



Nationaal Herbarium Nederland

**STAGE-, MINISTAGE- EN
SCRIPTIEONDERWERPEN
BACHELOR, MASTER AND TERM
PAPER PROJECTS
2008**

LEIDEN – WAGENINGEN

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INLEIDING

Dit boekje geeft een overzicht van stage- en scriptiemogelijkheden bij het Nationaal Herbarium Nederland. Het zwaartepunt ligt op (moleculair) systematisch en biogeografisch, morfologisch en (ultra)microscopisch onderzoek. Het hier gepresenteerde overzicht is zeker niet uitputtend, er vinden regelmatig veranderingen en aanpassingen plaats. Zowel de onderwerpen als de lengte van de stages zijn flexibel. Ook kunnen er op basis van eigen voorkeuren en ideeën andere onderwerpen en periodes worden afgesproken. Verslaglegging dient plaats te vinden in de vorm van een manuscript voor publicatie in een (inter)nationaal tijdschrift.

Veel stageonderwerpen (Afrika, Amerika, Europa, Nederland) kennen een veldwerkcomponent. Bij onderwerpen met betrekking tot de Zuidoost Aziatische flora zijn veldwerkmogelijkheden beperkt, maar kunnen worden onderzocht. Fondswerving en aanvragen voor visa en onderzoeksvergunningen kosten veel tijd. Onderdeel van een onderwerp kan zijn een bezoek aan een Europees zusterinstituut (m.n. Royal Botanic Gardens, Kew; Royal Botanic Garden, Edinburgh; Muséum National d'Histoire naturelle, Parijs).

Ministages hebben een beperkte omvang en laten veelal geen veldwerk toe. Scriptieonderwerpen betreffen uitsluitend literatuuronderzoek.

NATIONAAL HERBARIUM NEDERLAND

Het Nationaal Herbarium Nederland (NHN) is één van de 6 kerninstituten van de onderzoeksschool Biodiversiteit. In deze onderzoeksschool is het overgrote deel van de Nederlandse expertise op het gebied van taxonomie, fylogenie, biogeografie, biosystematiek, en nog een veelheid aan specialisaties gebundeld. Sommige van de gespecialiseerde aio/oio cursussen staan ook open voor studenten die bezig zijn met een Master thesis project (voorheen: doctoraalstage).

De belangrijkste taak van het NHN is om d.m.v. systematisch onderzoek kennis over en inzicht in de aard, omvang en oorsprong van de botanische diversiteit te verwerven. Hiermee draagt het NHN bij aan de opbouw van de vergelijkende kennisbasis van biodiversiteit voor alle botanische wetenschappen en levert essentiële informatie voor de bescherming en het duurzaam gebruik van de biosfeer.

Het NHN bestaat uit twee onderdelen: Leiden (Universiteit Leiden branch), Wageningen (Wageningen University branch). Het Leidse herbarium (NHN-L) is de hoofdvestiging. Voor meer informatie zie de website van het NHN.

I. UNIVERSITEIT LEIDEN BRANCH (NHN-L)

Het NHN-L behoort tot de 10 grootste systematisch-botanische instituten ter wereld en is het expertisecentrum op het gebied van Maleise en Nederlandse plantendiversiteit. Voor dit doel beheert het NHN-L omvangrijke herbariumcollecties (c. 4 000 000 exemplaren), een unieke bibliotheek (c. 3 km aan oude en recente botanische literatuur), en moderne en ruime laboratorium- en computerfaciliteiten. De plantencollecties en expertise zijn geconcentreerd op Malesia (de archipel tussen Azië en Australië die de landen Maleisië, Singapore, Indonesië, Brunei Darussalam, de Filipijnen en Papua Nieuw Guinea omvat) en op NW Europa.

Samenwerkingsprojecten: De staf van het NHN-L coördineert of is nauw betrokken bij een veelheid aan nationale en internationale projecten, die mogelijkheden bieden voor stageonderwerpen, zoals o.a. FLORON, het Flora Malesiana project, het Flora Agaricina Neerlandica project en het Tropenbos Oost-Kalimantan programma. Voorts wordt nauw samengewerkt met de Hortus Botanicus Leiden (zie pag. 21) en de Onderzoeksschool Biodiversiteit (zie boven).

Het NHN-L omvat 2 onderzoeksgroepen met de volgende specialisaties:

A. Onderzoeksgroep Plantendiversiteit van de Indo-Pacific en Tropisch Azië (PITA)

1. Taxonomisch onderzoek ten behoeve van Flora Malesiana. Systematisch onderzoek naar de botanische diversiteit van Malesia met behulp van kenmerksanalyses op verscheidene niveaus: Morfologie, Ultrastructuur, Moleculen (DNA).
2. Fylogenie en Biogeografie van vooral Malesische planten. Verwantschaps- en verspreidingsonderzoek.
3. Palynologie en systematisch anatomie. Onderzoek naar de (sub)microscopische bouw van pollen, hout, bladeren en zaden, mede t.b.v. fylogenetische classificaties van planten en identificatie van planten en plantresten. Ecologische en functionele aanpassingen in pollen en houtstructuur.
4. Strategisch en toegepast biodiversiteits onderzoek. Maatschappelijk relevante projecten, zoals duurzame exploitatie van het tropisch regenwoud; het gebruik van plantaardige hulpbronnen door de plaatselijke bevolking; natuurbescherming en natuurbeheer; etc.

B. Onderzoeksgroep Fanerogamen en Kryptogamen van Nederland en Europa (PCNE)

1. Taxonomisch en fylogenetisch onderzoek aan Nederlandse en Europese fanerogamen, fungi, algen en mossen.
2. Morfologisch onderzoek, m.n. aan algen.
3. Strategisch en toegepast biodiversiteitsonderzoek. Maatschappelijk relevante projecten, zoals monitoring van veranderingen in de botanische diversiteit van Nederland; natuurbescherming en natuurbeheer; forensisch onderzoek; etc.

Naast de hierboven gemelde specialisaties wordt in alle groepen onderzoek gedaan t.b.v. multimedia presentatie van biodiversiteitskennis.

CONTACTADRES:

Heb je interesse om een stage op het NHN-L te doen, neem dan contact op met de onderwijscoördinator van het instituut (of één van genoemde contactpersonen):

**Dr. Marco Roos, NHN-L, Van Steenisgebouw, Einsteinweg 2, Kamer B116,
Tel.: 071-5273524, Fax: 071-5273511, e-mail: roos@nhn.leidenuniv.nl**

II. WAGENINGEN UNIVERSITY BRANCH (NHN-W)

Het NHN-W beheert een middelgroot herbarium (c. 600 000 exemplaren) en een kleine (eigen) bibliotheek en is voorzien van moderne computerfaciliteiten. Er zijn goede laboratoriumfaciliteiten beschikbaar, zowel binnen als buiten de leerstoelgroep. De plantencollectie en de expertise zijn geconcentreerd op Tropisch Afrika en op cultuurplanten en hun wilde verwanten. Er wordt nauw samengewerkt met DLO instituten binnen en buiten Wageningen, de Botanische Tuinen van Wageningen en Nijmegen en de onderzoekschool Experimentele Plantenwetenschappen.

Samenwerkingsprojecten: De staf van het NHN-W coördineert of is nauw betrokken bij enkele nationale en internationale projecten, die mogelijkheden bieden voor stage onderwerpen en afstudeervakken, zoals systematiek van cultuurplanten o.a. in N en Z Amerika, Vaatplanten van Afrika (vnl. Gabon), Flora of Benin. Ook het PROTA project (Plant Resources Of Tropical Africa) biedt mogelijkheden voor stages en afstudeervakken. Voorts zijn er ook mogelijkheden in andere landen in Europa, Afrika, India, Australië.

Het NHN-W omvat 2 onderzoeksgroepen met de volgende specialisaties:

C. Biosystematiek van cultuurplanten en hun wilde verwanten

Systematisch onderzoek aan wilde verwanten van belangrijke cultuurgewassen.

D. Vaatplanten van Tropisch Afrika

1. Project botanisch biodiversiteit van Gabon.
2. Project Flora van Benin.
3. Taxonomische bewerkingen van verschillende groepen uit diverse families.

CONTACTADRES:

Heb je interesse om een stage op het NHN-W te doen, neem dan contact op met de onderwijscoördinator:

Dr. R.G. van den Berg, NHN-W, Generaal Foulkesweg 37, kamer 1027, 6703 BL Wageningen, Tel.: 0317-483377, e-mail: Ronald.vandenBerg@wur.nl

INTRODUCTION

The subject of this paper is an overview of some of the BSc and MSc projects of the Nationaal Herbarium Nederland. The emphasis is on (molecular) systematic and biogeographical, morphological and (ultra)structural research. The presented overview is not exhaustive, moreover, changes and adaptations happen regularly. Projects as well as duration of projects are flexible. Furthermore, it is possible to discuss own preferences and ideas for subjects and duration. The report on a project should be written as a manuscript for a publication in an international journal.

Many MSc-projects (Africa, America, Europe, The Netherlands) include fieldwork. Projects studying Southeast Asian plants have limited fieldwork opportunities, however, they may be explored. Applications for visa, research permits and funding are time consuming. As part of a project visits to European sisterinstitutes (e.g. Royal Botanic Gardens, Kew; Royal Botanic Garden, Edinburgh; Muséum National d'Histoire naturelle, Paris) may be included. [However, foreign students should be aware that they may need additional visa for other countries.]

BSc projects are of much shorter duration and usually do not include fieldwork. Term paper subjects are restricted to literature research.

NATIONAAL HERBARIUM NEDERLAND

The Nationaal Herbarium Nederland (National Herbarium of the Netherlands, NHN) is one of the six core institutes of the Research School Biodiversity. This research school coordinates most of the Netherlands expertise on taxonomy, phylogeny, biogeography, biosystematics, and much more. Several of the specialized PhD-courses are available for MSc students.

The most important task of NHN is research on the nature, size and origin of botanical diversity and dissemination of diversity knowledge. In doing this we contribute to the comparative knowledge bases of biodiversity for the whole of botanical science and provide essential information on conservation and sustainable use of the biosphere.

NHN consists of two herbaria: Leiden (Universiteit Leiden branch, NHN-L) and Wageningen (Wageningen University branch, NHN-W). The Leiden herbarium is the principal branch. For more information visit our website.

I. UNIVERSITEIT LEIDEN BRANCH (NHN-L)

NHN-L is one of the largest systematic botanic institutes of the world. It is the centre of expertise for the botanical diversity of Malesia and the Netherlands. For its research NHN-L maintains a large herbarium (c. 4 000 000 specimens), an unique library (c. 3 km botanical literature), modern, spacious laboratoria, and full computer facilities. Plant collections and expertise are focussed on Malesia (the archipelago between Asia and Australia, consisting of Malaysia, Singapore, Indonesia, Brunei Darussalam, the Philippines and Papua New Guinea) and NW Europe.

Cooperative projects: The staff of NHN-L coordinates or is closely involved in a multitude of national and international projects, that offers opportunities for MSc-projects; e.g. FLORON, Flora Malesiana, Flora Agaricina Neerlandica, Tropenbos East Kalimantan project. Furthermore, there is a close cooperation with Hortus Botanicus Leiden (see p. 21) and the Research School Biodiversity (see above).

NHN-L consists of two research groups with the following specialities:

A. Research group Plant diversity of the Indo-Pacific and Tropical Asia (PITA)

1. Taxonomic research for Flora Malesiana. Systematic research in the botanical diversity of Malesia with character analyses at various structural levels: Morphology, Ultrastructure, Molecules (DNA).
2. Phylogeny and Biogeography of Malesian plants.
3. Palynology and Systematic anatomy. Research on the (sub)microscopic structure of pollen, wood, leaves, and seeds. Collected data may be used for among others: phylogenetic classification of plants, identification of plants and plant remains, ecological and functional adaptations in pollen and wood structure.
4. Strategic and applied biodiversity research. Social impact projects, such as sustainable use of tropical rain forest, the use of plant resources by local people, nature conservation, nature management, etc.

B. Research group Phanerogams and Cryptogams of the Netherlands and Europe (PCNE)

1. Taxonomic and phylogenetic research on Netherlands and European phanerogams, fungi, algae and mosses.
2. Morphological research, especially in algae.
3. Strategic and applied research. Social impact projects, such as monitoring of developments in the botanical diversity of the Netherlands, nature conservation, nature management, forensic research, etc.

Allied to some of the above mentioned specialities both groups have projects on multimedia presentation of biodiversity knowledge.

CONTACT ADDRESS:

Are you interested in a MSc project at NHN-L, please contact the coordinator for tuition (or one of the persons mentioned with the projects):

Dr. Marco Roos, NHN-L, Van Steenisgebouw, Einsteinweg 2, Kamer B116, Tel.: 071-5273524, Fax: 071-5273511, email: roos@nhn.leidenuniv.nl

II. WAGENINGEN UNIVERSITY BRANCH (NHN-W)

NHN-W maintains a middle-sized herbarium (c. 60 000 specimens) and a small (own) library; it provides modern computer facilities. Good laboratory facilities are available both within and outside the chair group. Plant collections and expertise are focussed on tropical Africa and on cultivated plants and their wild relatives. NHN-W cooperates closely with DLO institutes in Wageningen and elsewhere, the Botanical Gardens of Wageningen and Nijmegen and the Research School Experimental Plant Sciences

Cooperative projects: The staff of NHN-W coordinates or is closely involved in some national and international projects, that offers opportunities for MSc-projects, e.g. Systematics of cultivated plants, Phanerogams of Tropical Africa (Gabon), Flora of Benin. The PROTA project (Plant Resources Of Tropical Africa) offers opportunities for MSc-projects ('Stages, Afstudeervakken'). Furthermore, there are opportunities in other countries in Europe, Africa, India, Australia.

NHN-W consists of 2 research groups with the following specialities:

C. Biosystematics of cultivated plants and their relatives

Systematics of wild relatives of important crop plants.

D. Vascular plants of Tropical Africa

1. Project botanical biodiversity of Gabon.
2. Project Flora of Benin.
3. Taxonomic revision of various groups in several families.

CONTACT ADDRESS

Are you interested in a project ('Stage, Afstudeervak') at HNH-W, please contact the coordinator for tuition (or one of the persons mentioned with the projects):

Dr. R.G. van den Berg, NHN-W, Generaal Foulkesweg 37, kamer 1027, 6703 BL Wageningen, Tel.: 0317-483377, e-mail: Ronald.vandenBerg@wur.nl

I. Stageonderwerpen/msc-projects

I.1. UNIVERSITEIT LEIDEN BRANCH (NHN-L)

A. Onderzoekgroep Plantendiversiteit van de Indo-Pacific en Tropisch Azië/Research group Plant diversity of the Indo-Pacific and Tropical Asia (PITA)

A.1. REVISION OF *ALPHANDIA* (EUPHORBIACEAE)

Background & objectives: *Alphandia* is a Euphorbiaceae genus (spurges / wolfsmelkachtigen) with a very weird distribution. One species is known from New Guinea, the others are present on New Caledonia and Vanuatu (New Hebrides). The research will concentrate on the revision of the New Guinean species for the Flora Malesiana Project, but the species from the other Pacific islands have to be used for species delimitation.

Duration: c. 2 months.

If wished for, the subject can be expanded by investigating the relationship of the genus with other genera (phylogenetic analysis on genus level).

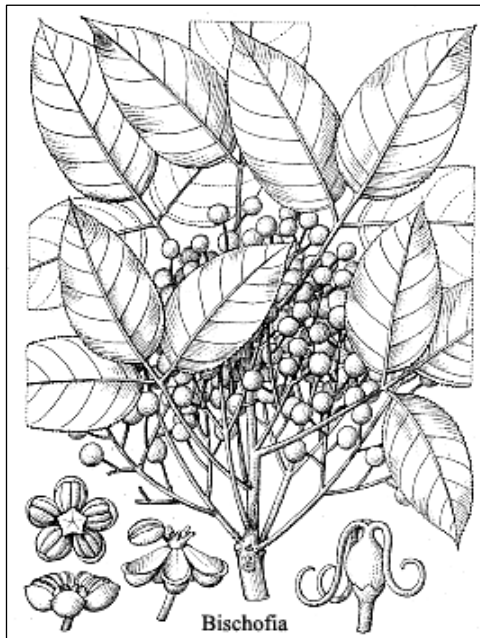
Duration: c. 1 month.

Results: to be published in a journal and Flora Malesiana.

Supervisor: Peter van Welzen (Room B122, tel.: 071 527 3571, email: welzen@nhn.leidenuniv.nl). Please, discuss date of research well in advance.



A.2. REVISION OF *BISCHOFIA* (EUPHORBIACEAE)



Background & objectives: *Bischofia* is a Euphorbiaceae genus (spurges / wolfsmelkachtigen) with two species, of which one in the Malay Archipelago. It is one of the very few Euphorbiaceae with a compound leaf. The research will concentrate on the revision of the Malesian species for the Flora Malesiana Project.

Duration: c. 2 months.

If wished, the subject can be expanded by investigating the relationship of the genus with other genera (phylogenetic analysis on genus level). The genus is anomalous within the Euphorbiaceae due to its pinnate leaves

Duration: c. 1 month.

Results: to be published in a journal and Flora Malesiana.

Supervisor: Peter van Welzen (Room B122, tel.: 071 527 3571, email: welzen@nhn.leidenuniv.nl). Please, discuss date of research well in advance.

A.3. REVISION OF *PTYCHOPYXIS* (EUPHORBIACEAE)

Background & objectives: *Ptychopyxis* is a Euphorbiaceae genus (spurges / wolfsmelkachtigen) with c. 12 species in the Malay Archipelago (Malesia). The stamens are quite typical, with four locules separated from each other and placed two by two above each other. The species delimitation seems to be relatively simple. A manuscript is present, but alas, in Indonesian.

Duration: c. 6 months.

If wished, the subject can be expanded by investigating the relationship of the genus with other genera (phylogenetic analysis on genus level).

Duration: c. 1 month.

Results: to be published in a journal and Flora Malesiana.

Supervisor: Peter van Welzen (Room B122, tel.: 071 527 3571, email: welzen@nhn.leidenuniv.nl). Please, discuss date of research well in advance.



A-4. POLLEN ANATOMICAL STUDY ON THE TRIBE SACCOPEALEAE

Background and objectives: Most research on Annonaceae pollen has been done on African and South American species. Walker (1971) carried out a general study on the pollen of most of the genera, however, only few species per genus were included. A more detailed study of the Asian species is needed to unravel the relationship between the genera. In this study the relationship between the genera of the tribe Saccopetaleae is investigated.

Research: The student will: make preparations, sections and slides of the pollen of the genera involved; study these preparations and make descriptions and comparisons for each genus; make a data matrix which can be used in the total evidence phylogenetic analysis of the tribe.

Methods: Acetolysis (preparation method for pollen), light microscopy, electron microscopy

Duration: 4 to 6 months.

Supervisors: Dr. Raymond van der Ham and Dr. Paul Keßler, tel.: 5273576, e-mail:

kessler@nhn.leidenuniv.nl

A-5. POLLENMORFOLOGIE VAN DE AMERIKAANSE SOORTEN VAN *ALLOPHYLUS* (SAPINDACEAE)

Vraagstelling in algemeen kader: Systematiek en fylogenie van de tropische familie Sapindaceae (Rambutan-familie, nauw verwant aan onze paardekastanjes en esdoorns)

Vraagstelling onderwerp:

- beschrijving van het pollen van de ± 35 Amerikaanse *Allophylus* soorten, met speciale aandacht voor de ornamentatie van de wand.
- vergelijking met niet-Amerikaanse *Allophylus* soorten (het geslacht is pantropisch).
- in hoeverre bevestigt de pollenmorfologie de voorgestelde systematiek van het geslacht (één soort i.p.v. 175 à 300).
- hoe past het pollen van *Allophylus* in het algemene beeld (morfologie en fylogenie) van de tribus Thouinieae (met behalve *Allophylus* nog 5 kleine Amerikaanse geslachten).

Toe te passen technieken: Acetolyse (prepareermethode voor pollen), lichtmicroscopie, raster-electronenmicroscopie van hele en gesneden ('vries-coupees') pollenkorrels.

Gewenste voorkennis: cursus Biodiversiteit & Patroonanalyse.

Onderwerptijd: c. 6 maanden.

Begeleiding: Dr. Raymond van der Ham, kamer A210, tel.: 5273593, e-mail:

ham@nhn.leidenuniv.nl

Summary: *Allophylus* (Sapindaceae) either has only 1 species or 300. The study will describe the pollen of c. 35 American species, compare these with the pollen of Asian and African species. The research should answer two questions: 1. Confirms the pollen

morphology the ideas about species numbers; 2. Does the *Allophylus* pollen fit in the pattern for the tribe Thouinieae?

A-6. FOSSIELE MOSSPOREN(?) UIT ZUID-LIMBURG*

Achtergrond: Algemeen wordt tegenwoordig aangenomen dat 65 miljoen jaar geleden de inslag van een c. 10 km grote meteoriet in de Golf van Mexico een einde maakte aan de heerschappij van de dinosauriërs, en daarmee ook aan het Krijttijdperk. De grens tussen het Krijt en het daaropvolgende tijdperk, het Tertiair, wordt gekenmerkt door een laagje van vaak kleilig materiaal waarin onder meer het element iridium in opvallend hoge concentratie voorkomt. Sinds 1992 zijn de sporen van de inslag ook bekend uit ons eigen Zuid-Limburg. In een grottenstelsel bij Valkenburg wordt bovenop de Krijt/Tertiair-grens (K/T boundary) een pakket van kalk- en kleilagen aangetroffen waarvan verondersteld wordt dat het onmiddellijk na de inslag is afgezet. In de kleilagen worden vele soorten dinoflagellaten (een groep van mariene eencelligen) gevonden, maar ook (dominant) diverse kleine bolvormige palynomorfen*, welke voorlopig worden beschouwd als mossporten.

Doel/vraagstellingen:

- Beschrijving van de morfologie en diversiteit van de kleine bolvormige palynomorfen uit de Zuidlimburgse K/T kleilagen.
- Zijn alle of een deel de kleine bolvormige palynomorfen uit de Zuidlimburgse K/T kleilagen mossporten?
- Als er (ten dele) sprake is van mossporten, is er dan aansluiting mogelijk bij recente (tropische) mosgroepen en zijn er uitspraken te doen over de ecologie?
- Wat is de identiteit/affiniteit van de eventuele niet-moscomponent?

Technieken:

- Lichtmicroscopie en scanning- en transmissie-electronenmicroscopie van het fossiele materiaal en sporen van te selecteren recente mossen.
- Inventarisatie van de literatuur over de morfologie en ultrastructuur van de wand van recente en fossiele mossporten.
- excursie/eventueel verzamelen in de grotten bij Valkenburg.

Voorkennis: cursus Palynologie en/of cursus Systematiek en biologie van Kryptogamen.

Periode: 4--6 maanden.

Begeleiding: Dr. Raymond van der Ham, kamer A210, tel.: 5273593, e-mail:

ham@nhn.leidenuniv.nl en Hans Kruijer (tel.: 5274713).

Summary: Traces of the K/T boundary are also found in the Netherlands province of Zuid Limburg. In caves near Valkenburg above this boundary layers of limestone and clay are found. These layers contain fossils of Dinoflagellates and (dominant) several small globular 'palynomorphs'. The study will try to ascertain whether these palynomorphs are moss spores or not.

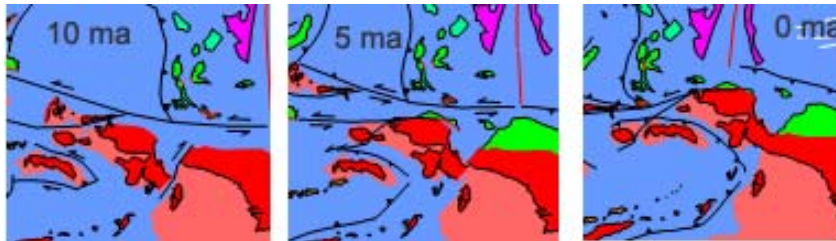
* Dit onderzoek geldt als een interne stage van de Leidse biologiëstudie, maar maakt deel uit van het multidisciplinaire K/T-project van het Laboratorium voor Palaeobotanie en Palynologie (Utrecht) en diverse andere instituten. Momenteel wordt in Utrecht onder meer een onderzoek gedaan naar de biopolymeren in de wanden van de vermeende mossporten.

* Verzamelnaam voor allelei plantaardige en dierlijke objecten (of onderdelen daarvan) kleiner dan 500 µm (0.5 mm).

A-7. FLORA COMPARISON BETWEEN NORTH AND SOUTH MOLUCCAS

Background & objectives: During the last 10 million years the northern half of the Moluccas moved due to tectonic displacements along the north of New Guinea to its present position. The southern half of the Moluccas moved south from New Guinea upwards.

Project: Herbarium specimens of the Moluccas will be databased and georeferenced. With these data the floras of the northern and southern Moluccas can be analysed in relation to other areas (e.g., Sulawesi and New Guinea). This will reveal the difference in flora between both areas and will also help in future floristic and historical biogeographic analyses.



Duration: c. 6 months.
Results: to be published in a high impact journal.
Supervisor: Peter van Welzen (Room B122, tel.: 071 527 3571, email:

welzen@nhn.leidenuniv.nl. Please, discuss date of research well in advance

A-8. CURIOUS DISTRIBUTION OF ALPINE GRASSES IN MALESIA

Background & objectives: Grasses on mountain tops in the Malay Archipelago have a very disjunct distribution. They are present on some summits and absent on others. The main question is, how did they disperse to these mountain tops? A possibility is long-distance dispersal, but then the next question is how? Another possibility is that the climate during for instance interglacial periods was more suitable for these grasses to disperse, with more suitable steps (eg. hills and mountains with lower altitudes) in between, steps which have disappeared nowadays.



Project: The latter hypothesis will be researched by correlating the present distribution to environmental variables (ecological niche modeling) and then see which distributions these



variables predict during former Palaeontological times (phyloclimatic modeling).

Duration: c. 6 months.

Results: to be published in a high impact journal.

Supervisor: Peter van Welzen (Room B122, tel.: 071 527 3571, email: welzen@nhn.leidenuniv.nl. Please, discuss date of research well in advance.

A-9. ENDEMISM AND PLATE TECTONICS IN NORTH BORNEO

Background & objectives: The Malay Archipelago (Malay Peninsula up to New Guinea, also known as Malesia) comprised two areas with relatively many endemic plant species (species with a very local distribution). One area is the northern half of New Guinea, the other the north part of Borneo (Sarawak, Brunei, Sabah and N. Kalimantan). For New Guinea there seemingly is a correlation between high plate tectonic activity and the number of endemics. The same correlation seems reasonable for N. Borneo too: high plate tectonic activity causes high speciation rates.



Project: The MSc-project entails the following topics: geo-referencing of collections, computerised production of distribution maps, recognition of patterns in the

various distributions, study of the geological history of Borneo, comparison of patterns with the history, statistical correlation between patterns and geology.

Duration: c. 6 months.

Results: to be published in a high impact journal.

Supervisor: Peter van Welzen (Room B122, tel.: 071 527 3571, email: welzen@nhn.leidenuniv.nl). Please, discuss date of research well in advance.

B. Onderzoekgroep Fanerogamen en Kryptogamen van Nederland en Europa/Research group Phanerogams and Cryptogams of the Netherlands and Europe (PCNE)

B-1. SYSTEMATIEK EN ECOLOGIE VAN FLUWELBOLETEN (*XEROCOMUS*) IN DE DUINEN

Achtergrond: Fluweelboleten hebben, zoals de naam al aangeeft, een droog, vaak fluwelig hoedoppervlak. Het zijn veelal tamelijk kleine soorten, met hoeden tussen de 3 en 7 cm doorsnee. Ze vormen mycorrhiza met loof- en naaldbomen en zijn waarschijnlijk niet erg waard specifiek. In de Hollandse duinen komen een aantal soorten voor, die niet altijd even makkelijk van elkaar zijn te onderscheiden. In het kader van een bewerking van deze groep voor de Nederlandse paddenstoelenflora zijn we nu bijna zo ver dat een sleutel kan worden uitgetest. Doel van de stage is om met behulp van de voorlopige sleutel een inventarisatie te maken van de fluweelboleten in een aantal duingebieden in de omgeving van Leiden (Meyendel, Pan van Persijn en Amsterdamse Waterleiding duinen).

Doel: Het onderzoek zal er op gericht zijn om: de voorlopige soortgrenzen beter af te bakenen; veldkenmerken te vinden en te testen; een betere indruk te krijgen van de ecologie van de aangetroffen soorten; het in samenwerking met de begeleider voltooien van de sleutels en soortbeschrijvingen voor de Flora.

Technieken: Verzamelen in het veld, vastleggen van de ecologische en morfologische kenmerken; licht- en scanning electronenmicroscopie; microfotografie.

Duur van de stage: 9 maanden. In verband met het paddenstoelenseizoen zal deze stage uiterlijk moeten aanvangen in juni.

Begeleiding: Dr. Machiel Noordeloos, tel 5374736, e-mail: noordeloos@nhn.leidenuniv.nl

Summary: A preliminary key to the species of *Xerocomus* in the Netherlands has been made for the Flora agaricina neerlandica. The MSc project will test this key; find good field characters for identification, find a better understanding of the ecological preferences of the species (host plant specificity) and together with the supervisor complete the revision of *Xerocomus* for the flora.

B-2. SYSTEMATIEK EN ECOLOGIE VAN KRULZOMEN (*PAXILLUS*) IN NEDERLAND

Achtergrond: De krulzoom (*Paxillus involutus*) is één van de meest algemene ectomycorrhiza-vormende paddenstoelen van Nederland. Hij heeft een zeer breed waardplantspectrum, dat zowel loof- als naaldbomen omvat en een brede ecologie van natte tot droge biotopen, op allerlei grondsoorten. Recentelijk is een studie verschenen van dit geslacht op grond van waarnemingen in Zuid Duitsland. Daarbij is aan het licht gebracht dat er een grotere morfologische en ecologische differentiatie lijkt te bestaan, dan men eerder heeft aangenomen. Op grond hiervan zijn in het complex van de gewone Krulzoom een aantal nieuwe soorten beschreven. Een belangrijke rol hierbij speelde het kenmerk van de anatomie van de rhizomorfen, ondergrondse, wortelachtige strengen die het vruchtlichamen met het mycelium en de waardplant verbinden. Dit kenmerk werd tot nu toe niet bij de morfologische karakterisering van soorten bij de plaatjeszwammen gebruikt.

Doel: het maken van een inventarisatie van de Krulzoom in Nederland, met inachtneming van de nieuwe kenmerken, teneinde vast te stellen of de in Duitsland vastgestelde variatie in Nederland ook voorkomt, en de nieuw voorgestelde soorten kritisch te evalueren. Het

uiteindelijke resultaat zal worden opgenomen in de Flora van de Nederlandse Paddenstoelen.

Technieken: veldwerk, het maken van een beschrijving van de veldkenmerken, de morfologie en de ecologie; lichtmicroscopische analyse van de vruchtlichamen en rhizomorfen. Een kritische vergelijking van de verzamelde collecties leidend tot soortafgrenzingen en een determinatiesleutel.

Duur: 9 maanden. In verband met het paddenstoelenseizoen is het noodzakelijk de stage aan te vangen in mei of juni.

Begeleiding: Dr. Machiel Noordeloos, tel 5374736, e-mail: [noordeloos@nhn.leidenuniv.nl](mailto:oordeloos@nhn.leidenuniv.nl);
Summary: *Paxillus involutus* is one of the most common ectomycorrhizal mushrooms of the Netherlands. The species is known from a wide range of hosts, including broadleaf and coniferous trees, and from a wide range of ecological preferences. Recently a number of new species have been described for Germany based on new characters. The MSc project will study dutch collections of *P. involutus* and critically evaluate the new characters to find out whether the new taxa also occur in the Netherlands. Fieldwork is included.

B-3. EEN INVENTARISATIE VAN DE (MICRO)FUNGI OP DODE STENGELS VAN BRANDNETEL (*URTICA DIOICA*)

Achtergrond: Dode, overjarige stengels van de gewone brandnetel (*Urtica dioica*) vormen een interessant substraat voor een grote variatie aan minipaddenstoelen en andere zwammen, voornamelijk uit de hoofdgroepen Asco- en Deuteromyceten. Er is veel literatuur over dit onderwerp, maar in Nederland is er nog geen systematisch onderzoek naar gedaan.
Doel: Het doen van een pilotstudie naar de verscheidenheid aan schimmels op dode stengels van de brandnetel, bij voorkeur in een aantal verschillende biotopen in de omgeving van Leiden.

Technieken: Verzamelen van material in het veld met een korte karakteristiek van de ecologie van de vindplaatsen. Analyseren en klassificeren van de op de brandnetels aangetroffen schimmels met behulp van literatuur en lichtmicroscopie.

Duur: 3—4 maanden, ongeveer beginnend in april.

Begeleiding: Dr. Machiel Noordeloos, tel.: 5274710, e-mail: [noordeloos@nhn.leidenuniv.nl](mailto:oordeloos@nhn.leidenuniv.nl)

Summary: Dead stems of *Urtica* (Brandnetel) offer an interesting substrate for a variety of small fungi, mostly Ascomycetes and Deuteromycetes, which is apparent from literature. This fungal community, however, has hardly been explored in the Netherlands. The aim of this small study is to make an inventory of the fungi on *Urtica* stems in a few different habitats in the vicinity of Leiden to establish the species composition and the influence of habitat on this composition. This study includes fieldwork and light microscopy, as well as literature research. A small report of the results must be written.

B-4. EEN REVISIE VAN DE SOORTEN VAN HET GESLACHT GYMNOPIILUS (VLAMHOEDEN) IN NEDERLAND

Achtergrond: Vlamhoeden behoren tot de familie van de Gordijnzwammen, en zijn gekarakteriseerd door vaak intens roodbruin gekleurde vruchtlichamen. In Nederland komen naar schatting 9 soorten voor. Twee groepen kunnen worden onderscheiden. De eerste, tevens de meest in het oog springende groep wordt gevormd door de soorten die op dood hout groeien en daar witrot veroorzaken. De groep valt uiteen in twee soortcomplexen, dat van de prachtvlamhoed, *Gymnopilus spectabilis* en dat van de dennevlamhoed (*G. penetrans* in wijde zin), waarbij de vraag rijst of dit slechts één, zeer variabele soort omvat, of meer, op morfologische en eventueel ecologische gronden gescheiden soorten. De andere groep wordt gevormd door de terrestrische of op kruidachtige gewassen groeiende soorten. Sommige daarvan zijn erg zeldzaam en staan op de Nederlandse Rode Lijst.

Doel: Aan de hand van zelf verzamelde collecties en herbarium exemplaren vast stellen welke soorten in Nederland voorkomen en hoe deze zijn te onderscheiden.

Technieken: Verzamelen, beschrijven en drogen van zelf verzameld materiaal, bestuderen van herbarium materiaal, lichtmicroscopie en SEM.

Duur: 9 maanden.

Begeleiding: Dr. Machiel Noordeloos, tel 5374736, e-mail: noordeloos@nhn.leidenuniv.nl

Summary: A revision of the genus *Gymnopilus* in the Netherlands. The genus *Gymnopilus* comprises about 9 species, in two distinct ecological groups. The first is formed by the species complexes of *G. penetrans* and *G. spectabilis*, wood destroying fungi that often grow in large clusters. The second group comprises a few terrestrial species. Goal of this study will be a revision of material collected in the field supplemented with herbarium specimens, in order to solve some of the problems in species delimitation, and to produce a key and descriptions. Techniques: collecting and describing in the field; light microscopy and SEM.

B-5. PHYLOGENETIC STUDIES OF SEaweEDS

Introduction & objectives: Several seaweed taxa are the subject of phylogenetic studies at NHN-L. As part of the Heterokont Tree of Life project (<http://ccmp.bigelow.org/deepbrown/>) the NHN-L is responsible for the the class Phaeophyceae (brown algae). Seven genes representing all three cellular compartments are being sequenced and used to reconstruct a phylogeny. On a lower taxonomic level the brown algal family Sargassaceae is being studied with an emphasis on the genus *Cystoseira* which has its centre of diversity in the Mediterranean with many endemic species. Another taxon that is being studied is the green algal genus *Caulerpa* with an emphasis on the *Caulerpa racemosa* species complex.



The green alga *Caulerpa racemosa* (Forssk.) J. Agardh

Methods & techniques: PCR, DNA-sequencing, phylogenetic analysis, revision, creating morphological database, character mapping.

Duration: in agreement with supervisor.

Supervisor: Dr. S.G.A. Draisma (room C132, tel.: 527 4735, e-mail: draisma@nhn.leidenuniv.nl)

I.1.A. PALAEOBOTANIE/PALAEOBOTANY

MSc Projects at Naturalis, Leiden.

1. REVISION OF THE TERTIARY FLORA FROM JAVA, INDONESIA

Background: In 1854 Goeppert described the Tertiary flora from Java (Indonesia) and in the late 19th century more authors dealt with the subject, but since then angiosperm fossil leaf remains of the Tertiary of Java were not studied anymore. The only fossil material that was examined up until the end of the 1960s was the fossil Tertiary wood. The original material described by Goeppert is part of the Naturalis palaeobotanical collection and includes over 40 type specimens. This material needs revision; support for comparison with extant taxa in the area can be found a.o. at the National Herbarium of the Netherlands, Universiteit Leiden branch, where research focuses around the Malaysian Archipelago. Contact will also be made with the Botanical gardens at Bogor, Java where comparison with modern taxa has proved to be very fruitful (pers. comm. Dr. R. Morley). As the relevant knowledge for this revision of Tertiary leaf taxa needs some involvement from specialized researchers in this area, angiosperm specialists such as Dr. Scott Wing from the Smithsonian, Washington DC, USA and Dr. Bruce Tiffney from St. Barbara, USA will be consulted when descriptions will be finalized.

Task & goals: Analysis and taxonomical revision of Goeppert's material from the Tertiary flora present at Naturalis, and possibly other, partly determined, later Tertiary collections from Java. Comparison with other Tertiary floras from adjacent areas in order to obtain an insight in the biodiversity and the palaeoecology during the Tertiary in this part of the world, and the differences in biodiversity with the extant plants from the area.

Methods: Detailed morphological analysis of venation pattern, dissecting microscopy, cuticular analysis, and comparison with living taxa from the area.

Duration: at least 9—12 months.

Supervisor: Prof. Dr. J.H.A. van Konijnenburg-van Cittert, Dr. I.M. van Waveren, tel. 5687686, e-mail: konijnenburg@naturalis.nl and waveren@naturalis.nl, with the support of specialists on Tertiary floras.

2. STANGALPE FLORA FROM THE LATEST CARBONIFEROUS OF AUSTRIA

Background: The palaeobotanical collections at Naturalis comprise a large collection of fossil plants from Stangalpe, Austria. This flora is Stephanian (latest Carboniferous) in age, a period characterized in Europe by ongoing droughts and climatic warming. Stephanian floras differ considerably from those of the previous stage (Westphalian) in that the large peat-forming mires have disappeared and other plants succeeded the large Lycophytes and Sphenophytes that dominated the swamps.

Task & goals: Analysis and taxonomical revision of the material from Stangalpe present at Naturalis. Comparison with other Stephanian floras from adjacent areas in Europe in order to obtain an insight in the biodiversity and the palaeoecology during the Stephanian in this part of the world.

Methods: Dissecting microscopy, cuticular analysis, study of in situ pollen and spores, palaeoecological reconstruction.

Duration: 9—12 months.

Supervisor: Prof. Dr. J.H.A. van Konijnenburg-van Cittert, tel. 5687686, e-mail: konijnenburg@naturalis.nl and Dr. I.M. van Waveren, tel. 5687686, email: waveren@naturalis.nl.

3. SILICIFIED WOOD FROM THE LATE CRETACEOUS OF S. LIMBURG

Background: The macrofossil record of the Maastrichtian (latest Cretaceous) type area is currently under study. Macroremains of conifer leaves and shoots have been assigned to 8

different taxa, and the study of angiosperm leaf remains has just begun. Additionally there are a number of (mainly silicified) wood remains that still have to be examined. In the past mainly angiosperm wood remains from the Cretaceous of Limburg have been described, but conifer wood has never been studied in detail

Task & goals: Determination of the conifer families represented in the Maastrichtian of S. Limburg, and comparison with the leaf fossil record and the pollen fossil record.

Methods: For this study polished sections in three dimensions should be made from each wood sample, and then studied under light microscopy.

Duration: 6—9 months.

Supervisor: Dr. R.W.J.M. van der Ham, tel. 5273593, e-mail: Ham@nhn.leidenuniv.nl and Prof. Dr. J.H.A. van Konijnenburg-van Cittert, tel. 5687686, e-mail:

konijnenburg@naturalis.nl

I.2. WAGENINGEN UNIVERSITY BRANCH (NHN-W)

C. Biosystematiek van cultuurplanten en hun wilde verwanten/Biosystematics of cultivated plants and their wild relatives

C-1. RELATIONSHIPS WITHIN SERIES TUBEROSA, A GROUP OF WILD SOLANUM SPECIES RELATED TO THE POTATO

Introduction & goals: Within the large genus *Solanum* a group of tuber-bearing species has been classified as *Solanum* section *Petota*. This section encompasses about 200 species, divided in 20 series. The cultivated potato, *Solanum tuberosum*, belongs to series *Tuberosa*. In this series a number of species are considered to be closest relatives of the cultivated potato (the *brevicaule*-complex). The relationships between the rest of the species in series *Tuberosae* are uncertain. How close are these to the cultivated potato, do they form one homogenous group or can they be subdivided? The morphology of the species is well documented, but a subdivision of the series using morphology has hardly been attempted. The molecular marker system AFLP is particularly suited to resolve questions at species level in *Solanum* and an extensive AFLP dataset encompassing nearly all tuber-bearing *Solanum* species has been generated. The Wageningen based genebank Centre of Genetic Resources The Netherlands (CGN) holds living material of many species. Students can set up experiments to solve (part of) the problem of the relationships among these species.

Duration: In agreement with the supervisor.

Supervisor: Dr. R.G. van den Berg.

C-2. THE EFFECT OF DOMESTICATION ON GENETIC VARIATION OF CROP PLANTS

Introduction & goals: Crop plants have originated from wild plants by human selection. Usually, only a subset of the genetic variation available in the wild progenitors has been utilised and most crops contain less genetic diversity than their wild ancestors. In certain cases, however, the crop displays a spectrum of variation that exceeds that found in nature, apparently stimulated by the domestication proces. Examples of both situations can be compared and studied with molecular techniques to establish which mechanisms are responsible for these phenomena. The problem of genetic erosion, e.g. the loss of ancient landraces that are replaced by modern high yielding cultivars, and the dangerously narrow genetic basis of many crops necessitates research into the domestication proces. At the Wageningen genebank (Centre of Genetic Resources the Netherlands, CGN) a project on the genetic diversity of lettuce is being prepared, where the current genetic diversity will be compared with that of earlier periods, and with that of the wild progenitor. The reverse situation, a crop displaying wider variation than its wild relative, will be studied in examples of ornamental crops.

Duration: In agreement with the supervisor.

Supervisor: Dr. R.G. van den Berg.

D. Vaatplanten van Tropisch Afrika/Vascular plants of Tropica Africa

D-1. APPLICATION OF IUCN RED DATA LIST CRITERIA TO PLANT COLLECTION DATA OF GABON

Introduction & goals: The International Union for the Conservation of Nature (IUCN) has developed categories of rareness and threat, the so-called Red Data List categories. These are applied internationally to support conservation strategies. A problem we are facing is that for the majority of species on earth we lack sufficient knowledge for a proper Red Data List assessment. This is especially true for tropical species. Therefore, IUCN has developed criteria that can be applied even if our global knowledge of a certain species consists of just a few museum or herbarium specimens. The National Herbarium of the Netherlands – Wageningen University branch (part of the Biosystematics Group) owns a large database with data related to plant collections from tropical Africa. Especially for Gabon, the database is almost complete. After an initial effort to improve the data quality, the student will apply the IUCN criteria to the endemic species of Gabon (about 500). The results will be laid down in a report as well as be made available through the on-line database. The possibilities to further publish the results in a scientific publication will be investigated during the MSc thesis. Furthermore, the assessment can almost directly be applied by organizations like WWF, WCS and the National Herbarium of Gabon, who are very actively involved in nature conservation in Gabon.

Apart from the Red Data List assessment itself, the student should make a critical evaluation of the process of application of the criteria, and deliver suggestions for improvements and/or limitations of the method.

Duration: In agreement with supervisors.

Supervisors: Prof. Dr. M.S.M. Sosef, dr. J.J. Wieringa.

D-2. FLORA OF GABON: TAXONOMIC TREATMENT WITH POSSIBILITIES FOR TROPICAL FIELDWORK

Introduction & goals: The Biosystematics group has a long-term cooperation with the National Herbarium of Gabon (tropical Africa) to study the plant diversity of that country. Data related to the vast majority of plant collections ever made in Gabon have been digitized and are available in a database and on-line. This has recently led to the publication of the Checklist of Gabonese Vascular Plants, a publication representing an extremely useful tool to speed up the publication of family treatments in the Flore du Gabon series. In consultation with the supervisors, the student will select a suitable plant family to study. The project will start with improving data quality related to this plant family (adding of locality data, checking plant identification and nomenclature, adding missing data from newly traced specimens or from literature, etc.). These activities will lead to a final list of the species present in Gabon. A diagnostic identification key to the species will be developed and taxonomic treatments for all species produced. The aim is to arrive at a manuscript (in English), to be published in the Flore du Gabon series, of which the student will be first author.

Depending on the size of the family, a visit to the herbarium of the Muséum National d'Histoire Naturelle in Paris will have to be included in this study. Furthermore, depending on available time, finances and students preferences, fieldwork in Gabon to study the morphology and ecology of the plant species under study and the collecting of additional material may be organized.

Duration: In agreement with supervisors.

Supervisors: Prof. Dr. M.S.M. Sosef, dr. J.J. Wieringa.

D-3. CHARACTER EVOLUTION AND HYBRID DETECTION OF AFRICAN BEGONIA SPECIES

Introduction & goals: A systematic study of group of about 8 tropical African rain forest *Begonia* species (section *Filicibegonia*), based upon morphological characters has been performed. Several species boundaries still remain unclear, and we suspect that some species are of hybrid origin, creating reticulate patterns in evolution. To test this hypothesis, and to produce a phylogenetic tree, a molecular phylogenetic study needs to be performed. DNA samples of about half of the species concerned are already available. However, it is optional to organize additional fieldwork in Gabon to acquire more DNA-material. In that case the focus of the project will be more towards studying within-species variation and hybrid detection. The work will include DNA extraction, PCR, DNA sequencing of chloroplast and nuclear markers and phylogenetic reconstruction using various algorithms including network methods. The outcome should be interpreted in comparison with morphological characters and lead to a scenario of character evolution and of evolution of the group as a whole, including historical biogeography.

Duration: In agreement with supervisor.

Supervisor: Prof. Dr. M.S.M. Sosef.

D-4. EFFECTS OF TERTIARY CLIMATE CHANGE ON BEGONIA DIVERSIFICATION IN AFRICA.

Introduction & goals: East African rain forest is restricted to small areas in coastal and montane regions of Tanzania and Kenya, Fossil evidence indicates that 30—40 million years ago the rainforests of Africa were distributed across tropical latitudes, but have been subject to periods of contraction as a result of aridification at various times since then. The effects of these climatic changes on the evolution of the rain forest flora are in need of further study. The genus *Begonia* has been the subject of much taxonomic work at Wageningen University over the past 30 years. It has also been the subject of phylogenetic studies at the Royal Botanic Garden in Edinburgh. Due to its poor dispersal capability *Begonia* is an ideal genus to study the effects of climate change on the development of African rain forest flora. This project will build on existing phylogenetic data by adding DNA sequences from the c. 15 species that are distributed in coastal and montane forests in Tanzania.

Duration: In agreement with supervisor.

Supervisor: Prof. Dr. M.S.M. Sosef.

D-5. MOLECULAR PHYLOGENY AND BIOGEOGRAPHY OF ANNICKIA (ANNONACEAE)

Introduction & goals: A taxonomic revision of *Annickia* from tropical Africa is nearing completion and this work will provide the basis for a study of the evolution of the genus. This will require phylogenetic reconstruction using morphological and molecular characters. As well as the morphological data already gathered molecular data in the form of nuclear and chloroplast DNA sequences will be produced for at least one member of each species in the genus (the work will therefore involve DNA extraction, PCR and DNA sequencing). DNA samples of about three species are available and the student will also investigate the use of herbarium specimens to extract DNA. The phylogeny will be used to investigate patterns in morphological evolution and to determine the biogeographic history of the genus. The latter will involve use of a molecular clock to determine the age at which species diversified. The results of this study will be published as a scientific article in a systematic biology journal.

Duration: In agreement with supervisor.

Supervisor: Dr. L. W. Chatrou.

D-6. THE PARTING OF AFRICAN ANNONACEAE: BIOGEOGRAPHY OF UVARIASTRUM

Introduction & goals: Lowland tropical rainforest dominated much of the African continent from the late Cretaceous (ca. 65 million years ago) through the Eocene-Oligocene, until

some 25 million years ago. After that, aridification is thought to have shaped the present-day plant diversity to a large extent. Nowadays, an arid corridor runs throughout the African continent from the Horn of Africa in the north-east to the Namib Desert in the south-west. This arid corridor has been a barrier preventing the exchange of taxa between Eastern and Western forests in Africa. The origin and distribution of tropical forests on the African continent, and the taxa they contain, therefore needs to be dealt with against the background of this aridification, and the arid corridor. In this project, you will address the evolutionary-geographical relationships between West-Central African and East African plants, as representatives of the areas on either side of the corridor. More specifically, you will focus on *Uvariastrum*, a genus of small to large trees of the family Annonaceae. You will assess species delimitations, and reconstruct a phylogeny of the species using chloroplast DNA markers that you generate yourself in the laboratory. Finally, you will estimate both temporal and spatial aspects of the evolutionary history of *Uvariastrum* on the African continent. The results of this study will be published as a scientific article in a systematic biology journal.

Duration: In agreement with supervisor.

Supervisor: Dr. L. W. Chatrou.

D-7. SPECIATION IN RELATION TO THE UPLIFT OF THE ANDES

Introduction & goals: The genus *Mosannona* comprises 16, mostly recently discovered species of small trees, with an 'Andean centred' distribution. The bulk of the species diversity is found in lowland tropical forest along the Andes in Peru and Ecuador with significant diversity also discovered extending north through Colombia into Central America. Only a single species has been collected from further east: *M. discolor* from Guyana and Surinam. There is a good amount of molecular phylogenetic results that have recently been gathered. Together with the geographic distribution, these results suggest that speciation within *Mosannona* is related to the uplift of the Andes. A project is available for an undergraduate student to do further work on this topic, and conclusively answer the question where and when in evolutionary time *Mosannona* originated. The project involves some laboratory work (PCR, DNA sequencing) and phylogenetic, biogeographic and molecular dating analyses.

Duration: In agreement with supervisor.

Supervisor: Dr. L.W. Chatrou.

D-8. UNRAVELLING LONG-DISTANCE DISPERSAL BETWEEN AFRICA AND SOUTH AMERICA

Introduction & goals: Trans-atlantic distributions of tropical organisms have long fascinated biologists. Such distributions of related taxa in Africa and Latin America have often been explained in relation to the old continent Gondwana. The moment this southern supercontinent disintegrated into the landmasses of today's southern hemisphere, a part of a lineage would have found itself on Africa, another part on south America. A consequence of this scenario is that present-day lineages would need to date back to around 100 million years ago, the time at which the split up of Gondwana started.

In the tropical family Annonaceae we have a group of approximately 100 species of rain forest trees and lianas with a trans-Atlantic distribution. Applying phylogenetic methods and dating the resulting trees, we have found that the age of this group is much too young to explain its distribution with the break up of Gondwana. Multiple long-distance dispersal events seem a more probable alternative explanation.

A project is available for an undergraduate student to finalize our work on this group. All steps in the data-gathering and analytical process would be included in this project, although only a small amount of raw data-gathering in our molecular laboratory is expected. A stronger focus will be on data analysis and hypothesis testing, using techniques of phylogenetic inference, biogeography and molecular dating.

Duration: In agreement with supervisor.

Supervisor: Dr. L.W. Chatrou.

D-9. DELIMITATION OF TWO SIBLING SPECIES OF ANGRAECUM (ORCHIDACEAE) USING MOLECULAR MARKERS

Introduction & goals: More than 25 years ago Joost van der Burg described the new orchid species *Angraecum bancoensis* Burg from Ivory Coast and Cameroon (Burg, 1980), a close relative of *A. distichum*. Since then also specimens from Ghana and Gabon have become available. However, other authors have never used the name. Some authors discard the differences and consider them as a single species, others apply the name *A. distichum* for *A. bancoensis* and use a third name for the species considered to be *A. bancoensis* by Joost van der Burg (Szlachetko & Olszewski, 2001), or recognise the existence of two different species in again another way (Segerbäck, 1983). This research project will analyse available living accessions of these orchids, and some silica gel dried DNA samples using molecular markers like ITS and with AFLPs. If these markers enable the delimitation of two (or more?!) species, a small morphological study and examination of the type material will enable the student to write a key to these species and determine the correct name for each species. Distribution maps of the species should be added. These results should be written down in an article of which the student will be the first author.

Duration: In agreement with supervisors.

Supervisors: Dr. ir. Jan J. Wieringa, Dr. Freek T. Bakker, Dr. ir. W. Joost van der Burg.

D-10. CRITICAL ASSESSMENT OF THE TRIFOLIUM SPECIES OF ETHIOPIA, ESPECIALLY THOSE FROM THE SEMIEN MOUNTAINS (LEGUMINOSAE-PAPILIONOIDEAE)

Introduction & goals: Currently 32 species of *Trifolium* have been reported from Ethiopia, several of which are endemic to that country. Recent collections show that far more variation is present than is indicated in the key in the Flora of Ethiopia. Maybe some parts of the key are not as accurate as they should be, but probably quite some of the identification problems we have with this new material is the result of the presence of new species among the material. This thesis project will focus on identifying all *Trifolium* material from Ethiopia present in Wageningen and some other herbaria, recognise new species in this material (either new to Ethiopia or for science) and describe these new species.

Ideally this study is combined with a collecting journey or practical thesis to Ethiopia. In collaboration with the National Herbarium of Ethiopia at Addis Ababa University the student should try to collect as many different species of *Trifolium* as possible, especially from mountainous areas. If this subject might become too large to be dealt with within the given time frame, this project should focus on the *Trifolium* species of the Semien Mountains (and possibly extended with the Bale Mountains)

Duration: In agreement with supervisor.

Supervisor: Dr. ir. Jan J. Wieringa.

D-11. EVOLUTION IN AMORPHOPHALLUS: COMPLETING THE PUZZLE

Introduction & goals: Since morphological analysis seems unable to solve the phylogeny of the genus *Amorphophallus* satisfactorily, molecular analysis has been started a few years ago with several first publications showing promising results. These studies were directed towards creating a phylogenetic backbone of the genus and cover species representing diverse species-groups. Recently work has started on the extraction of molecular data following the AFLP-technique. The research question is to analyse the species-level relationships of a number of seemingly monophyletic groups. This will enable the interpretation of the high morphological variation and will be a test for the hypothesis that *Amorphophallus* is in active speciation.

On the basis of AFLP analysis, the internal structure of a purported monophyletic group in *Amorphophallus* will be reconstructed. This dataset will be integrated with the morphological dataset, to reveal the value and traps present in the morphological dataset. Then a hypothesis will be presented on the possible evolutionary scenario leading to the present day morphology of the chosen group.

Duration: In agreement with supervisor.
Supervisor: Drs. W.L.A. Hetterscheid

D-12. DNA BARCODING OF AFRICAN RINOREA: TESTING ACCURACY AND APPLICATION OF NEWLY PROPOSED BARCODING REGIONS IN A 'DIFFICULT' PLANT GROUP

Introduction & goals: *Rinorea* Aubl. (Violaceae) comprises app. 200 species of woody shrubs and understory bushes in tropical rainforests distributed in Old and New World tropics. Although species of *Rinorea* are usually frequently occurring and locally abundant, they can be difficult to recognise, especially when not in flower. In this project the newly proposed universal DNA barcode regions for land plants will be tested for whether they indeed contain species-level variation. In this project you will then implement DNA barcoding using unidentified *Rinorea* material from various sources. It is not envisaged to collect new material in Cameroon.

Duration: In agreement with supervisor.
Supervisor: Dr. Freek T. Bakker.

D-13. EXPLORING THE INFLUENCE OF PRIOR SETTING IN BAYESIAN ESTIMATION OF PHYLOGENETIC RELATIONSHIPS

Introduction & goals: Ignorant ('flat') priors are one of the *bête noirs* in today's molecular phylogenetic reconstruction practice. Especially the choice of prior probability density distribution could in principle influence posterior probabilities of the resulting phylogenetic tree topologies. In this project you will explore this relation by re-analysing previously published DNA sequence data sets as well as newly simulated data sets according to a 'true tree'.

Duration: In agreement with supervisors.
Supervisors: Dr. Freek T. Bakker, dr. P. Hovenkamp

D-14. MOLECULAR EVOLUTION OF mtDNA IN GERANIACEAE: FAST, FASTER, FASTEST

Introduction & goals: Extraordinarily high substitution rates have been uniquely observed in mtDNA from Geraniaceae and *Plantago*. Hypotheses (incorporating such amazing events as retroprocessing and the loss of the original mtDNA genome) have been put forward to explain this remarkable phenomenon. What we don't know is where the speed-up in substitution rate started, i.e. 'how many sisters away' from these two lineages can we still detect the speed-up effect. In this project you will further characterise the extent of this phenomenon by sampling mtDNA from several increasingly remote sister lineages.

Duration: In agreement with supervisor.
Supervisor: Dr. Freek T. Bakker.

D-15. STRUCTURAL CHANGES IN GERANIACEAN CHLOROPLAST DNA: CHARACTERISING LARGE DELETIONS IN THE AUSTRALIAN *Pelargonium* LINEAGE

Introduction & goals: One of the most widely used plastid DNA regions for phylogenetic reconstruction is between the genes coding for *trnT* and *trnF*. In one of the main clades of the genus *Pelargonium* (well-known as 'Cape geranium') part of this region appears to be missing, which would be quite a remarkable molecular evolutionary event which is rarely recorded in the literature. In this project you will explore this deletion further in several related lineages of the Australian *Pelargoniums*, for which material is available.

Duration: In agreement with supervisor.
Supervisor: Dr. Freek T. Bakker.

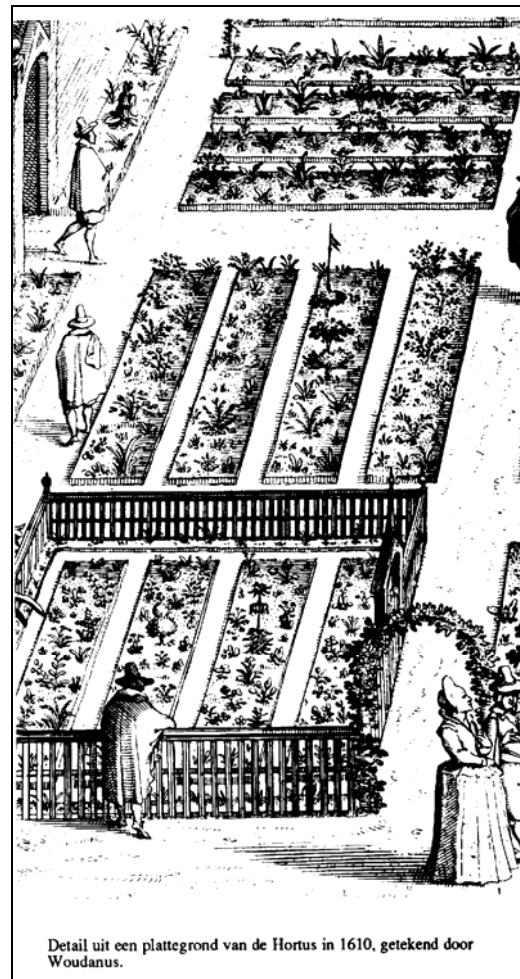
I-4. HORTUS BOTANICUS

De Leidse Hortus botanicus, aangelegd in 1594, is één van de oudste botanische tuinen ter wereld. De tuin ca. 2½ ha groot ligt in het centrum van Leiden, achter en naast het Academieggebouw. De collectie van de tuin omvat ca. 10.000 soorten.

Bij de Hortus Botanicus kan een aantal onderwerpen worden gedaan met betrekking tot de collecties en de geschiedenis van de tuin. Daarnaast verzorgt de tuin ten behoeve van het onderzoek van de Leidse vestiging van het NHN o.m. collecties van orchideeën, *Amorphophallus* (Araceae), en tropische varens.

The Hortus botanicus Leiden, planted in 1594, is one of the oldest botanical gardens in the world. The garden, c. 2½ hectare, is situated in the centre of Leiden, at the back of and adjacent to the 'Academy building'. The botanical garden maintains a collection of 10 000 species.

At the Hortus botanicus Leiden there is an opportunity to work on MSc projects pertaining to the collections and history of the garden. Furthermore, the botanical garden maintains for the benefit of the research of NHN-L collections of orchids, *Amorphophallus* (Araceae), and tropical ferns.



Detail uit een plattegrond van de Hortus in 1610, getekend door Woudanus.

H-1. IDENTIFICATION OF INVASIVE PLANT SPECIES IMPORTED THROUGH POT PLANTS

Background & objectives: Since years the Plant Protection Service (PPS) is inspecting incoming pot plants from subtropical and tropical countries to prevent the import of invasive plant species. As the climate in the Netherlands gets more and more favourable for those species due to climate changes the chance of importing invasive weeds gets higher and higher. So far proper identification is difficult as a variety of plant families and genera is involved. This makes it difficult for the inspectors to correctly carry out the laws and regulations. In cooperation with the PPS weeds will be selected and cultivated in the botanical garden at Leiden. When flowering or fruiting photographs of the important characters will be made. Afterwards (parts of) the plants will be dried and documented as herbarium specimen. Keys to the different groups will be constructed, using easy to observe characters to support horticulturists and ministry staff. Additionally colour photographs of the different species will be included in the botanical descriptions. If necessary, black and white drawings showing specific characters will be added.

Results: The report will include keys to the species and Fact Sheets of about 30 different species, including full botanical description, photographs and drawings, distribution, chance of getting invasive, other relevant information as weed control, etc. The results will be

included in the website of the Hortus Botanicus Leiden (www.hortusleiden.nl).

Duration: 6 months.

Supervisor: Dr. Paul J.A. Keßler, prefect Hortus Botanicus Leiden,
kessler@hortus.leidenuniv.nl; kessler@nhn.leidenuniv.nl .

II. MINISTAGE ONDERWERPEN/BACHELOR STAGE PROJECTS

Ministages betreffen kleine praktische onderzoeken (revisies, e.d.) in de Bachelor fase. Alle aspecten van systematisch en/of biogeografisch onderzoek zullen aan bod komen. Een ministage duurt gemiddeld 3 maanden (8—20 weken) en wordt afgesloten met het schrijven van een verslag. Het onderstaande overzicht is beperkt en bij verscheidene begeleiders zijn meer onderwerpen mogelijk. Ook voor een vollediger beschrijving van de onderwerpen dient men zich tot de begeleiders te wenden.

Bachelor projects are short term practical research projects (revisions, etc.). All aspects of systematic and/or biogeographical research will be treated. A Bachelor project averages 3 months (8—20 weeks), it is concluded by writing a report. The overview presented here is limited, several supervisors have more subjects available. For more detailed descriptions of the subjects consult the supervisors.

II.1. UNIVERSITEIT LEIDEN BRANCH

Dr. S.G.A. Draisma (room C132): Compiling a morphological dataset for the brown seaweed genus *Cystoseira* C. Agardh and investigating seasonal polymorphism and morphology of putative hybrids.

---: Molecular identification of new arrivals of the Dutch seaweed flora.

---: Inventory of seaweed collections from Indonesia.

Dr. Raymond van der Ham (Room A 210): Pollen morphology of the deviating (pollination ecology) *Arum pictum* from Corsica. Duration: c. 2 months.

---: Pollen morphology of *Ochrosia* and *Neidosperma* (Apocynaceae): different or not? Duration: 4—5 months.

---: Pollen morphology of the tribe Melodinae (Apocynaceae). Duration: 2—3 months.

---: Pollen morphology of the genus *Tabernaemontana* (Apocynaceae): diverse or not. Duration 4—5 months.

---: Pollen morphology of the genus *Hemsleya* (Cucurbitaceae). Duration: 2—3 months.

Prof. Dr. J.H.A. van Konijnenburg-van Cittert (Naturalis, tel.: 5687686)/Dr. Raymond van der Ham (Room A 210): Is the seed fern *Neuropteris osmundae*, known from England, also found in the Carboniferous of the Netherlands? Duration: 2—3 months.

---: Identification of the Upper Devonian material van Bereneiland, especially material of the genus *Archaeopteris* (a pro-gymnosperm) and of *Pseudobornia ursina* (an early horsetail). Duration: 3 months.

---: Research on the Middle Devonian specimens from Eberfeld (Germany) of the following genera: *Asteroxylon* en *Duisbergia* (are they early Lycophytes?), *Hyenia* en *Calamophyton* (predecessors of Horsetails) and *Aneurophyton* (earliest pro-gymnosperm?). Duration: 2—3 months.

---: Research on the presence of the early phanerogam *Moresnetia* in the Upper Devonian (Famennien) of Moresnet (Belgium).

---: Research on the Lower Devonian flora (Siegenien) of Wahnbachtal near Siegburg (Germany), with early landplants as *Taenioocrada*, *Zosterophyllum*, *Drepanophycus* and *Sciadophyton*. Duration: 2—3 months.

Dr. Chiel Noordeloos (Room C 134): Inventory of fungi (Ascomycetes, Deuteromycetes) on dead stems of *Urtica* (Nettle) in a few different habitats around Leiden. Duration: 3 months (starting c. April).

---: Study of the genus *Poronia* (Ascomycetes) in the Netherlands. Duration: 3 months (in autumn).

---: Fungi on wood chips: an inventory and case studies of selected species. Duration: 3 months.

---: Powdery mildews (Erysiphales, Ascomycetes) on a selection of wild plants and ornamentals in public gardens. Duration: 3 months (mid spring and summer).

---: Development of fruitbodies of different representatives of Phalales (Stinkhorns).

Duration: 3 months (literature study).

Dr. J.F. Veldkamp (Room B 124): Revision of the genus *Pogonanthrum* (Gramineae). Which species is cultivated in the Netherlands? Duration: 2 months.

---: Revision of the genus *Pseudosorghum* (Gramineae). Is it different from *Eulalia*?

Duration: 3 months.

---: Are the six forms of *Coix lacrima-jovi* species, varieties or cultivars? Duration: 4 months.

---: Revision of the genus *Ophiuros* (Gramineae): 1 or 4 species? Duration: 2 months.

Dr. Peter van Welzen (Room B 122, welzen@nhn.leidenuniv.nl): Revision of *Blachia* and *Strophoblachia* (Euphorbiaceae). Duration c. 2 months. Expansion with a phylogenetic analysis will add another two months.

---: Revision of *Dicoelia* (Euphorbiaceae). Duration c. 2 months. Inclusion of a phylogenetic analysis will add c. 1 month.

III. SCRIPTIEONDERWERPEN/TERM PAPER SUBJECTS

Scriptieonderwerpen betreffen uitsluitend literatuuronderzoek en worden afgesloten met het schrijven van een scriptie (verslag). Duur van een scriptieonderwerp is 4—6 weken (6--9 ECTS). Het onderstaande overzicht is beperkt en bij verscheidene begeleiders zijn meer onderwerpen mogelijk.

Term paper subjects are restricted to literature research and are concluded by writing a term paper (report). Duration: 4—6 weeks (6—9 ECTS). The overview presented here is limited, several supervisors have more subjects available.

III.1. UNIVERSITEIT LEIDEN BRANCH

Dr. S.G.A. Draisma (room C132): Taxonomic problems in the brown seaweed genus *Cystoseira* C. Agardh; is speciation still operating?

---: Alien seaweed invasions in the Netherlands.

---: Biogeography of the Fucales (Phaeophyceae).

Dr. B. Gravendeel (Room B 110) and Drs. A. Schuiteman (Room A 116): Tracing the area of origin of the genus *Geesinkorchis* (Orchidaceae): Borneo of Sumatra?

Dr. Raymond van der Ham (Room A 210): Comparison of pollenmorphology of *Alectryon* with molecular data. Duration: 4—6 weeks.

---: Pollen morphology of the Cycadaceae. Duration: 4—6 weeks.

---: Pollen morphology of the family Apocynaceae. [For a short paper in Flora Malesiana.]

---: Pollen morphology of *Tabernaemontana* (Apocynaceae).

Prof. Dr. J.H.A. van Konijnenburg-van Cittert (Naturalis): Study of literature on fossil plants of SE Asia, especially tertiary and quaternary plant remains. Duration: 4—6 weeks.

---: Updating the literature on fossil Annonaceae. A follow up of the research by Dr. Van den Hoek Ostende in 1985.

Dr. Willem F. Prud'homme van Reine: (Room C 120): Biological methods for assessment of health situation of coral reefs.

---: Can epiphytization of the green alga *Ventricaria ventricosa* give indications on the health situation of coral reefs?

---: Survey of economic marine algae ('seaweeds') and their uses in a given area.

---: Geographical distribution of seaweeds in a given area.

---: Molecular taxonomy of seaweeds and changes in classification.

Dr. M.C. Roos (Room B 116): What are the different interpretations of the concept 'Hotspot'? What is the significance of these differences for nature conservation and the description of biodiversity patterns?

---: What geographical and climatic changes in the Malesian area are predicted by the most commonly used models of Global Change? What are the consequences for the vegetation?

---: What are the most recent hypotheses about the main divisions of biodiversity and their skeleton phylogeny. What are the relations of the 'Protists', what the relations between

Green Algae and landplants; of the group of mosses, of Gymnosperms and Angiosperm groups. What is the basis for this and what are the differences with traditional ideas.

---: What are the alternative ideas about the evolution of the flower (Carpels, stamens, etc.; both paleobotanic and phylogenetic)? What are the bases of the various ideas? Which one is preferable?

---: Is it possible to compare the different uses of tropical rain forest (sustainability, feasibility of economical gain, etc.), what aspects have to be reviewed?

---: What is the present speed of deforestation in the Malesian area? What are the changes (good or bad) in the last three decades?

Dr. J.F. Veldkamp (Room B 124): Are *Callipedium* (Gramineae) and related genera 'good' distinct genera or just one genus with three subgenera?

---: Three species of *Phalaris* (Gramineae) are introduced in the Flora Malesiana area. What are their names and economic properties?

---: The travels of Otto Warburg (1859—1938), retracing his steps by the species described by him or named after him and various revisions in German language publications.

Dr. Peter van Welzen (Room B 122): Overview of the various historical biographic methods.

---: Does Wallace's line (the geographical limit in the centre of the Malay Archipelago) apply to Plants?

---: How can circumpacific distributions (S America and SE Asia) be explained?

OVERZICHT OVERIG ONDERWIJS/OUTLINE OF OTHER TEACHING

UNIVERSITEIT LEIDEN BRANCH

Bachelor Programme

NHN-L verzorgt of neemt deel aan de volgende colleges, cursussen en excursies/NHN-L takes care of or is partner in the following lectures, courses and field trips:

-- Propedeuse/year 1: Blok 1: Introductie en Veiligheidskursus; Blok 3: Project wetenschappelijk boek; Blok 4: Tree of Life, Biodiversiteit plant/the Tree of Life, Biodiversity of plants; Lijnonderwijs: Flora- en veldexcursies/Linear education: Flora and field trips..

Jaar 2/year 2: Biodiversiteit-1/Biodiversity-1; Excursie marien-litoraal/Field trip marine-litoral; Flora excursie Zuid Limburg/Field trip (Flora) Zuid Limburg.

Jaar 3/year 3: Biodiversiteit-2/Biodiversity-2 (incl. Angiosperm Phylogeny; Mycology).

Voor informatie en details zie de website van Biologie (<http://bio.leidenuniv.nl>) en de 'estudiegids' (<http://www.studiegids.leidenuniv.nl>). For information and details visit the website of Biology (<http://bio.leidenuniv.nl>) and the 'estudyguide' (<http://www.studiegids.leidenuniv.nl>).

MSc-PROGRAMME

NHN-L verzorgt het track Biodiversity in Time and Space/NHN-L takes care of the track Biodiversity in Time and Space (Profile course 1, 2). Coordinator: Dr. M.C. Roos. Other courses: Basic Molecular Biological Techniques; Basic statistics; Economic Botany; Ethnobotanical knowledgesytems (EKS); Introduction into Palaeobotany; Phycology; Pteridology and Bryology. Voor informatie en details zie de website Biologie (zie boven) en de 'estudiegids (zie boven). For Information and details visit the Biology website (see above) and the 'estudyguide (see above).

WAGENINGEN UNIVERSITY BRANCH

1. Dutch Flora course. Bachelor programme, year 1, period 5. Credits: 3 ECTS.

Aims to familiarize the students with the most important plant families, to obtain the knowledge necessary to identify them, and some basic knowledge of their biology.

The course gives an introduction to the systematics of plants occurring in the Netherlands, their morphology, ecology, and distribution, with emphasis on angiosperms. For BBN (forestry) students extra attention will be given to woody plants.

2. Biosystematics and Biodiversity. Bachelor programme, year 2, period 3. Credits: 6 ECTS. Familiarizes the students with the fundamental theoretical aspects of biosystematics and biodiversity research, with the application of computer programs to analyze datasets and produce phylogenies and classifications, with the interpretation of the contribution of molecular data to evolutionary research, and with the fundamental and functional aspects of biodiversity. Students are trained to critically read and evaluate scientific papers.
3. Fieldcourse European Flora and Fauna. Bachelor programme, year 2, period 5. Credits: 3 ECTS.
A two week field course in southern France (eastern Pyrenees), where a range of sites are visited to study plants and insects, as a follow-up of the Dutch Flora and Fauna course in the first year (BIS 10304). Plants and animals will be collected in the field and studied during the practicals.
4. Advanced Biosystematics. Bachelor programme, year 3, period 2. Credits: 6 ECTS. The course treats the theoretical background and practical problems of modern biosystematic research, elaborating and extending on the course Biosystematics and Biodiversity. Subjects include: species concept and speciation modes, botanical and zoological nomenclature, phenetic and phylogenetic approaches to reconstructing evolutionary relationships and producing classifications, molecular systematics, biogeography, and biodiversity assessment.
5. Capita selecta Biosystematics. Bachelor programme, year 4. Credits: 1-6 ECTS. In-depth study of a particular topic in the area of biosystematic or biodiversity research. Extending knowledge of and insight in certain aspects of systematic or biodiversity research. Depending on the topic the student will perform a literature study and/or conduct interviews with experts, or participate in computer simulation experiments, etc.
6. Internship Biosystematic (stage), MSc programme. Credits: 24-39 ECTS.
7. Thesis Biosystematics (afstudeervak), MSc programme. Credits: 18-39 ECTS.
8. PhD-course Molecular phylogenies, MSc/PhD-programmes. Credits: 2 (EPS), 20 credit hours (Biodiversity).

COLOPHON

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