# 15 Appendix

Table **1**: Species list of molecular studies. DNA-numbers follow an internal numbering code of the Institut für Biologie – Systematische Botanik und Pflanzengeographie – (FU Berlin). Species with an asterisk (*) were obtained from GenBank (http://www.ncbi.nlm.nih.gov/). Abbreviations: B: Herbarium, Bot. Mus. (Berlin-Dahlem, Germany); BSB: Herbarium, Inst. Biol. – Syst. Bot. –, Freie Univ. (Berlin, Germany); CANB: Australian Nat. Herb. (Canberra, Australia); F: Herbarium, Field Mus. (Chicago, USA); HB: Botanical Garden; HUT: Univ. Nac. La Libertad (Trujillo, Peru); KUN: Kunming Inst. Bot., Chinese Acad. Sci. (Yunnan, China); L: Nat. Herbarium Nederland (Leiden, Netherlands); M: Bot. Staatssammlung (München, Germany); MO: Missouri Bot. Gard. (St. Louis, USA); MSB: Ludwig-Maximilians-Univ. (München, Germany); n.ind.: not indicated; NY: Herbarium, New York Bot. Gard. (New York, USA); USM: Univ. Nac. Mayor de San Marcos (Lima, Peru).

| DNA No. | Species name with author | *Collector/collection#* (herbarium) | Location (state) | GenBank# (marker) |
|---|---|---|---|---|
| **Boraginaceae *s.str.*** | | | | |
| 672 | *Anchusa officinalis* L. | *Hilger s.n.* (BSB) | Germany | AY045710 (ITS1) |
| 671 | *Borago officinalis* L. | *cult. Hilger 7/2000* (BSB) | Germany | ### (*trn*L), AF402572 (ITS1) |
| 662 | *Buglossoides arvensis* (L.) I.M.JOHNST. | *Kagiampaki 5* (BSB) | Greece | AF402574 (ITS1) |
| * | *Cerinthe major* L. | n. ind. | n. ind. | L43200 (ITS1) |
| * | *Cryptantha flavoculata* (A.NELSON) PAYSON | n. ind. | n. ind. | AF091154 (ITS1) |
| 323 | *Cryptantha micrantha* (TORR.) I.M.JOHNST. | *Hofmann 18/98* (BSB) | USA (CA) | AF402581 (ITS1) |
| 646 | *Cynoglossum officinale* L. | *HB Berlin-Dahlem* (B, BSB) | Germany | AF402582 (ITS1) |
| * | *Echium giganteum* L.f. | n. ind. | Spain (Canary Islands) | L43224 (ITS1) |
| * | *Echium leucophaeum* WEBB ex SPRAGUE & HUTCHINSON | n. ind. | Spain (Canary Islands) | L43240 (ITS1) |
| 706 | *Elizaldia calycina* (ROEM. & SCHULT.) MAIRE | *Reading s.n.* (B) | Morocco | AF402583 (ITS1) |
| **Hydrophyllaceae *s.str.*** | | | | |
| * | *Emmenanthe penduliflora* BENTH. | n. ind. | n. ind. | AF091158 (ITS1) |
| * | *Eriodictyon trichocalyx* A.HELLER | n. ind. | n. ind. | AF091164 (ITS1) |

| DNA No. | Species name with author | *Collector/collection#* (herbarium) | Location (state) | GenBank# (marker) |
|---|---|---|---|---|
| 255 | *Nama aretioides* (HOOK.& ARN.) BRAND | *Hilger et al. 264* (BSB) | USA (CA) | AF402589 (ITS1) |
| 281 | *Nama demissum* A.GRAY | *Hofmann 10/98* (BSB) | USA (CA) | AF402590 (ITS1) |
| * | *Nama rothrockii* A.GRAY | n. ind. | n. ind. | AF091179 (ITS1) |
| 291 | *Phacelia bicolor* TORR. ex S.WATSON | *Hilger & Hofman 368/97* (BSB) | USA (CA) | ### (*trn*L) |
| * | *Phacelia rotundifolia* TORR. ex S.WATSON | n. ind. | n. ind. | AF091200 (ITS1) |
| * | *Tricardia watsonii* TORR. ex S.WATSON | n. ind. | n. ind. | AF091209 (ITS1) |
| * | *Wigandia urens* (RUIZ & PAV.) KUNTH | n. ind. | n. ind. | AF091212 (ITS1) |
| **Heliotropiaceae** | | | | |
| 768 | *Heliotropium amplexicaule* VAHL | *Tillich 3606* (M) | Australia | AY176076 (ITS1) |
| 563 | *Heliotropium arborescens* L. | *HB Berlin-Dahlem* (B) | Germany | AF396896 (ITS1) |
| 842 | *Heliotropium asperrimum* R.BR. | *Craven 9671* (CANB) | Australia | AF402586 (ITS1) |
| 496 | *Heliotropium europaeum* L. | *HB Berlin-Dahlem* (BSB) | Germany | AF402587 (ITS1) |
| 581 | *Heliotropium europaeum* L. | *Hilger Bg 97/6* (BSB) | Bulgaria | ### (*trn*L) |
| 692 | *Heliotropium hirsutissimum* GRAUER | *Kagiampkai s.n.* (BSB) | Greece | AF396912 (ITS1) |
| 733 | *Heliotropium incanum* RUIZ & PAV. | *Weigend 2000/162* (M) | Peru | AY176077 (ITS1) |
| 233 | *Heliotropium krauseanum* FEDDE | *Weigend & Förther 97/727* (BSB) | Peru | AF396909 (ITS1) |
| 720 | *Heliotropium nicotianaefolium* POIR. | *Hilger s.n.* (BSB) | Argentina | AY176078 (ITS1) |
| 3B | *Heliotropium oculatum* A.HELLER | *Hilger USA 94/21* (BSB) | USA (CA) | AF396897 (ITS1) |
| 210 | *Heliotropium procumbens* MILL. | *Feuerer 9452b* (BSB) | Bolivia | AF396885 (ITS1) |
| 16 | *Heliotropium rariflorum* STOCKS | *Hilger Nam 93/23* (BSB) | Namibia | AF396889 (ITS1) |
| 204 | *Heliotropium suaveolens* M.BIEB. | *Hilger Bg 97/5* (BSB) | Bulgaria | AF396911 (ITS1) |
| 838 | *Heliotropium submolle* KLOTZSCH | *Weigend et al. 2000/809* (BSB) | Peru | AF402588 (ITS1) |
| 844 | *Heliotropium tenuifolium* R.BR. | *Craven 9688* (CANB) | Australia | AY176079 (ITS1) |
| 74 | *Tournefortia hirsutissima* L. | *Stenzel 96/32* (BSB) | Cuba | AY176082 (ITS1) |
| 601 | *Tournefortia luzonica* I.M.JOHNST. | *Liede 3302* (BSB) | Philippines | AF396899 (ITS1) |
| 686 | *Tournefortia microcalyx* (RUIZ & PAV.) I.M.JOHNST. | *Weigend & Dostert 97/5* (BSB) | Peru | AF396905 (ITS1) |
| 719 | *Tournefortia salzmannii* DC. | *Franca & Melo 16843* (M) | Brazil | AF396884 (ITS1) |
| 794 | *Tournefortia usambarensis* (VERDC.) VERDC. | *Lovett & Thomas 2464* (MO) | Tanzania | AY176083 (ITS1) |

| DNA No. | Species name with author | *Collector/collection#* (herbarium) | Location (state) | GenBank# (marker) |
|---|---|---|---|---|
| **Cordiaceae** | | | | |
| 801 | *Coldenia procumbens* L. | *Jongkind & Nieuwenhuis* 1973 (MO) | Ghana | ### (*trn*L) |
| 930 | *Cordia africana* LAM. | *Pope 284* (B) | Zimbabwe | AY176067 (ITS1) |
| 371 | *Cordia alliodora* (RUIZ & PAV.) OKEN | *HB Marburg* (BSB) | n. ind. | ### (ITS1) |
| 916 | *Cordia americana* (L.) STEUD. ex GOTTSCHLING (≡ *Patagonula americana* L.) | *HB München* (BSB) | Argentina | AY176080 (ITS1) |
| 976 | *Cordia aspera* G.FORST. | *Whistler 3113* (B) | Samoa | ### (ITS1) |
| 1206 | *Cordia bordasii* SCHININI | *Mereles & Degen 5513* (MO) | Paraguay | ### (ITS1) |
| 1185 | *Cordia borinquensis* URB. | *Miller et al. 6596* (MO) | Puerto Rico | ### (ITS1) |
| 865 | *Cordia cochinchinensis* GAGNEP. | *in Chinese letters 002245* (KUN) | China | ### (ITS1) |
| 1072 | *Cordia collococca* L. | *Miller & Sherman 6370* (MO) | Mexico | AY176068 (ITS1) |
| 1205 | *Cordia decandra* HOOK. & ARN. | *Taylor et al. 10825* (MO) | Chile | ### (ITS1) |
| 929 | *Cordia dentata* POIR. | *Narvaez & Seymour 2527* (B) | Nicaragua | AY176069 (ITS1) |
| 384 | *Cordia ecalyculata* VELL. | *Anonymous 5* (BSB) | Paraguay | ### (ITS1) |
| 981 | *Cordia elaeagnoides* DC. | *Miller & Tellez 3087* (BSB) | Mexico | ### (ITS1) |
| 577 | *Cordia elliptica* SW. (as *Cordia nitida* VAHL) | *Gottschling CUB15* (BSB) | Cuba | ### (ITS1) |
| 818 | *Cordia faulkneri* VERDC. | *Medley 272* (MO) | Kenya | ### (ITS1) |
| 909 | *Cordia galleotiana* A.RICH. | *Gottschling CUB 38* (BSB) | Cuba | ### (ITS1) |
| 397 | *Cordia guineensis* THONN. | *HB Berlin-Dahlem 003-90-77-13* (B, BSB) | E Africa | ### (ITS1) |
| 1196 | *Cordia iguaguana* MELCH. ex I.M.JOHNST. | *Gentry et al. 37700* (MO) | Peru | ### (ITS1) |
| 1198 | *Cordia incognita* GOTTSCHLING (≡ *Patagonula bahiensis* MORIC.) | *Souza 5395* (MO) | Brazil | ### (ITS1) |
| 988 | *Cordia lutea* LAM. | *Weigend et al. 2000/707* (BSB, HUT, MSB, USM) | Peru | AY176070 (ITS1) |
| 1199 | *Cordia mairei* HUMBERT | *Miller & Miller 3796* (MO) | Madagascar | ### (ITS1) |
| 396 | *Cordia monoica* ROXB. | *HB Berlin-Dahlem 084-19-83-53* (B, BSB) | Zimbabwe | AY176071 (ITS1) |
| 1006 | *Cordia morelosana* STANDL. | *Miller & Tenorio 565* (BSB) | Mexico | ### (ITS1) |

| DNA No. | Species name with author | *Collector/collection#* (herbarium) | Location (state) | GenBank# (marker) |
|---|---|---|---|---|
| 377 | *Cordia myxa* L. | *HB Berlin-Dahlem* (B, BSB) | n. ind. | AF402578 (ITS1) |
| * | *Cordia nodosa* LAM. | n. ind. | n. ind. | AF091153 (ITS1) |
| 939 | *Cordia nodosa* LAM. | *Weigend et al. 5742* (BSB, HUT, MSB, USM) | Peru | AY176072 (ITS1) |
| 1261 | *Cordia oncocalyx* ALLEMÃO [≡ *Auxemma oncocalyx* (ALLEMÃO) BAILL.] | *Nunes s.n.* (MO) | Brazil | ### (ITS1) |
| 1260 | *Cordia* aff. *oncocalyx* (≡ *Auxemma* spec. nov.) | *Quintona et al. 604* (MO) | Paraguay | ### (ITS1) |
| 1007 | *Cordia panamensis* L.RILEY | *Miller & Miller 1000* (BSB) | Panama | ### (ITS1) |
| 1197 | *Cordia parvifolia* A.DC. | *Diggs & Nee 3117* (MO) | Mexico | ### (ITS1) |
| 1202 | *Cordia rufescens* A.DC. | *Almeide 50050* (MO) | Brazil | ### (ITS1) |
| 815 | *Cordia saccellia* GOTTSCHLING (≡ *Saccellium lanceolatum* HUMB. & BONPL.) | *Taylor et al. 11353* (MO) | Argentina | ### (*trn*L), AF402592 (ITS1) |
| 370 | *Cordia sebestena* L. | *HB Berlin-Dahlem 260-07-85-83* (B, BSB) | n. ind. | ### (*trn*L), AF402579 (ITS1) |
| 541 | *Cordia sebestena* L. | *Gottschling CUB 48* (BSB) | Cuba | AF385773 (ITS1) |
| 982 | *Cordia seleriana* FERNALD | *Miller & Tenorio 510* (BSB) | Mexico | ### (ITS1) |
| 918 | *Cordia sinensis* LAM. [as *C. gharaf* (FORSSK.) EHRENB. ex ASCH.] | *Greuter 20310* (B) | Namibia | AY176073 (ITS1) |
| 398 | *Cordia* spec. | *HB Berlin-Dahlem* (BSB) | n. ind. | AF402576 (ITS1) |
| 931 | *Cordia sinensis* LAM. | *Breckle 3999* (B) | Israel | ### (ITS1) |
| 979 | *Cordia sonorae* N.E.ROSE | *Miller & Campos 2956* (BSB) | Mexico | ### (ITS1) |
| 367, 403 | *Cordia subcordata* LAM. | *HB Berlin-Dahlem 162-62-87-10* (B, BSB) | Papua New Guinea | AF385774 (ITS1) |
| 1204 | *Cordia superba* CHAM. & SCHLTDL. | *Souza s.n.* (MO) | Brazil | ### (ITS1) |
| 1203 | *Cordia taguahyensis* VELL. | *Thomas et al. s.n.* (MO) | Brazil | ### (ITS1) |
| 118 | *Cordia trichotoma* VELL. ex STEUD. | *Hilger et al. ARG 95/58* (B) | Argentina | AF402580 (ITS1) |
| 1200 | *Cordia varronifolia* I.M.JOHNST. | *Hutchinson & Wright 6774* (MO) | Peru | ### (ITS1) |
| 1004 | *Varronia angustifolia* H.WEST (as *Cordia stenophylla* ALAIN) | *Hilger 99/46* (BSB) | Cuba | ### (ITS1) |
| 262 | *Varronia bifurcata* (ROEM. & SCHULT.) BORHIDI | *Mehltreter ARG s.n.* (BSB) | Argentina | AF402575 (ITS1) |

| DNA No. | Species name with author | *Collector/collection#* (herbarium) | Location (state) | GenBank# (marker) |
|---|---|---|---|---|
| 56 | *Varronia bonplandii* DESV. | *HB Munich* (BSB) | n. ind. | ### (*trn*L), ### (ITS1) |
| 915 | *Varronia bullata* L. | *Gottschling CUB 49* (BSB) | Cuba | AY176084 (ITS1) |
| 917 | *Varronia curassavica* JACQ. (as *Cordia divaricata* HUMB., BONPL. & KUNTH) | *Wilbur 7631* (B) | Dominican Republic | ### (ITS1) |
| 978 | *Varronia lauta* (I.M.JOHNST.) GOTTSCHLING | *Miller & Tellez 3158* (BSB) | Mexico | ### (ITS1) |
| 451 | *Varronia lenis* (ALAIN) BORHIDI | *Hilger 18* (BSB) | Cuba | AF402577 (ITS1) |
| 1009 | *Varronia leucocephala* (MORIC.) GOTTSCHLING | *Forstreuter* 93170 (BSB) | Brazil | ### (ITS1) |
| 1005 | *Varronia lima* DESV. | *Miller et al. 6572* (BSB) | Puerto Rico | ### (ITS1) |
| 503 | *Varronia longipedunculata* BRITTON & P.WILSON | *Stenzel 802* (BSB) | Cuba | ### (ITS1) |
| **Ehretiaceae** | | | | |
| 1218 | *Bourreria cumanensis* (LOEFL.) O.E.SCHULZ | *Ramirez 2744* (MO) | Venezuela | ### (*trn*L) |
| 808 | *Bourreria huanita* (LA LLAV. & LEX.) HEMSL. | *Sandoval 1159* (B, BSB) | El Salvador | AF402573 (ITS1) |
| 417 | *Bourreria petiolaris* (LAM.) THULIN | *Gachathi 76 (202)* (B) | Kenya | ### (*trn*L), AF385783 (ITS1) |
| 573 | *Bourreria petiolaris* (LAM.) THULIN | *Polhill & Paulo* 713 (B) | Kenya | AF385784 (ITS1) |
| 544 | *Bourreria polyneura* O.E.SCHULZ | *Gottschling CUB20* (BSB) | Cuba | ### (*trn*L) |
| 1210 | *Bourreria pulchra* MILLSP. ex GREENM. | *Simá 2101* (F) | Mexico | ### (*trn*L) |
| 1215 | *Bourreria quirosii* STANDL. | *Gómez 18666* (MO) | Costa Rica | ### (*trn*L) |
| 70 | *Bourreria succulenta* JACQ. | *Stenzel 013* (BSB) | Cuba | ### (*trn*L) |
| 559 | *Bourreria succulenta* JACQ. | *Gottschling CUB13* (BSB) | Cuba | AF385776 (ITS1) |
| 570 | *Bourreria teitensis* (GÜRKE) THULIN | *Drummond & Hemsley* 4264 (B) | Kenya | AY176066 (ITS1) |
| 450 | *Bourreria wrightii* ALAIN | *HB Berlin-Dahlem 260-18-93-10* (B, BSB) | Cuba | ### (*trn*L) |
| 492 | *Ehretia acuminata* R.BR. | *HB Adelaide* (BSB) | Australia | AF385798 (ITS1) |
| 135 | *Ehretia anacua* (TERÁN & BERLAND.) I.M.JOHNST. | *Anonymous* (BSB) | USA (TX) | ### (*trn*L) |
| 493 | *Ehretia anacua* (TERÁN & BERLAND.) I.M.JOHNST. | *HB Adelaide* (BSB) | n. ind. | AF385796 (ITS1) |

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|---|---|---|---|---|
| 792 | *Ehretia aquatica* (LOUR.) GOTTSCHLING & HILGER | *Jongkind 2517* (MO) | Ghana | ### (*trn*L), AF385791 (ITS1) |
| 416 | *Ehretia cymosa* THONN. | *Friis et al. 3521* (B) | Ethiopia | AY176074 (ITS1) |
| 415 | *Ehretia laevis* ROXB. | *Rechinger 29501* (B) | Pakistan | ### (*trn*L), AF385787 (ITS1) |
| 863 | *Ehretia longiflora* CHAMP. ex BENTH. | *HB Taiwan* (BSB) | Taiwan | ### (*trn*L) |
| 395 | *Ehretia macrophylla* WALL. (as *Ehretia dicksoni* HANCE) | *HB Berlin-Dahlem* (B, BSB) | n. ind. | ### (*trn*L) |
| 407 | *Ehretia macrophylla* WALL. (as *E. dicksoni* HANCE) | *HB Tsukuba* (BSB) | n. ind. | AY176075 |
| 406 | *Ehretia microphylla* LAM. | *HB Singapore* (BSB) | Singapore | ### (*trn*L), AF385792 (ITS1) |
| 572 | *Ehretia rigida* (THUNB.) DRUCE | *Schwerdtfeger s.n.* (B) | Namibia | ### (*trn*L), |
| 414 | *Ehretia saligna* R.BR. | *Walter & Walter s.n.* (B) | Australia | ### (*trn*L), |
| 439 | *Ehretia tinifolia* L. | *Gottschling CUB 52* (BSB) | Cuba | ### (*trn*L), |
| 732 | *Halgania andromedifolia* BEHR & F.MUELL. ex F.MUELL. | *Strid 21146* (B) | Australia | ### (*trn*L), AF402584 (ITS1) |
| 880 | *Halgania cyanea* LINDL. | *Greuter 18801* (B) | Australia | ### (*trn*L), |
| 751 | *Halgania rigida* S.MOORE | *Strid 21301* (B) | Australia | ### (*trn*L), AF402585 (ITS1) |
| * | *Lennoa madreporoides* LA LLAVE & LEX. | n. ind. | n. ind. | AF091171 (ITS1) |
| 912 | *Lepidocordia punctata* DUCKE | *Steyermark 88509* (NY) | Venezuela | ### (*trn*L) |
| 146 | *Pholisma arenarium* NUTT. ex HOOK. | *Hilger & Hofmann 1992/62* (BSB) | USA (CA) | ### (*trn*L), AF402591 (ITS1) |
| * | *Pholisma arenarium* NUTT. ex HOOK. | n. ind. | n. ind. | AF091203 (ITS1) |
| 910 | *Rochefortia acanthophora* (DC.) GRISEB. | *Liogier & Martorell 34291* (NY) | Puerto Rico | ### (*trn*L) |
| 440 | *Rochefortia spinosa* (JACQ.) URB. | *Hilger & Urquiola 99/20* (BSB) | Cuba | ### (*trn*L) |
| 854 | *Tiquilia dichotoma* (RUIZ & PAV.) PERS. | *Weigend & Förther 99/637* (BSB) | Peru | ### (*trn*L) |
| 882 | *Tiquilia hispidissima* (TORR. & A.GRAY) A.RICHARDSON | *Howell & True 44757* (B) | USA (UT) | ### (*trn*L) |
| 851 | *Tiquilia litoralis* (PHIL.) A.RICHARDSON | *Weigend & Förther 97/828* (BSB) | Peru | ### (*trn*L) |

| DNA No. | Species name with author | *Collector/collection#* (herbarium) | Location (state) | GenBank# (marker) |
|---|---|---|---|---|
| 589 | *Tiquilia nuttallii* (HOOK.) A.RICHARDSON | *Hilger & Hofmann 1992/60* (BSB) | USA (CA) | ### (*trn*L) |
| 884 | *Tiquilia paronychioides* (PHIL.) A.RICHARDSON | *Weigend & Förther 97/759* (BSB) | Peru | ### (*trn*L) |
| **Outgroup** | | | | |
| * | *Atropa bella-donna* L. | n. ind. | n. ind. | AB019288 (ITS1) |
| * | *Nicotiana tabacum* L. | n. ind. | n. ind. | AJ300215 (ITS1) |
| 431 | *Pteleocarpa lamponga* (MIQ.) BAKH. ex K.HEYNE | *Chung s.n.* (L) | Malaysia | ### (*trn*L) |

Table **2**: Species list of morphological studies. Abbreviations: B: Herbarium, Bot. Mus. (Berlin-Dahlem, Germany); BHUPM: Mus. Nat. (Berlin, Germany); BM: British Mus. (London, UK); BSB: Herbarium, Inst. Biol. – Syst. Bot. –, Freie Univ. (Berlin, Germany); HB: Botanical Garden; n. ind.: not indicated.

| Species name with author | *Collector/collection#* (herbarium) | Location (State) |
|---|---|---|
| **Boraginaceae *s. str.*** | | |
| *Anchusa strigosa* BANKS & SOL. | *Hilger 18/94* (BSB) | Israel |
| *Borago pygmaea* (DC.) CHATER & GREUTER | *HB Berlin-Dahlem* (BSB) | n. ind. |
| *Cynoglossum creticum* MILL. | *Hilger 94/3* (BSB) | Israel |
| *Echium vulgare* L. | *HB Berlin-Dahlem* (BSB) | Germany |
| **Hydrophyllaceae *s.str.*** | | |
| *Emmenanthe penduliflora* BENTH. | *Hilger & Hofmann 97/354* (BSB) | USA (CA) |
| *Nama demissum* A.GRAY | *Hofmann 98/10* (BSB) | USA (CA) |
| *Nemophila menziesii* HOOK. & ARN. | *Hofmann 98/32* (BSB) | USA (CA) |
| *Phacelia tanacetifolia* BENTH. | *Hofmann 1997 s.n.* (BSB) | Germany |
| *Wigandia urens* (RUIZ & PAV.) KUNTH | *Weigend et al. 5671* (BSB) | Peru |
| **Heliotropiaceae** | | |
| *Heliotropium ciliatum* KAPLAN | *Hilger 93/1* (BSB) | Namibia |
| *Heliotropium elongatum* (LEHM.) DC. | *Hilger et al. ARG 95/18* (BSB) | Argentina |
| *Heliotropium erosum* LEHM. | *Zippel 2000/69* (BSB) | Spain (Gran Canarya) |
| *Heliotropium europaeum* L. | *Hilger 1984 s.n.* (BSB) | Sicily |
| *Heliotropium humifusum* HUMB., BONPL. & KUNTH | *Hilger 99/3* (BSB) | Cuba |

| Species name with author | *Collector/collection#* (herbarium) | Location (State) |
|---|---|---|
| *Heliotropium indicum* L. | *Hilger 99/22* (BSB) | Cuba |
| *Heliotropium nelsonii* C.H.WRIGHT | *Hilger 93/19* (BSB) | Namibia |
| *Heliotropium nicotianaefolium* POIR. | *Hilger et al. 95/38* (BSB) | Argentina |
| *Heliotropium ovalifolium* FORSSK. | *Hilger 93/4* (BSB) | Namibia |
| *Heliotropium procumbens* MILL. | *Hilger et al. ARG 95/28* (BSB) | Argentina |
| *Heliotropium transalpinum* VELL. | *Hilger et al. ARG 95/17* (BSB) | Argentina |
| *Heliotropium veronicifolium* GRISEB. | *Hilger ARG 95/29* (BSB) | Argentina |
| *Ixorhea tschudiana* FENZL | *HB München-Nymphenburg* (BSB) | Argenina |
| *Myriopus volubilis* (L.) SMALL | *HB Berlin-Dahlem* (BSB) | n. ind. |
| *Tournefortia argentea* L.f. | *Tillich 1996 s.n.* (BSB) | Mauritius |
| *Tournefortia glabra* ZOLL. & MORITZI | *Hilger 99/3* (BSB) | Cuba |
| *Tournefortia gnaphalodes* R.BR. | *Hilger 99/34* (BSB) | Cuba |
| *Tournefortia tarmensis* (K.KRAUSE) J.F.MACBR. | *Weigend et al. 5668* (BSB) | Peru |
| **Cordiaceae** | | |
| *Cordia sebestena* L. | *Gottschling CUB 11* (BSB) | Cuba |
| *Varronia bifurcata* (ROEM. & SCHULT.) BORHIDI | *Weigend et al. 5751* (BSB) | Peru |
| **Ehretiaceae** | | |
| *Bourreria homalophylla* O.E.SCHULZ | *Gottschling CUB 6* (BSB) | Cuba |
| *Bourrera ovata* MIERS | *Gottschling s.n.* (BSB) | Cuba |
| *Bourreria petiolaris* (LAM.) THULIN | *Hilger & Schultka s.n.* (BSB) | Kenya |
| *Bourreria succulenta* JACQ. | *Gottschling CUB 37* (BSB) | Cuba |
| *Ehretia acuminata* R.BR. | *HB Coot-tha, Australia* (BSB) | Australia |
| † *Ehretia clausentia* CHANDLER | *Curry & Chandler V.34572* (BM) | UK |
| † *Ehretia hedericarpa* MAI | *Mai 2641* (BHUPM) | Germany |
| *Ehretia laevis* ROXB. | *Rechinger 29501* (B) | Pakistan |
| *Ehretia longiflora* CHAMP. ex BENTH. | *HB Taiwan* (BSB) | Taiwan |
| *Ehretia microphylla* LAM. | *HB Singapore* (BSB) | Singapore |
| *Ehretia macrophylla* WALL. | *HB Kyoto* (BSB) | Japan |
| *Ehretia rigida* (THUNB.) DRUCE | *Seydel 357* (B) | Namibia |
| *Ehretia tinifolia* L. | *Gottschling CUB 52* (BSB) | Cuba |
| *Pholisma arenarium* NUTT. ex. HOOK. | *Hilger & Hofmann 92/62* (BSB) | USA (CA) |
| *Tiquilia dichotoma* (RUIZ & PAV.) PERS. | *Weigend & Förther 97/637* (BSB) | Peru |
| *Tiquilia elongata* (RUSBY) A.RICHARDSON | *Weigend & Förther 97/757* (BSB) | Peru |
| *Tiquilia nuttallii* (HOOK.) A.RICHARDSON | *Hilger & Hofmann 92/60* (BSB) | USA (CA) |
| *Tiquilia paronychioides* (PHIL.) A.RICHARDSON | *Weigend & Förther 97/759* (BSB) | Peru |
| *Tiquilia plicata* (TORR.) A.RICHARDSON | *Hilger USA 94/6* (BSB) | USA (TX) |

Table **3**: Statistics of the secondary structures (ITS1) proposed in this thesis.

| Species | Sequence length (in bases) | Length stem-loop (in bases) | GC-content | Pairing G—U | Length helices (in pairing bases) I | II | III | IV | ΔG (20°C, in kcal/mol) |
|---|---|---|---|---|---|---|---|---|---|
| *Nicotiana tabacum* | 283 | 95 | 62 % | 11 % | 20 | 14 | 5 | 17 | –90.7 |
| *Borago officinalis* | 271 | 74 | 46 % | 27 % | 17 | 10 | 5 | 19 | –101.6 |
| *Nama demissum* | 263 | 99 | 63 % | 18 % | 18 | 6 | 6 | 20 | –86.5 |
| *Cordia sebestena* | 267 | 81 | 60 % | 14 % | 19 | 6 | 5 | 25 | –121.6 |
| *Ehretia acuminata* | 271 | 93 | 63 % | 8 % | 21 | 7 | 6 | 20 | –96.7 |
| *Heliotropium europaeum* | 234 | 92 | 66 % | 5 % | 5 | 6 | 6 | 20 | –105.5 |
| *Pholisma arenarium* | 270 | 73 | 55 % | 10 % | 17 | 6 | 5 | 22 | –103.0 |

Table **4**. Presence and distribution of transfer cells in seeds of Boraginales. Taxa are abbreviated as follows: BOR: Boraginaceae *s.str.*, COR: Cordiaceae, EHR: Ehretiaceae, HEL: Heliotropiaceae, HYD: Hydrophyllaceae *s.str.*, LEN: Lennoaceae.

| | **BOR** | **HYD** | **HEL** | **COR** | **EHR** | **LEN** |
|---|---|---|---|---|---|---|
| Common dispersal unit | 'nutlet' | seed (out of capsules) | drupe/ schizocarp | drupe | drupe/ exceptional schizocarp | fleshy capsule |
| Protective layer of the seed | Exocarp | – | endocarp | endocarp | endocarp | endocarp |
| Seed coat (number of layers) | – | + (1) no overall occurrence | + (1) | + (3-4) | + (1) | + (1) |
| Funicle | – | – | + | + | + | + |
| Placenta | – | – | + | + | + | + |

Table **5**: The five most similar sequences in GeneBank based on a NCBI Blast Search to the *trn*L sequence of *Pteleocarpa*.

| GeneBank# | Species name with author | Taxon | Source |
|---|---|---|---|
| AF102428 | *Gelsemium sempervirens* (L.) AIT. | Gelsemiaceae, Gentianales | STRUWE *et al.* (1998) |
| GSE430908 | *Gelsemium sempervirens* (L.) AIT. | Gelsemiaceae, Gentianales | BREMER *et al.* (2002) |
| AF102430 | *Geniostoma rupestre* J.R.FORST. & G.FORST. | Loganiaceae, Gentianales | STRUWE *et al.* (1998) |
| AF102447 | *Labordia tinifolia* A.GRAY | Loganiaceae, Gentianales | STRUWE *et al.* (1998) |
| AF102446 | *Labordia* spec. | Loganiaceae, Gentianales | STRUWE *et al.* (1998) |

Table **6**: Fossils attributed to *Ehretia*, species investigated bold.

| Fossil name | Stratigraphy | Locality | Number of locules | Citations |
|---|---|---|---|---|
| † *E. cantalensis* REID | Lower Pliocene | Pont-de-Gail (Cantal, France) | 2 | REID 1923 |
| † ***E. clausentia* CHANDLER** | Lower Eocene | Southern England (UK) | 2 | CHANDLER 1961, 1962, 1964 |
| † *E. ehretioides* (REID & CHANDLER) CHANDLER | Lower Eocene | Harefield (near London, UK) | 2 | REID & CHANDLER 1933, CHANDLER 1964 |
| † *E. europea* REID | Lower Pliocene | Pont-de-Gail (Cantal, France) | 2 | REID 1923 |
| † ***E. hedericarpa* MAI** | Upper Oligocene to Middle Miocene | Laussig (Germany) | 1 | MAI 1991 |
| † *E. lakensis* CHANDLER | Eocene | Dorset (UK) | 2 | CHANDLER 1962, 1964 |

Table **7**: Geological ages and used absolute dates of geological events and fossils.

| No. | Estimated geological date | Geological age | Used absolute date | Reference |
|---|---|---|---|---|
| 1 | Dissociation of Australia from Gondwana | Lower Cretaceous | 120 | PARRISH (1993), PITMAN *et al.* (1993), SCOTESE (1998) |
| 2 | Interruption of regular diaspore exchange between South America and Africa | mid Cretaceous | 90 | PARRISH (1993), PITMAN *et al.* (1993), SCOTESE (1998) |
| 3 | Separation of North America and Eurasia | mid Cretaceous | 90 | PARRISH (1993), PITMAN *et al.* (1993), SCOTESE (1998) |
| 4 | Origin of Boraginales | Upper Cretaceous | 80 | WIKSTRÖM *et al.* (2001) |
| 5 | Ehretiaceae: fossil endocarpids (*Ehretia* II subclade) | early Eocene | 50 | COLLINSON (1983) |
| 6 | Cordiaceae: fossil leaves (*Myxa* subclade) | Eocene | 50 | CHELEBAJEVA (1984) |
| 7 | Interruption of the Thulean land bridge | late Eocene | 40 | TIFFNEY (1985a, b) |
| 8 | Heliotropiaceae: fossil pollen (*Tournefortia* subclade) | Oligocene | 30 | GRAHAM & JARZEN (1969) |

Table **8**: Likelihood ratio tests (LRTs) on the taxa under investigations (for all three taxa: df = 11, x = 17.28, $P > 0.1$) and aligned length.

| Trees of | $-\ln L_0$ (clock) | $-\ln L_1$ (non-clock) | $-2*(\ln L_0 - \ln L_1) \approx \chi^2$ | $H_0$ | Aligned length (bp) |
|---|---|---|---|---|---|
| Cordiaceae | 1149.45 | 1145.35 | 8.20 | accepted | 290 |
| Ehretiaceae | 1293.19 | 1289.13 | 8.12 | accepted | 284 |
| Heliotropiaceae | 1252.49 | 1246.84 | 11.30 | accepted | 296 |

Table **9**: Ehretiaceae: Estimated minimum ages in MY, with standard deviation, of separation events A, B, C, D, E, and F in the phylogeny of Ehretiaceae (Fig. **9-9**) under different calibrations (shown italic) of ITS1 sequence divergences, plausible time estimates are in bold print. Absolute dates for alternative calibrations are given in table **7**.

| Geological date in table **7** | Divergence rate per MY ($*10^{-4}$) | Node | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F |
| 2 | 7.86 | 205 ± 28 | *90* (2) | 177 ± 26 | 80 ± 18 | 112 ± 21 | 84 ± 19 |
| **7** | **16.53** | **98 ± 13** | **43 ± 9** | **84 ± 12** | **38 ± 9** | **53 ± 10** | ***40*** **(7)** |
| **5** | **17.58** | **91 ± 12** | **40 ± 9** | **79 ± 12** | **36 ± 8** | ***50*** **(5)** | **38 ± 8** |
| 4 | 20.15 | *80* (4) | 35 ± 8 | 69 ± 10 | 31 ± 7 | 44 ± 8 | 33 ± 7 |
| Average K2P distances | | 0.1612 ± 0.0218 | 0.0708 ± 0.0152 | 0.1392 ± 0.0205 | 0.0631 ± 0.0144 | 0.0879 ± 0.0168 | 0.0661 ± 0.0147 |

Table **10**: Cordiaceae: Estimated minimum ages in MY, with standard deviation, of separations events A, B, and C in the phylogeny of Cordiaceae (Fig. **9-10**) under different calibrations (shown italic) of ITS1 sequence divergences, plausible time estimates are in bold print. Absolute dates for alternative calibrations are given in Table **7**.

| Geological date in Table **7** | Divergence rate per MY ($*10^{-4}$) | Node | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| 2 | 7.82 | 147 ± 24 | *90* (2) | 34 ± 12 | 70 ± 17 |
| 6 | 10.94 | 105 ± 17 | 64 ± 14 | 25 ± 9 | *50* (6) |
| **6** | **14.08** | **82 ± 13** | ***50*** **(6)** | **19 ± 7** | **39 ± 9** |
| **4** | **14.40** | ***80*** **(4)** | **49 ± 10** | **19 ± 7** | **38 ± 9** |
| **–** | ***17.58*** | **66 ± 11** | **40 ± 9** | **15 ± 5** | **31 ± 8** |
| Average K2P distances | | 0.1152 ± 0.0187 | 0.0704 ± 0.0150 | 0.0269 ± 0.0095 | 0.0547 ± 0.0134 |

Table **11**: Heliotropiaceae: Estimated minimum ages in MY, with standard deviation, of separations events A, B, C, and D in the phylogeny of Heliotropiaceae (Fig. **9-11**) under different calibrations (shown italic) of ITS1 sequence divergences, plausible time estimates are in bold print. Absolute dates for alternative calibrations are given in Table **7**.

| Geological date in Table **7** | Divergence rate per MY ($*10^{-4}$) | Node | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| 2 | 11.12 | 152 ± 20 | *90* (2) | 95 ± 16 | 31 ± 10 |
| 8 | 11.43 | 148 ± 19 | 88 ± 15 | 92 ± 16 | *30* (8) |
| 2 | 11.70 | 145 ± 19 | 86 ± 15 | *90* (2) | 29 ± 9 |
| **–** | ***17.58*** | **96 ± 12** | **57 ± 10** | **60 ± 10** | **20 ± 6** |
| **4** | **21.16** | ***80*** **(4)** | **47 ± 8** | **50 ± 8** | **16 ± 5** |
| Average K2P distances | | 0.1693 ± 0.0218 | 0.1000 ± 0.0174 | 0.1053 ± 0.0178 | 0.0342 ± 0.0106 |

Table **12**: Apomorphic traits of the nodes investigated in this study and molecular support representing bootstrap support values from parsimony analyses of former studies (Cordiaceae: GOTTSCHLING *et al.* in prep. a; Ehretiaceae: GOTTSCHLING & HILGER 2001; Heliotropiaceae: DIANE *et al.* 2002a).

| Taxon | Apomorphic traits | Bootstrap support (previous / this study) |
|---|---|---|
| **Cordiaceae** | | |
| node A | — | 89 / (100) |
| node B | — | 100 / 98 |
| node C | Calyx fleshy at maturity | 98 / 58 |
| node D | Linear stigmas | 99 / 96 |
| **Ehretiaceae** | | |
| node A | — | 72 / (100) |
| node B | Endocarpids with lamellae on the abaxial surface and with a chamber filled with the placenta | 100 / 100 |
| node C | — | 68 / 71 |
| node D | — | 99 / 99 |
| node E | Syn-mericarpy (fusion of endocarpids) | 93 / 52 |
| node F | — | 69 / — |
| **Heliotropiaceae** | | |
| node A | | 66 / (100) |
| node B | Endocarpids with 'pits' (characteristic surface sculpturing) | 95 / 95 |
| node C | Embryo straight | 72 / 89 |
| node D | Secondarily ligneous, corolla aestivation apert-duplicative | — / — |