NE of Touws River	3320AC
Haworthia	<i>pygmaea</i>		JDV84-15	Great Brakrivier	3422AA
Haworthia	<i>pygmaea</i> var. <i>acuminata</i>		JDV91-31	N of Gouritzmond	3421BD
Haworthia	<i>pygmaea</i> var. <i>argenteo-maculosa</i>		VDV249	Humor, W of Mossel Bay	3421BB
Haworthia	<i>pygmaea</i> var. <i>esterhuizenii</i>	comb. et stat. nov.	GM320	E of Albertinia	3421BA
Haworthia	<i>pygmaea</i> var. <i>vincentii</i>		VDV71	NE of Albertinia	3421BA
Haworthia	<i>reticulata</i>		SS1202	Wolfkloof	3319DC
Haworthia	<i>reticulata</i> var. <i>attenuata</i>		MBB6515	Aurora, Bonnievale	3320CC
Haworthia	<i>reticulata</i> var. <i>hurlingii</i>		JDV87-191	Goudmyn	3320CC
Haworthia	<i>reticulata</i> var. <i>subregularis</i>		MBB6693	NE of Worcester	3319DA
Haworthia	<i>retusa</i>		JDV92-124	SE of Riversdale	3421AB
Haworthia	<i>retusa</i> var. <i>dekenahii</i>		GG55489	N of Albertinia	3421BA
Haworthia	<i>retusa</i> var. <i>fouchei</i>	comb. et stat. nov.	JDV87-5	E of Riversdale	3421AB
Haworthia	<i>retusa</i> var. <i>fusca</i>	comb. et stat. nov.	IB8971	W of Paulsfontein	3421BA
Haworthia	<i>retusa</i> var. <i>mutica</i>		IB6328	Stormsvlei	3420AA
Haworthia	<i>retusa</i> var. <i>nigra</i>		JDV86-16	SW of Heidelberg	3420BB
Haworthia	<i>retusa</i> var. <i>quimutica</i>		JDV90-1	SE of Heidelberg	3420BB
Haworthia	<i>rooibergensis</i>		JME7-97	Vanwyksdorp	3321DA
Haworthia	<i>rooibergensis</i> var. <i>erii</i>	comb. et stat. nov.	VDV443	ESE of De Rust	3322DA
Haworthia	<i>rossouwii</i>		DMC13215	Soutkloof, NW of Bredasdorp	3420AC
Haworthia	<i>rossouwii</i> var. <i>minor</i>		JDV86-5	Rooivlei, N of Bredasdorp	3420AC
Haworthia	<i>rossouwii</i> var. <i>scabra</i>	comb. nov.	JDV87-4	E of Drew	3320CC
Haworthia	<i>rossouwii</i> var. <i>serrata</i>	comb. et stat. nov.	IB7159	SW of Heidelberg	3420BA
Haworthia	<i>salina</i>		IB15454	Stillwell	3325DA
Haworthia	<i>salina</i> var. <i>venusta</i>	comb. et stat. nov.	JDV94-5	Alexandria	3326DA
Haworthia	<i>scottii</i>		IB6617	SE of Calitzdorp	3321DA
Haworthia	<i>springbokvlakensis</i>		EA976	Springbokvlakte	3324BC
Haworthia	<i>suberecta</i>		IB7180	Brandwag	3422AA
Haworthia	<i>suberecta</i> var. <i>pallidifolia</i>	comb. nov.	KBG313/73	NW of Albertinia	3421BA
Haworthia	<i>tenera</i>		IB6667	Fish River	3326BB
Haworthia	<i>tenera</i> var. <i>cumingii</i>	comb. et stat. nov.	IB12447	SES of Committees Drift	3326BB
Haworthia	<i>tenera</i> var. <i>doldii</i>	comb. nov.	IB8547	Kwa Sandile, Chalumna	3327BA
Haworthia	<i>transiens</i>		IB4172	SSE of Uniondale	3323CA
Haworthia	<i>transiens</i> var. <i>florens</i>	comb. et stat. nov.	PVB7093	Skrikrivier	3323DB
Haworthia	<i>tretyrensis</i>		IB5372	Tretyre, Steytlerville	3324BC
Haworthia	<i>tretyrensis</i> var. <i>pectinis</i>	comb. et stat. nov.	IB8935	Noorspoort	3324AD
Haworthia	<i>truncata</i>		VDV472	N of Oudtshoorn	3322AC
Haworthia	<i>truncata</i> var. <i>minor</i>		IB5379	Dysseldorp	3322CB
Haworthia	<i>turgida</i>		IB8753	SW of Swellendam	3420AB
Haworthia	<i>umbraticola</i>		IB7023	Swartwater Poort	3325BB
Haworthia	<i>umbraticola</i> var. <i>obesa</i>	comb. nov.	ISI1856	E of Idutywa	3328AB
Haworthia	<i>unicolor</i>		IB7155	Sandlegte	3320DA
Haworthia	<i>variegata</i>		JDV89-6	NW of Stilbay	3421AD
Haworthia	<i>variegata</i> var. <i>hemicrypta</i>		JDV86-11	N of Potberg	3420BC
Haworthia	<i>variegata</i> var. <i>modesta</i>		MBB2551	Kathoek	3420AD
Haworthia	<i>variegata</i> var. <i>petrophila</i>		IB8794	Karsrivier	3420AC
Haworthia	<i>venetia</i>		DMC8560	N of Hankey	3324DD
Haworthia	<i>venetia</i> var. <i>calva</i>	comb. et stat. nov.	MBB6904	W of Kaboega	3325AD
Haworthia	<i>venetia</i> var. <i>jeffreis</i>	comb. et stat. nov.	IB225	Jeffrey's Bay	3424BB
Haworthia	<i>venetia</i> var. <i>teres</i>	comb. et stat. nov.	MBB6940	E of De Plaat	3325AC
Haworthia	<i>venteri</i>		IB6582	SW of Ladismith	3321CA
Haworthia	<i>vlokii</i>		JDV91-2	E of Meiringspoort	3322BC
Haworthia	<i>wittebergensis</i>		DMC5075	Witteberggrivier	3320BD
Haworthia	<i>xiphophylla</i>		IB6517	N of Uitenhage	3325CB
Haworthia	<i>zantneriana</i>		IB6574	N of Kampherspoort	3324AB
Haworthia	<i>zantneriana</i> var. <i>minor</i>		JDV85-26	Miller	3323BB
Haworthiopsis	<i>attenuata</i>	comb. nov.	IB7199	Coega Kop	3325DC
Haworthiopsis	<i>attenuata</i> var. <i>glabrata</i>	comb. et stat. nov.	PVB4400	Bashee River	3328BA
Haworthiopsis	<i>attenuata</i> var. <i>radula</i>	comb. et stat. nov.	GM415	Hankey	3324DD

<i>Haworthiopsis</i>	<i>bruynsii</i>		IB5908	Springbokvlakte	3324BD
<i>Haworthiopsis</i>	<i>fasciata</i>		DMC8556	SE of Hankey	3324DD
<i>Haworthiopsis</i>	<i>fasciata</i> var. <i>browniana</i>	comb. et stat. nov.	ISI1664	Hillwacht, N of Uitenhage	3325CB
<i>Haworthiopsis</i>	<i>glauca</i>		IB8523	Weltevrede	3325AB
<i>Haworthiopsis</i>	<i>glauca</i> var. <i>herrei</i>		ISI1568	Miller	3323BB
<i>Haworthiopsis</i>	<i>granulata</i>		IB531	Verlatekloof	3220DA
<i>Haworthiopsis</i>	<i>granulata</i> var. <i>schoemaniae</i>	comb. et stat. nov.	MH03-309	Dwyka	3321BA
<i>Haworthiopsis</i>	<i>koelmaniorum</i>		IB876	Grobbersdal	2529AB
<i>Haworthiopsis</i>	<i>koelmaniorum</i> var. <i>mcmurtryi</i>	comb. et stat. nov.	IB6664	SE of Verena	2529CA
<i>Haworthiopsis</i>	<i>limifolia</i>		IB10840	Abercorn Drift	2632CC
<i>Haworthiopsis</i>	<i>limifolia</i> var. <i>arcana</i>		IB6746	Hectorspruit	2531BC
<i>Haworthiopsis</i>	<i>limifolia</i> var. <i>gigantea</i>		IB5652	Nongoma	2731DC
<i>Haworthiopsis</i>	<i>limifolia</i> var. <i>glaucophylla</i>	comb. nov.	FV13700	3Sisters, Barberton	2531CB
<i>Haworthiopsis</i>	<i>limifolia</i> var. <i>striata</i>	comb. nov.	MBB7137	Lebombo Mountains	2732CD
<i>Haworthiopsis</i>	<i>limifolia</i> var. <i>ubomboensis</i>		IB634	Stegi, Ubombo Mountains	2732CA
<i>Haworthiopsis</i>	<i>longiana</i>		IB4180	SE of Patensie	3324DB
<i>Haworthiopsis</i>	<i>nigra</i>		IB6556	Steytlerville	3324AD
<i>Haworthiopsis</i>	<i>nigra</i> var. <i>diversifolia</i>		IB7121	W of Beaufort West	3221BD
<i>Haworthiopsis</i>	<i>pungens</i>		MBB6380	Bramriver	3323DD
<i>Haworthiopsis</i>	<i>reinwardtii</i>		IB8555	W of Wesley	3327AD
<i>Haworthiopsis</i>	<i>reinwardtii</i> var. <i>brevicula</i>		IB525	E of Kaffir drift	3327AC
<i>Haworthiopsis</i>	<i>reinwardtii</i> var. <i>coarctata</i>	comb. et stat. nov.	IB7025	Blaukrans Stasie	3326BC
<i>Haworthiopsis</i>	<i>reinwardtii</i> var. <i>greenii</i>	comb. et stat. nov.	JDV90-046	S of Grahamstown	3326AD
<i>Haworthiopsis</i>	<i>reinwardtii</i> var. <i>olivacea</i>	comb. et stat. nov.	IB6976	Kaffir drift Police Station	3327AC
<i>Haworthiopsis</i>	<i>reinwardtii</i> var. <i>tenuis</i>	comb. nov.	IB6545	NE of Alexandria	3326DA
<i>Haworthiopsis</i>	<i>scabra</i>		JDV86-93	Schoemanspoort	3322CA
<i>Haworthiopsis</i>	<i>scabra</i> var. <i>johannii</i>	comb. nov.	IB7184	Prince Alfred Pass	3323CC
<i>Haworthiopsis</i>	<i>scabra</i> var. <i>lateganiae</i>		VDV112	E of Klein Kruis	3322AD
<i>Haworthiopsis</i>	<i>scabra</i> var. <i>smitii</i>	comb. et stat. nov.	JDV90-82	Schoemanspoort	3322CB
<i>Haworthiopsis</i>	<i>scabra</i> var. <i>starkiana</i>		SS1166	Schoemanspoort	3322AC
<i>Haworthiopsis</i>	<i>sordida</i>		IB4818	Steytlerville	3324AD
<i>Haworthiopsis</i>	<i>sordida</i> var. <i>agavoides</i>	comb. et stat. nov.	VDV518	Bluecliff, S of Kirkwood	3325AD
<i>Haworthiopsis</i>	<i>sordida</i> var. <i>lavranii</i>		IB6501	SEE of Steytlerville	3324BC
<i>Haworthiopsis</i>	<i>tessellata</i>		IB422	Lady Grey	3027CA
<i>Haworthiopsis</i>	<i>tessellata</i> var. <i>crousii</i>	comb. et stat. nov.	MH97-001	Postmasburg	2823AC
<i>Haworthiopsis</i>	<i>variabilis</i>		IB13743	Joubertina	3324CC
<i>Haworthiopsis</i>	<i>venosa</i>		DMC12751	Breede River, Swellendam	3420AB
<i>Haworthiopsis</i>	<i>venosa</i> var. <i>woolleyi</i>	comb. et stat. nov.	IB635	SW of Kleinpoort	3324BD
<i>Haworthiopsis</i>	<i>viscosa</i>	comb. nov.	IB6633	SW of Kammanassie Dam	3322CB
<i>Haworthiopsis</i>	<i>viscosa</i> var. <i>asperiuscula</i>	comb. et stat. nov.	VDV131	NWN of Prince Albert	3322AA
<i>Haworthiopsis</i>	<i>viscosa</i> var. <i>beanii</i>	comb. et stat. nov.	IB284	NE of Patensie	3324DD
<i>Tulista</i>	<i>kingiana</i>	comb. nov.	IB150	Mossel Bay	3422AA
<i>Tulista</i>	<i>marginata</i>		IB7158	Heidelberg	3420BB
<i>Tulista</i>	<i>marginata</i> var. <i>mortonii</i>	comb. et stat. nov.	DMC10485	N of Bredasdorp	3420CA
<i>Tulista</i>	<i>minima</i>		IB8968	Zeegoegat, N of Riversdale	3421AB
<i>Tulista</i>	<i>minima</i> var. <i>poellnitziana</i>	comb. et stat. nov.	IB344	Drew, NW of Swellendam	3320CC
<i>Tulista</i>	<i>opalina</i>	comb. nov.	MBB215	Brandrivier	3321CC
<i>Tulista</i>	<i>opalina</i> var. <i>zenigata</i>	comb. et stat. nov.	MH81-122	Moerasrivier	3322CC
<i>Tulista</i>	<i>pumila</i>		IB8809	Robertson	3319CB
<i>Tulista</i>	<i>pumila</i> var. <i>ohkuwae</i>	comb. et stat. nov.	GM600	SW of Laingsburg	3320BB
<i>Tulista</i>	<i>pumila</i> var. <i>sparsa</i>	comb. et stat. nov.	MH95-036	Lemoenpoort	3319CD

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1. Genus *Haworthia*. Photographs of each species in alphabetical order.



Haworthia angustifolia
var. *altissima*. SS1034



Haworthia angustifolia
var. *angustifolia*. B6984



Haworthia angustifolia
var. *baylissii*. IB3590



Haworthia angustifolia
var. *paucifolia*. DMC8213



Haworthia aquamarina.
IB13683



Haworthia arachnoidea
var. *angiras*. IB6591



Haworthia arachnoidea
var. *arachnoidea*. IB8877



Haworthia arachnoidea
var. *calisdorpensis*. IB6596



Haworthia arachnoidea
var. *joubertii*. IB7140



Haworthia arachnoidea
var. *laxa*. B7143



Haworthia arachnoidea
var. *limbata*. JDV97-87



Haworthia arachnoidea
var. *scabrispina*. IB3752



Haworthia aranea var. *aranea*.
DMC3994
Please see top right of page 24



Haworthia archeri.
IB597



Haworthia asema.
IB6619



Haworthia atrofusca.
var. *atrofusca*. IB371



Haworthia atrofusca
var. *enigma*. IB511



Haworthia azurea.
DMC8583



Haworthia badia
var. *badia*. IB6460



Haworthia badia
var. *bobii*. MBB7248



Haworthia badia
var. joleneae. IB1892



Haworthia batesiana
var. batesiana. IB377



Haworthia batesiana
var. lepida. GGS5066



Haworthia batesiana
var. reddii. DV92-113



Haworthia batteniae.
SS1046



Haworthia bayeri
var. bayeri. IB7095



Haworthia bayeri
var. hayashii. MH81-122



Haworthia bayeri
var. jadea. GM261



Haworthia blackbeardiana
var. blackbeardiana. DMC5400



Haworthia blackbeardiana
var. calaensis. IB12513



Haworthia blackbeardiana
var. specksii. VDD42



Haworthia blackburniae.
VDV34



Haworthia bolusii
var. bolusii. IB7002



Haworthia bolusii.
IB12579



Haworthia bolusii
var. semiviva. JDV91-048



Haworthia caerulea
var. caerulea. SS1036



Haworthia caerulea
var. pallens. B6537



Haworthia caespitosa
var. caespitosa. IB2869



Haworthia caespitosa
var. consanguinea. IB54



Haworthia cangoensis
var. cangoensis. IB6643



Haworthia cangoensis
var. *kogmanensis*. IB7157



Haworthia cangoensis
var. *royalis*. VDV1672



Haworthia cangoensis
var. *tradouwensis*. IB7170



Haworthia chloracantha
var. *chloracantha*. IB6650



Haworthia chloracantha
var. *denticulifera*. IB37



Haworthia chloracantha
var. *subglauca*. IB315



Haworthia cooperi
var. *cooperi*. SS1031



Haworthia cooperi
var. *dielsiana*. MBB6565



Haworthia cooperi
var. *hisui*. DMCB249



Haworthia cooperi
var. *pilifera*. IB8576



Haworthia cyanea
var. *amethysta*. JDV94-74



Haworthia cyanea
var. *cyanea*. MH03-267



Haworthia cyanea
var. *lanthina*. IB6576



Haworthia cyanea
var. *succinea*. MH03-267



Haworthia cymbiformis
var. *cymbiformis*. IB4507



Haworthia cymbiformis
var. *ramosa*. GGS3168



Haworthia cymbiformis
var. *setulifera*. JDV91-91



Haworthia decipiens
var. *decipiens*. IB206



Haworthia decipiens
var. *exilis*. MBB6587



Haworthia decipiens
var. *incrassa*. PVB7052



Haworthia devriesii.
VDV643



Haworthia dimorpha.
GM646



Haworthia elizeae.
VDV563



Haworthia emeralda.
MBB6925



Haworthia floribunda.
JDV89-22



Haworthia floribunda
var. *major*. JDV91-3



Haworthia globifera.
PVB7338



Haworthia gordoniana.
DMC11040



Haworthia graminifolia
var. *derustensis*. JDV93-24



Haworthia graminifolia
var. *graminifolia*. IB11689



Haworthia groenewaldii.
DMC13222



Haworthia habdomadis.
VDV83



Haworthia hamata
var. *hamata*. MBB6600



Haworthia hamata
var. *subhamata*. MBB6935



Haworthia harryi.
DMC8246



Haworthia heidelbergensis
var. *heidelbergensis*. JDV87-1



Haworthia heidelbergensis
var. *toonensis*. JDV87-3



Haworthia herbacea
var. *flaccida*. JDV96-31



Haworthia herbacea
var. *herbacea*. IB8888



Haworthia herbacea
var. *lupula*. JDV94-36



Haworthia herbacea
var. paynei. IB8848



Haworthia ikra.
ISI1762



Haworthia inconfluens
var. crystalline. IB12419



Haworthia inconfluens
var. inconfluens. IB5394



Haworthia inconfluens
var. lockwoodii. IB6739



Haworthia inconfluens
var. morrisiae. VDV87



Haworthia incurvula.
B6539



Haworthia indigoa
var. indigoa. VDV445



Haworthia indigoa
var. truterorum. IB20852



Haworthia integra
var. integra. IB6651



Haworthia integra
var. standeri. JME1-98



Haworthia intermedia.
JDV87-203



Haworthia isabellae
var. arabesqua. SS1009



Haworthia isabellae
var. bella. JDV92-136



Haworthia isabellae
var. isabellae. MBB6801



Haworthia isabellae
var. ligulata. IB12439



Haworthia jansenvillensis
var. crinita. DMC5157



Haworthia jansenvillensis
var. eminens. MH03-287



Haworthia jansenvillensis
var. flavida. IB12611



Haworthia jansenvillensis
var. fluffa. MBB6910



Haworthia jansenvillensis
var. jansenvillensis. IB6996



Haworthia jansenvillensis
var. mollis. IB6995



Haworthia jansenvillensis
var. regina. IB6575



Haworthia joeyae
DMC6682



Haworthia lapis
var. lapis. DMC8600



Haworthia lapis
var. rava. MBB6899



Haworthia lazulis.
MBB6852



Haworthia leightonii
var. davidii. IB6970



Haworthia leightonii
var. leightonii. IB4735



Haworthia longibracteata.
LAV26913



Haworthia luri.
IB13694



Haworthia maculata
var. maculata. JDV88-29



Haworthia maculata
var. livida. IDV88.31



Haworthia magnifica
var. asperula. JDV94-6



Haworthia magnifica
var. magnifica. IB7172



Haworthia magnifica
var. obserata. GM718



Haworthia magnifica
var. splendens. JDV93-59



Haworthia maraisii
var. maraisii.



Haworthia maraisii
var. schuldtiana. IB5432



Haworthia marumiana
var. marumiana. IB123



Haworthia marumiana
var. marmorata. MH03205



Haworthia marumiana
var. viridis. MBB3620



Haworthia marxii.
GM623



Haworthia maughanii.
IB4820



Haworthia meiringii.
KGW224-70



Haworthia mirabilis
var. depauperata. IB8788



Haworthia mirabilis
var. mirabilis. IB2850



Haworthia mirabilis
var. sublineata. IB8795



Haworthia monticola
var. bronkhorstii. JME18-94



Haworthia monticola
var. monticola. IB4554



Haworthia multifolia
var. breueri. JDV90-22



Haworthia multifolia
var. major. IB5539



Haworthia multifolia
var. multifolia. IB133



Haworthia mundula
var. calcarea. IB187



Haworthia mundula
var. mundula. BB6631



Haworthia namaquensis.
MBB1674



Haworthia nortieri
var. agnis. IB12805



Haworthia nortieri
var. giftbergensis. LAV26669



Haworthia nortieri
var. globosiflora. IB5461



Haworthia nortieri
var. montana. IB676



Haworthia nortieri
var. *nortieri*. IB12823



Haworthia notabilis
var. *diversicolor*. MBB6757



Haworthia notabilis
var. *notabilis*. JDV87-203



Haworthia oculata.
SS1084



Haworthia odetteae
var. *odetteae*. DMC8604



Haworthia odetteae
var. *odyssei*. IB12597



Haworthia outeniquensis.
IB6645



Haworthia paradoxa
var. *jakubii*. IB13757



Haworthia paradoxa
var. *paradoxa*. DMC9247



Haworthia parksiana
var. *dentata*. MBB5460



Haworthia parksiana
var. *parksiana*. GM284



Haworthia pehlemanniae
var. *albispina*. IB11766



Haworthia pehlemanniae
var. *pehlemanniae*. IB7125



Haworthia pellucida.
IB8929



Haworthia picta
var. *comptoniana*. IB6779



Haworthia picta
var. *janvlokii*. IB7111



Haworthia picta
var. *picta*. IB6209



Haworthia picta
var. *tricolor*. GM256



Haworthia picturata
var. *picturata*. JDV90-76



Haworthia picturata
var. *pusilla*. MBB6928



Haworthia pilosa
var. *ciliata*. IB18239



Haworthia pilosa
var. *lachnosa*. PVB7128



Haworthia pilosa
var. *pilosa*. MBB6826



Haworthia pringlei
var. *hastata*. MBB6561



Haworthia pringlei
var. *pringlei*. MBB6561



Haworthia pubescens.
IB499



Haworthia pulchella.
IB8901



Haworthia pygmaea
var. *acuminata*. DV91-31



Haworthia pygmaea
var. *argenteo-maculosa*. VDV249



Haworthia pygmaea
var. *esterhuizenii*.



Haworthia pygmaea
var. *pygmaea*. JDV87-15



Haworthia pygmaea
var. *vincentii*. VDV71



Haworthia reticulata
var. *attenuata*. MBB6515



Haworthia reticulata
var. *hurlingii*. JDV87-191



Haworthia reticulata
var. *reticulata*. SS1202



Haworthia reticulata
var. *subregularis*. MBB6693



Haworthia retusa
var. *dekenahii*. GGS5489



Haworthia retusa
var. *fouchei*. DV87-5



Haworthia retusa
var. *fusca*. IB8971



Haworthia retusa
var. *mutica*. IB6328



Haworthia retusa
var. nigra. JDV86-16



Haworthia retusa
var. quimutica. JDV90-1



Haworthia retusa
var. retusa. JDV92-124



Haworthia rooibergensis
var. erii. IB443



Haworthia rooibergensis
var. rooibergensis. JME7-97



Haworthia rossouwii.
DMC13215



Haworthia rossouwii
var. minor. JDV86-5



Haworthia rossouwii
var. scabra. B4756



Haworthia rossouwii
var. serrata. IB7159



Haworthia salina
var. salina. IB15454



Haworthia salina
var. venusta. JDV94-5



Haworthia scottii.
IB6617



Haworthia springbokvlakensis.
EA976



Haworthia suberecta
var. suberecta. IB7180



Haworthia suberecta
var. pallidifolia. KGB313-73



Haworthia tenera
var. cummingii. IB12447



Haworthia tenera
var. doldii. IB8547



Haworthia tenera
var. tenera



Haworthia transiens
var. florens. PVB7093



Haworthia transiens
var. transiens. IB4172



Haworthia tretyrensis
var. pectinis. IB12585



Haworthia tretyrensis
var. tretyrensis. IB5372



Haworthia truncata
var. minor.
IB5379



Haworthia truncata
var. truncata.
VDV472



Haworthia turgida.
IB8753



Haworthia umbraticola
var. umbraticola. IB7023



Haworthia umbraticola
var. obesa. ISI1856



Haworthia unicolor.
IB7155



Haworthia variegata
var. hemiscripta. JDV89-11



Haworthia variegata
var. modesta. MBB2551



Haworthia variegata
var. petrophila. IB8794



Haworthia variegata
var. variegata. JDV89-6



Haworthia venetia
var. calva. MBB6904



Haworthia venetia
var. jeffreisi. IB225



Haworthia venetia
var. teresi. IB7236



Haworthia venetia
var. venetia. DMC8560



Haworthia venterii.
IB6582



Haworthia vlokii.
JDV91-2



Haworthia wittebergensis
IB7129



Haworthia xiphiophylla
var. xiphiophylla. IB6517



Haworthia zantneriana
var. minor. JDV85-26



Haworthia zantneriana
var. zantneriana. IB6574



Haworthia aranea
var. candida. GM415

2. Genus Haworthiopsis.

Photographs of each species in alphabetical order.



Haworthiopsis attenuata
var. attenuata. IB7199



Haworthiopsis attenuata
var. glabrata. PV4400



Haworthiopsis attenuata
var. radula. GM415



Haworthiopsis bruynsii.
IB5908



Haworthiopsis fasciata
var. fasciata. DMC8556



Haworthiopsis fasciata
var. browniana. ISI664



Haworthiopsis glauca
var. glauca. IB8523



Haworthiopsis glauca
var. herrei. ISI1568



Haworthiopsis granulata
var. granulata. IB531



Haworthiopsis granulata
var. schoemania. MH0309



Haworthiopsis koelmaniorum
var. koelmaniorum. IB876



Haworthiopsis koelmaniorum
var. mcmurtryi. IB6664



Haworthiopsis limifolia
var. arcana. IB6746



Haworthiopsis limifolia
var. gigantea. IB5652



Haworthiopsis limifolia
var. glaucophylla. 13700



Haworthiopsis limifolia
var. limifolia. IB10840



Haworthiopsis limifolia
var. striata. MBB7137



Haworthiopsis limifolia
var. ubomboensis. IB634



Haworthiopsis longiana.
IB4180



Haworthiopsis nigra
var. diversifolia. IB7121



Haworthiopsis nigra
var. nigra. IB6556



Haworthiopsis pungens.
MBB6380



Haworthiopsis reinwardtii
var. brevicula. IB525



Haworthiopsis reinwardtii
var. coarctata. IB7025



Haworthiopsis reinwardtii
var. greenii. JDV90-046



Haworthiopsis reinwardtii
var. olivacea. IB6976



Haworthiopsis reinwardtii
var. reinwardtii. IB8555



Haworthiopsis reinwardtii
var. tenuis. IB6545



Haworthiopsis scabra
var. johanii. IB7184



Haworthiopsis scabra
var. lateganiae. VDV112



Haworthiopsis scabra
var. scabra. JDV86-93



Haworthiopsis scabra
var. smitii. JDV90-82



Haworthiopsis scabra
var. starkiana. SS1166



Haworthiopsis sordida
var. agavoides. VDV518



Haworthiopsis sordida
var. lavranii. IB6501



Haworthiopsis sordida
var. sordida. IB4818



Haworthiopsis tessellata
var. crousii. MH97-001



Haworthiopsis tessellata
var. tessellata. IB422



Haworthiopsis variabilis.
IB13743



Haworthiopsis venosa
var. venosa. DMC 1275



Haworthiopsis venosa
var. woolleyi. IB635



Haworthiopsis viscosa
var. asperiuscula. VDV131



Haworthiopsis viscosa
var. beanii. IB284



Haworthiopsis viscosa
var. viscosa. IB6633

3. Genus Tulista. Photographs of each species in alphabetical order.



Tulista kingiana.
IB150



Tulista marginata
var. marginata. IB7158



Tulista marginata
var. mertonii. DMC10485



Tulista minima
var. minima. IB8968



Tulista minima
var. *poellnitziana*. IB344



Tulista opalina
var. *opalina*. MBB215



Tulista opalina
var. *zenigata*. MH81-122



Tulista pumila
var. *ohkuwae*. GM600



Tulista pumila
var. *pumila*. IB8809



Tulista pumila
var. *sparsa*. MH95-036

Index of Plant Names.

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Haworthia blackbeardiana var. *calaensis*. IB12513



Haworthia maculata var. *livida*. IDV88.31



Haworthiopsis fasciata var. *browniana*. ISI664



Haworthiopsis reinwardtii var. *brevicula*. IB525



Tulista opalina var. *zenigata*. MH81-122



Tulista pumila var. *pumila*. IB8809