Contract no: RESGEN CT99 109-112

"*Brassica* Collections for Broadening Agricultural Use" including "Characterising and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

PROGRESS REPORT

Fourth year (1st January to 31 December 2003)
Final report (1st January 2000 to 31 December 2003)

March, 2004

P1 Centre for Genetic Resources, Wageningen, the Netherlands.
P2 Genetic Resources Unit, Horticulture Research International, Wellesbourne, UK.
P3 Nordic Gene Bank, Alnarp, Sweden.
P4 Institute National de la Recherche Agronomique, Rennes, France.
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P8 Universidade de Trás-os-Montes e Alto Douro, Vila Real, Portugal.
P9 Consejo Superior de Investigaciones Cientificas, Mision Biologica de Galicia, Pontevedra, Spain.
P10 Federal Centre for Breeding Research on Cultivated Plants, Gene Bank, Braunschweig, Germany.
P11 Norddeutsche Pflanzenzucht Hans Georg Lembke KG, Hohenlieth, Holtsee, Germany.
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P13 Universidad Politechnica Valencia, Valencia, Spain
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Contract no: RESGEN CT99 109-112

***Brassica* Collections for Broadening Agricultural Use" including "Characterising and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"**

short title:
Brassica*, including *B. carinata

A. Consolidated progress report of the coordinator

Fourth year (1st January to 31 December 2003)
Final report (1st January 2000 to 31 December 2003)

March, 2004

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Executive summary

Highlights and impact of the project

A. Highlights

European database for Brassica (Bras-EDB)
The Bras-EDB was updated twice during the four-year project period. This database focuses on passport data of collections of the Genus *Brassica* maintained in European countries. The version 2001 of the Bras-EDB included 32 collections of 22 countries. This version contains 19110 accessions of both cultivated and wild material.
The version 2004 was extended with a few new collections and further updated and improved with addresses in line with the FAO/IPGRI Multi-crop Passport Descriptors. The database contains passport data of c.19.600 accessions and includes 36 collections of 22 countries. The version 2004 of the Bras-EDB will be made on line searchable on the Internet in 2004 (www.cgn.wur.nl/pgr/)

Core collections of the four Brassica species
Each of the four subgroups of the project developed their own core collection. The size of the four core collections is as follows:

B. oleracea: 395 accessions
B. rapa: 100 accessions
B. napus: 150 accessions
B. carinata 80 accessions

The project has given much emphasis on regeneration, characterisation and evaluation of germplasm included in the core collections. Evaluation for 18 different properties has been carried out. All accessions selected for the four core collections are tagged in the Bras-EDB.

Characterisation and regeneration
The subgroups agreed upon sets of minimum descriptors for each of the four *Brassica* species. The cores and parts of the collections were characterised for these descriptors. In total the project characterised over1250 accessions. A large part of the *B. carinata* collection was characterised using DNA finger printing.
The project regenerated some 889 accessions divided over all four *Brassica* species.

Evaluation
More than 4800 samples were evaluated for a range of properties.(see overview). Results of these evaluation experiments will be linked to the Bras-EDB. The different evaluations resulted in the detection of accessions with interesting properties for further breeding (see papers of subgroup co-ordinators).

Overview of the evaluations conducted.

Property	Number of properties	*Brassica* species
Pest and diseases	11	All four *Brassica* spp.
Quality	4	*B. napus, B. rapa, B. carinata*
Salt Tolerance	1	*B. oleracea*
Agronomic evaluation	2	*B. carinata*

Safety duplication
The system of safety duplication of *Brassica* collections in Europe has been highly improved compared to the situation at the beginning of the project in 2000. The majority of the genebanks have now safety duplicated their *Brassica* collections in another place.

Gaps in the collections
All subgroups identified gaps in the respective four Brassica species. This information can be seen as a guideline for the future to fill the gaps in the existing Brassica collections.

Dissemination of information
The project forwarded 5 progress reports to the European Commission. The results of the project were disseminated by means of a workshop, publications and presentations and the Internet (Bras- EDB is on line searchable)

B. Impact of the EU GENRES CT 99 109-112 project

The project has brought together European scientists actively involved in the conservation and utilisation of plant genetic resources of the most important *Brassica* species. A substantial number of the partners, mainly from genebanks, co-operated already in the ECP/GR Working Group on *Brassica*. However, private breeding companies from Germany and the Netherlands, universities and institutes from Italy, Spain and UK were also involved, particularly in the evaluation of the *Brassica* collections. This guaranties the future use of the *Brassica* material in the production of new varieties for the benefit of European agriculture.

The enormous improvement of the European *Brassica* Database (Bras-EDB), with an addition of more than 6500 accessions allows optimal access of the European *Brassica* collections to all potential users. This specific crop database is unique in the world and can be used by researchers and plant breeders for selecting *Brassica* germplasm. The linkage of the evaluation and characterisation results of this GENRES project makes the Bras-EDB even more useful for future research.

The core collections defined by the four subgroups of the project represent a broad diversity in the respective *Brassica* species. Research conducted during this GENRES project has been taken into account while developing these core collections. The accessions selected for these for core collections are tagged in the Bras-EDB and can be easily selected for future research activities.

The regeneration and characterisation conducted in the framework of this project contributes to a better accessibility of the germplasm and opportunities for further utilisation in research and breeding projects.

The extensive evaluation program, including several economic properties for further improvement of the *Brassica* crops resulted in evaluation data of approximately 4800 samples. The program detected some interesting accessions, which may have a valuable impact in the future breeding of these species.

The achievements of the project were presented during a one-day Symposium organised in Giessen, Germany, for which interested researchers and breeders from different EU countries were invited. The four subgroups of the project presented each the most important achievements of the project in 2 to 3 papers. Short communications on the outcome of the project will be published in the *Cruciferae* Newsletter of 2004.

Consolidated progress report of the co-ordinator

1. Introduction

The RESGEN CT99 109-112 project "Brassica Collections for Broadening Agricultural Use, including Characterising and Utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop" started officially on 1 January 2000.
It aims to conserve, document, characterise, evaluate and rationalise European collections of four important *Brassica* species and will contribute to a better knowledge of the genetic resources of these important *Brassica* species and improve the utilisation of the genepools in Europe by plant breeders and growers. The project deals with the following *Brassica* species:

- *B. oleracea* - Cole crops, e.g. kales, cabbages, cauliflower, broccoli, kohlrabi, couve tronchuda, Brussels sprouts
- *B. rapa* - turnip and turnip rapeseed
- *B. napus* - rapeseed or colza and swedes
- *B. carinata* - Abyssinian mustard

This progress report includes the report over the fourth year (1st January to 31 December 2003) and the final report (1st January 2000 to 31 December 2003) of RESGEN CT99 109-112. The report has the following sub-division:
A. Consolidated progress report of the co-ordinator
B. Consolidated progress report of the four sub-co-ordinators
C. Individual progress reports of the 16 partners

The consolidated progress report of the coordinator (Part A) will review the overall milestones and achievements of the project, whereas more details of the conducted research will be discussed in the reports of the four sub-co-ordinators (Part B) and individual partners (Part C).

2. Tasks and milestones (Fourth year and the whole project)

2a. Tasks and milestones for the fourth year according to the Technical Annex

Quantitative details of each milestone are given in the table "Overall milestones of the project" at the end of the end of the Technical Annex of RESGEN CT99 109-112.

Task 1a
COO updates the Bras-EDB with additional accessions regenerated during the project and not yet included in the Bras-EDB. Passport data will be made on line searchable on the Internet. **COO** and **SCO's** will link the characterisation and evaluation data resulting from the project to the Bras-EDB.

Milestone 1a
Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet.

Task 1b
COO tags accessions of the core collections in the Bras-EDB.

Milestone 1b
Core collections of the four Brassica species tagged in the Bras-EDB.

Task 2a
PGR partners finish the characterisation of the accessions included in the cores according to the minimum descriptor list. Part of other material will be characterised also. **Partners 15 and 16** finish the characterisation of the *B. carinata* core using DNA markers and make conclusions about the phylogenetic relationships between accessions in the *B. carinata* core.

Milestone 2a
All four core collections and part of other material (total of about 500 accessions) characterised for minimum descriptors. Including already available characterisation data approximately 600 accessions will have been characterised
The B. carinata core (100 accessions) is characterised using DNA fingerprinting.
Conclusions about the phylogenetic relationships between accessions in the B. carinata core are made.

Task 2b
PGR partners finish the regeneration of the accessions included in the cores. Some other material will be regenerated as well.

Milestone 2b
Accessions of all four-core collections, which required regeneration and some other material (total of about 600 accessions) are regenerated and this material will be available for use.

Task 3a
EVA partners finish all work related to evaluation for resistance against important pests and diseases (about 1800 samples), evaluation for quality properties (about 300 samples) and screening for abiotic characters (c. 100 samples) and agronomic characters (c. 100 samples) as described in chapter 1.3.

Milestone 3a
All evaluation work as described in chapter 1.3 finished and conclusions about evaluations made.

Task 3b
EVA partners make their results of the evaluations available in a structure, which can be linked, to the Bras-EDB

Milestone 3b
Results of the evaluations available in a format allowing links to the Bras-EDB

Task 4a
COO made last update of Bras-EDB allowing tracing duplicates
All **PGR** partners send safety duplicates of their collections to the appointed centers, with priority of the material included in the core collections (safety duplication to be continued after end of the project).

Milestone 4a
*Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration;*
Safety duplication of the core collections and part of the other material will be completed.

Task 4b
COO and the **PGR** partners will identify gaps in the collections using the Bras-EDB in order to present recommendations for further collecting in European countries.

Milestone 4b
Gaps in the collections are identified and recommendations for appropriate collecting a made.

Task 5
COO organises the final meeting at the end of the fourth year to discuss the final results of the project and the draft version of the final report. The four **SCO's** prepare the draft version of the final report for the *Brassica* species, for which they have responsibility, using the contributions of **all partners**. **COO** finalises the report. **All partners** submit their cost statements to the **COO**.
Progress reports and cost statements will be sent by the co-ordinator to the European Commission. Results will be disseminated throughout the Internet and by means of paper presentations to meetings of scientists, plant breeders, seed companies and growers and scientific publications.
It is foreseen that at the final meeting the co-ordinators of the project will present the results of each of the four *Brassica* groups. Invitations for this workshop will be sent to a selected group of scientists and representatives of the seed industry. The workshop will be open to any others expressing interest.

Milestone 5
Final report comprising overall results of the project submitted with the cost statements to the European Commission.

Used acronyms
COO Managing co-ordinator (P1)
SCO Sub-co-ordinators of four *Brassica* species (P1, P2, P3, P15)
PGR Partners involved in Plant Genetic Resources activities (all crops**)**
EVA Partners involved in the evaluation of the material (all crops)

2b. Tasks and milestones over the whole project period according to the Technical Annex

The Technical Annex of the contract no: RESGEN CT99 109-112 includes chapter 5 with the Tasks and Milestones of the project. This chapter presents the tasks for each year, for each objective and the milestones by which to judge progress. At the end of this chapter a type of checklist (Table 1) is included with the overall milestones of the project over the whole period.
This checklist allows a clear evaluation of the tasks conducted and the milestones achieved by RESGEN CT99 109-102 project from 2000 to 2003. The assessment of the project per defined task and subsequent milestone over the 4-year period will be presented in chapter 4.

Table 1. Overall milestones of RESGEN CT99 109-112 according to Technical Annex.

Task	*Activity*	*Results expected*	*Partners involved*
1a	*Database*	*6000 acc. of* B. oleracea *1700 acc. of* B. rapa *1500 acc. of* B. *napus.* *570 acc. of* B. carinata	*P1 with input of all partners*
1b	*Core collections*	*400 acc. of* B.oleracea *100 acc. of* B. rapa *150 acc. of* B. *napus* *100 acc. of* B. carinata	*P1* *P2* *P3* *P15*
2a	*Characterisation*	*Total 500 acc. of* B. *species,* *about 10-20 acc. per year per partner, for mimimal descriptors on all four species* *DNA fingerprinting of* B.carinata *core*	*P1, P2, P3, P4, P5, P6, P7, P9, P10, P13, P15, P16,* *P15, P16*
2b	*Regeneration*	*Total 600 acc. of B. species in 3 years. P1, P3, P4, P7 each 10 /year, P2, P9, P13 each 15/year, P5, P10, P6 each 25/year, P15, P16 each 30/year*	*P1, P2, P3, P4, P5, P6, P7, P9, P10, P13, P15, P16*
3a	*Evaluation* *<u>Pest /disease resistance</u>* *Blackrot* *Mycosphearella* *Clubroot* *Clubroot* *Field slugs* *Stem flea beetle and stem weevils* *Downy mildew* *White blister* *Flea beetles* *<u>Quality properties</u>* *Pattern TAGs, fatty ac. Comp.* *Glucosinolates* *Seed storage components* *<u>Abiotic characters</u>* *Salt tolerance* *<u>Agronomic characters</u>* *Racemen, pod characters*	*Total of about 1800 samples* *Core (400 acc.)* B. oleracea *Core (400 acc.)* B. oleracea *Core (400 acc.)* B. oleracea *Core (150 acc.)* B. napus *Core (150 acc.)* B. napus *Core (150 acc.)* B. napus *Core (100 acc.)* B. rapa *Core (100 acc.)* B. rapa *Core (100 acc.)* B. carinata *Core (150 acc.)* B. napus *Core (100 acc.)* B. rapa *Core (100 acc.)* B. carinata *Core (100 acc.)* B. oleracea *Core (100 acc.)* B. carinata	 *P14* *P14* *P4* *P3* *P11, P12* *P11, P12* *P2* *P2* *P15, P16* *P11* *P8* *P15, P16* *P7* *P15, P16*
3b	*Evaluation data available*	*Evaluation data of about 1800 samples available and linked to Bras-EDB*	*Partners under 3a and P1*
4a	*Tracing duplicates* *Safety duplication*	*In the updated Bras-EDB duplicates can be traced.* *Safety duplication of acc. from core realised*	*P1 and all PGR partners* *All PGR partners*
4b	*Identification of gaps in collections*	*Recommendations for appropriate collecting made*	*P1 and all PGR partners*
5	*Management and dissemination results*	*Five meetings organised* *Five reports produced*	*P1* *P1,sub-coordinators P1, P2, P3, P15, and input of all partners*

3. Results of the defined milestones for the fourth year.

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet.*

The 2001 version of the Bras-EDB was further updated and improved. The new version includes additional data sets from non-GENRES partners of Slovakia, Yugoslavia, Spain, Russia and Austria. The 2001 edition was updated to be in line with the latest FAO/IPGRI Multi-crop Passport Descriptors. The 2004 version of the Bras-EDB includes c. 19.600 accessions and will be available on the homepage of CGN (www.cgn.wur.nl/pgr/) mid 2004.

Conclusion Milestone 1a
A final version of the Bras-EDB (2004 version) will be made available on the Internet in 2004.

Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*

The core collections of the four *Brassica* species as defined by the four subgroups were tagged in the Bras-EDB and these accessions can be linked to the results of the evaluation data.

Conclusion Milestone 1b
The final core collections were defined and the respective accessions tagged in the Bras-EDB.

Milestone 2a *All four core collections and part of other material (total of about 500 accessions) characterised for minimum descriptors. Including already available characterisation data approximately 700 accessions will have been characterised*
The B. carinata core (80 accessions) is characterised using DNA Fingerprinting.

Table 2. Overview of the completed characterisations of the four sub-groups in 2003

***Brassica* subgroup**	**No of accessions characterised**	**(Partners involved)**
B. oleracea	92	P6, P7 and P13
B. rapa	114	P2 and P5
B. napus	68	P3 and P10
B. carinata	100	P15 and P16 (same set on two locations)
Subtotal 2003	**374**	**See above**

In 2003 a last set of 374 samples were characterised by different partners (Table 2). The characterisation was particularly conducted on material included in the core collections. In *B. carinata* molecular characterisation was conducted on the core collection with five microsatellite markers. These markers have been used to evaluate the homogeneity degree among and with in the accessions

Conclusion Milestone 2a
Including the characterisations conducted in 2003 the project characterised more than 1250 accessions, whereas only 500 were required following the Technical Annex (see Table 1).

Milestone 2b *Accessions of all four-core collections, which required regeneration and some other material are regenerated (total of about 600 accessions).*

During the last year of the project the partners regenerated 282 accessions of the four *Brassica* species (Table 3).

Table 3. Overview of the completed regeneration's in 2003

***Brassica* subgroup**	**No. of accessions regenerated**	**Remarks (Partners involved)**
B. oleracea	62 +22 (other species)	P1, P4, P6, P7, P9 and P13
B. rapa	90+ 9 (other species)	P2, P5, and P9
B. napus	39	P3 and P10
B. carinata	60*	P15 and P16
Subtotal 2003	**251 +31=282**	**See above**

Conclusion Milestone 2a
Inclusive the 282 accessions of 2003, the project regenerated about 890 accessions, nearly 300 more than the required 600 accessions following the Technical Annex (see Table 1).

Milestone 3a *All evaluation work as described in chapter 1.3 finished and conclusions about evaluations made.*

Partners finalised the evaluation activities. In the last year partners evaluated nearly 1000 samples. Details are presented in the reports of the sub-co-ordinators and the individual partners. An overview of the evaluations conducted by the four subgroups from 2000 to 2003 is presented in Table 4, whereas more details on the type of evaluations is listed in Table 5. Results of the evaluations are reported in the papers of the sub-co-ordinators and the individual reports. Promising accessions have been also listed.

Table 4. Overview of evaluations conducted by the four *Brassica* sub-groups (2000-2003).

Property/ Subgroup	***B. oleracea***	***B. rapa***	***B. napus***	***B. carinata***	**Total evaluations**
Pest &diseases	1648 (4)*	200 (2)	702 **(4)	200 (1)	**2750 (11)**
Quality		100 (1)	1431 (2)	222 (1)	**1753 (4)**
Abiotic character	100 (1)				**100 (1)**
Agronomic characters				222 (2)	**222 (2)**
Total	1748 (5)	300 (3)	2133 (6)	644 (4)	**4825 (18)**

* In brackets number of different properties,
** Additional evaluation of 65 samples for three diseases

Conclusion Milestone 3a
Project partners evaluated in 2003 more than 1000 accessions for different properties.

Milestone 3b *Results of the characterisation and evaluations available in a format allowing links to the Bras-EDB*

Formats have been made and sent to all partners to present the characterisation- and evaluation results obtained during the project. 50 sets of characterisation and evaluation data have been received and adapted by CGN to be linked to the Bras-EDB

Conclusion Milestone 3b
Characterisation and evaluation data of the project partners were received and linked to the Bras-EDB

Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; safety duplication of the collections and part of the other material will be completed.*

The newly updated Bras-EDB, on line searchable on the Internet, allows PGR partners to trace duplicates in the collections. This allows the PGR partners to give priority to the regeneration of material unique in their *Brassica* collections and not present in other genebanks.
The present situation regarding the safety duplication of the *Brassica* collections within the EU is shown in Table 7.

Conclusion Milestone 4a

The Bras-EDB can now be used as management tool for prioritising accessions in the regeneration programs of the PGR partners.
Safety duplication of the Brassica collections, including material of the four core collections has been highly improved (see Table 7.)

Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*

The four subgroups discussed this milestone at the last project meeting in Giessen, Germany. Gaps in the collections of the four *Brassica* species were identified and are listed under milestone 4b in chapter 4 (Overall assessment of the defined milestones of RESGEN CT99 109-112) of this report.

Conclusion Milestone 4b
All four subgroups identified gaps (see milestone 4b of chapter 4)

Milestone 5 *Last project meeting organised.*
Final report comprising overall results of the project submitted with the cost statements to the European Commission.

The fifth and last project meeting was held from 10 to 14 December 2003 in Giessen and was organised by Wilfried Luehs of the "Instituut fur Pflanzenbau und Pflanzenzuchtung", Giessen, Germany. A symposium with presentations of the four subgroups of the project was organised and was attended by 45 persons including the project members. The last session of the symposium was dedicated on the subject "Utilisation of wild species in breeding". Discussions during previous project meetings made clear that breeders are more and more interested in the utilisation of the genepool of wild *Brassica* species in order to find properties, which are not present in cultivated material.
The program of the symposium is presented in Appendix 1.
The final report was discussed during the last project meeting and finalised in February 2004. The co-ordinator forwarded the final report in March 2004 to the European Commission in Brussels.

Conclusion Milestone 5

The last project meeting was organised and a symposium on the achievements of the project was very successful and attended by 45 persons. The co-ordinator submitted the final report in March 2004 to the European Commission in Brussels.

4. Overall assessment of the defined milestones of RESGEN CT99 109-112

The overall achievements of the project following the milestones listed in Table 1 are summarised in Table 5.

Table 5. Milestones (results) achieved by RESGEN CT99 109-112 over four year.

Task	*Activity*	*Results expected*	*Results achieved*
1a	*Database* *(data base includes more than 19.000 accessions)*	*6000 acc. of* B. oleracea *1700 acc. of* B. rapa *1500 acc. of* B. *napus.* *570 acc. of* B. carinata	*10.408 acc.* *3.324 acc.* *3.797 acc.* *339 acc.*
1b	*Core collections*	*400 acc. of* B.oleracea *100 acc. of* B. rapa *150 acc. of* B. *napus* *100 acc. of* B. carinata	*395 acc.* *100 acc.* *150 acc.* *80 acc*
2a	*Characterisation*	*Total 500 acc. of Brassica species,*	*495 B. oleracea* *216 B. rapa* *320 B. napus* *222 B carinata* ***1253***
2b	*Regeneration* *(Totals conducted by partners of respective subgroup)**	*Total 600 acc. of B. species in 3 years.*	*287 B.oleracea* *210 B. rapa* *212 B. napus* *180 B carinata* ***889***
3a	*Evaluation* *<u>Pest /disease resistance</u>* *Blackrot* *Mycosphearella* *Clubroot (isolate MS 6)* *Clubroot (isolateK 9)* *Clubroot* *Field slugs* *Stem flea beetle and stem weevils* *Cabbage stem flea beetles* *Downy mildew* *White blister (isolate 7V)* *White blister (isolate Acem 2)* *Flea beetles* *<u>Quality properties</u>* *Pattern TAGs, fatty ac. Comp.* *Glucosinolates (8 compounds)* *Seed storage componets* *<u>Abiotic characters</u>* *Salt tolerance* *<u>Agronomic characters</u>* *Racemen, pod characters*	*Total of about 1800 samples* *Core (400 acc.)* B. oleracea *Core (400 acc.)* B. oleracea *Core (400 acc.)* B. oleracea *Core evaluated with second isolate* B.oleracea *Core (150 acc.)* B. napus *Core (150 acc.)* B. napus *Core (150 acc.)* B. napus *Core (150 acc.)* B. napus *Core (100 acc.)* B. rapa (replaced by Wh.blister) *Core (100 acc.)* B. rapa *Core (100 acc.)* B. rapa, replaced downy mildew *Core (100 acc.)* B. carinata *Core (150 acc.)* B. napus *Core (100 acc.)* B. rapa *Core (100 acc.)* B. carinata *Core (100 acc.)* B. oleracea *Core (100 acc.)* B. carinata	***4825*** *396 acc.* *396 acc. (+64 additional)* *396 acc.* *396 acc. (additional)* *188 acc.* *196 acc.* *95+ 95 = 190 acc.* *128 acc. (additional)* *not conducted* *100 acc.* *100 acc.* *200 acc* *1431 acc, incl core* *100 acc.* *222 acc, incl core* *100 acc.* *222 acc.*
3b	*Evaluation data available*	*Evaluation data of about 1800 samples available and linked to Bras-EDB*	*Data of all evaluations linked to the Bras-EDB*
4a	*Tracing duplicates* *Safety duplication*	*In the updated Bras-EDB duplicates can be traced.* *Safety duplication of acc. from core realised*	*Duplicates can be traced* *c. 80% of all EU collections*
4b	*Identification of gaps in collections*	*Recommendations for appropriate collecting made*	*Gaps identified (milestone 4b)*

* some partners regenerated also other Brassica species beside the material of their respective subgroup species (see reports subgroup co-ordinators)

Overall conclusion with regard to the set milestones
Table 5 clearly shows that the set milestones of the project have been more than fulfilled. Some of the tasks including the number of characterisations and evaluations have been much more fulfilled than was required following the Technical Annex. Details on the individual milestones follow below.

Milestone 1a *Updated Bras-EDB available on the Internet.*

During the project period the Bras-EDB was twice updated, a major update resulted in the 2001 version; the 2004 version was only a minor update of the 2001 version.
The 2001 version of the Bras-EDB as presented in the 'Annual Progress Report of the second year' and included 19.113 accessions.
The 2004 version can be found on the homepage of the CGN: www.cgn.wur.nl/pgr/

Table 6. Updating of Bras-EDB for the four *Brassica* species included in the project

***Brassica* species**	**Estimated size after updating (Technical Annex, 1999)**	**Bras-EDB Version 2001**	**Bras-EDB Version 2003**
B. oleracea	6.000	10.252	10.408
B. rapa	1.700	3.022	3.324
B. napus	1.500	3787	3.797
B. carinata	570	310	339
Total	9.770	17.371	17.868
Other species	Not mentioned in TA	1.742	1.777
Total		19.113	19.645

Table 6 shows the large increase of the Bras-EDB for the four mentioned species. With exception of *B. carinata* all collections were much increased

The 2004 version includes presently 19.645 accessions. Additional data sets were received in 2002/2003 from Slovakia, Yugoslavia, Spain, Russia and Austria. These data sets from non-GENRES partners were converted for inclusion in the Bras-EDB in 2003. The 2004 edition was also further updated and improved with addresses to be in line with the FAO/IPGRI Multi-crop Passport Descriptors.

Conclusion milestone 1a
The updating of the Bras-EDB has been realised and the database is searchable on the Internet

Milestone 1b *Core collections of four Brassica species finalised and tagged in the Bras-EDB*

On the basis of the characterisation and evaluation activities, conducted during the whole project period, final core collections of all crops were established. The subgroups *B. oleracea* and *B. rapa* made only minor modifications in the core collections developed at the end of the second year. The preliminary core collection of the *B. napus* group was reduced from 202 to 150 accessions after further characterisation and evaluation. The *B. carinata* group needed to conduct more research to define the size of their core collection and finally established a core of 80 accessions. The final size of the core collections of the four species is as follows:

B. oleracea: 395 accessions
B. rapa: 100 accessions
B. napus: 150 accessions
B. carinata 80 accessions

All accessions included in the four *Brassica* core collections will be tagged in the Bras-EDB. The accessions belonging to the core collections were tagged in the database, in order to be able to link the results of the characterisation and evaluation data.
.
Conclusion milestone 1b
The final versions of the four core collections are defined and tagged in the Bras-EDB, these cores will be very useful for future research.

Milestone 2a *A total of 500 accessions of the Brassica collections are characterised, giving high priority on the material included in the four core collections.*

12 partners were involved in the characterisation of *Brassica* material of the four different *Brassica* species. The minimum descriptors agreed upon at the start of the project were utilised to conduct these characterisations. Table 5 presents data on the number of characterisations completed by each subgroup over the whole project period. Material included in the four core collections has received high priority, but also material of individual collections was characterised. In total the project characterised 1253 accessions.
In *B. carinata* molecular characterisation was conducted on the core collection material with five microsatellite markers. These markers have been used to evaluate the homogeneity degree among and within the accessions.

Conclusion milestone 2a
The project has characterised 1253 accessions over the four-year period, the defined target of 500 accessions has been more than fulfilled.

Milestone 2b *600 accessions of different Brassica species are regenerated, with emphasis on material of four core collections.*

12 partners were involved in the regeneration of *Brassica* accessions of the four species**.** Material included in the four core collections has received high priority, but also material of individual collections was regenerated. Table 5 shows that the project regenerated about 890 accessions.

Conclusion milestone 2b
The project has regenerated 890 accessions during the period and the overall milestone of 600 accessions was reached

Milestone 3a *A total of 1800 samples are evaluated for different properties with high emphasis on the accessions of the four core collections.*

An overview of the total number of evaluations conducted by the four subgroups is presented in Table 4, whereas more details on the type of evaluations is listed in Table 5. The project evaluated more than 4800 samples for 18 different properties during the whole project period. Results of the evaluations can be found in the papers of the sub-co-ordinators and the individual reports. Promising accessions have also been listed. The participating private breeders stated that these results are useful for further breeding. The results of the evaluations will be linked to the Bras-EDB (see 3b).

Conclusion milestone 3a
With the evaluation of more than 4800 samples, the project has conducted much more than the target of 1800 evaluations included as overall milestone in the Technical Annex. The individual reports of the partners and the sub-co-ordinators also conclude that the evaluation program resulted in some promising material for further breeding.

Milestone 3b *Evaluation and characterisation data obtained during this project linked to the Bras-EDB.*

The partners of the project collected a large number of data from the evaluation and characterisation activities. During the meeting in Catania it was discussed how to make this information public available. It was decided to link this data to the Bras-EDB. Subsequently, formats were developed and sent to all partners to present these results. In total 50 sets of data have been received and adapted by CGN and this information will be available in excel files linked to the Bras-EDB.

Conclusion Milestone 3b
Characterisation and evaluation data of the project partners were received and this information will be available in excel files linked to the Bras-EDB.

Milestone 4a *Safety duplication almost finished.*

Further discussions on the system of safety duplication of *Brassica* species in Europe took place at the fourth and fifth project meetings in 2003. The system of safety duplication of *Brassica* material in Europe has been highly improved compared to the state of art at the beginning of the project in 2000

(see Annual Progress Report of the first year 2000). Table 7 presents an overview of the actual situation and shows that most genebanks with *Brassica* holdings have now safety duplicated their *Brassica* germplasm. 11 participating genebanks (collecting holders), including one non EU member have now safety duplicated their *Brassica* collections. Table 7. also indicates where the Brassica material of each genebank is stored and whether the listed genebanks have storage capacity available for further safety duplication.
Remark: In 2003 the *Brassica* collections of the BAZ-genebank in Braunschweig, Germany were transferred to the IPK genebank in Gatersleben and this genebank is now responsible for all *Brassica* germplasm in Germany.

Conclusion milestone 4a
The system of safety duplication of European Brassica collections has been highly improved and approximately 80 % of the EU Brassica collections are now safety duplicated.

Milestone 4b *Identification of gaps in the collections*
This subject was intensively discussed during the last project meeting and each subgroup identified gaps in the respective four *Brassica* species.

B. oleracea
For the cultivated *B. oleracea* there are gaps in the collections for material from the Balkan, Greece (except the northeastern part), North Africa and Middle East. For wild related species there are gaps for material from the Adriatic coasts and the northern part of the Ionic Sea and the Aegean Sea.
It is supposed that there exist more collections of the ex-Yugoslavian countries than included in the Bras-EDB. This material should be traced before conclusions can be made about the gaps from this region

B. rapa
An analysis of the Bras-EDB for *B. rapa* accessions that can be identified in some way as being of wild origin produces 12 accessions from a total of more than 3,000. It is interesting to note that even considering these 12 accessions only a proportion can be guaranteed as originating from wild populations. It is evident, therefore, that wild *B. rapa* material is wholly under-represented in genetic resources collections throughout the countries whose data are represented in the Bras-EDB. The *B. rapa* project group agreed that the collection of wild *B. rapa* material in ECP/GR countries has a very high priority. In a wider consultation the NGB representatives noted their particular interest to collect wild *B. rapa* in the 4 NGB representative countries (Norway, Sweden, Denmark and Finland) and in the Baltic States (Estonia, Latvia & Lithuania). The Baltic States are particularly interesting because during the Soviet period no *Brassica* oilseed material was grown in these countries, thus offering the opportunity to collect wild *B. rapa* guaranteed not to be contaminated by introgressed genetic material. The *B. rapa* group recognised the collection of wild material in the Baltic countries as a very high priority.

B. napus
There is limited French oilseed rape material represented in the Bras-EDB. We are therefore happy to experience that recently it was decided to start a collection of old oilseed rape material in France.
There are only three Chinese oilseed rape accessions in the Bras-EDB. Considering the high production and development that has taken place in China lately, we expect that interesting material is available from there, which partly need to be included in European collections.

B. carinata
B. carinata comes from a very restricted geographical area (Ethiopia) and it is not possible to estimate gaps in the collection. However, it is known that there exist other collections, which were not introduced and characterised. Therefore it is suggested to look first to this type of material before extending the collections with newly collected material.

Conclusion milestone 4b
All subgroups identified gaps in the respective four Brassica species. This information can be seen as a guideline to fill the gaps in the existing Brassica collections.

Table 7. Actual and offered capacity for safety duplication (situation 15 December 2003)

Institute	Country	Storage temperature	Conditions relative humidity (%)	Already arranged	Safety duplication Location	Offering to Host
CGN	The Netherlands	-20° C	not controlled	YES	HRI-GRU, UK	YES
HRI-GRU	United Kingdom	-20° C	not controlled	YES	CGN, NLD	YES
UPV	Spain	3° C	5-6%	YES	CRF, MBG, ESP	NO
CSIC/MBG	Spain	2° C	60%	YES	CRF, UPV, ESP	NO
CSIC/IAS	Spain	4° C	20%	YES	perspective CRF, ESP	YES
NGB	Nordic Countries	-4° C	not controlled	YES	Svalbord (NOR)	YES
IPK	Germany	-15° C/ -20° C	different conditions and not controlled	YES	IPK at IPKM and vice versa	YES
IGB	Italy	-20° C	not controlled	YES	partly duplicated at IPK and HRI-GRU	YES
GGB	Greece	1-4° C	20%	partly	partly duplicated in Madrid (G. Campo)	YES
INRA	France	-20° C	not controlled	NO	perspective to CGN	NO
BPGV	Portugal	-20° C	not controlled	partly	partly duplicated at HRI-GRU	YES
VIR	Russia	-10° C	6 %	NO		NO
RICP (Olomouc)	Czech Republic.	-20° C	5-6%	YES	Partly in RICP (Prague) and Slovakia Rep.	
IVCSP	Yugoslavia	-4° C	not controlled	NO		YES

Milestone 5 *Co-ordination and management of project*

A. Production and submission of the progress reports and cost statements,
B. Organisation of the project meetings
C. Organisation of workshops (dissemination of results)

A. Production and submission of the progress reports and cost statements

The following five reports were submitted to the European Commission.

1) First half year progress report of RESGEN CT99 109-112, including outcome of the start-up meeting. 1 January to 30 June 2000. CGN, Wageningen, the Netherlands. 41 Pp.
2) Annual progress report of RESGEN CT99 109-112 over the first year, 1 January to 31 December 2000. CGN, Wageningen, the Netherlands. 77 Pp.
3) Annual progress report of RESGEN CT99 109-112 over the second year, 1 January to 31 December 2001. CGN, Wageningen, the Netherlands. 95 Pp.
4) Annual progress report of RESGEN CT99 109-112 over the third year, 1 January to 31 December 2002. CGN, Wageningen, the Netherlands. 101 Pp.
5) Progress report of RESGEN CT99 109-112 over the fourth year (1 January to 30 December 2003) and the final report (1 January 2000 to 30 December 2003). CGN, Wageningen, the Netherlands.(In press).

Cost statements of the project partners were each year submitted to the European Commission and advance payments made to the 16 partners

B. Organisation of the project meetings

The project organised the following five project meetings:

1. The first and start-up project meeting was held from 23 to 26 February 2000 in Wageningen, the Netherlands. Organisers Loek van Soest and Ietje Boukema, Centre for Genetic Resources, The Netherlands (CGN), Wageningen, the Netherlands.
2. The second project meeting was held from 11 to 13 January 2001 in Cordoba, Spain. Organiser Antonio De Haro, Instituto de Agricultura Sostenible-CSIC, Cordoba, Spain.
3. The third project meeting was held from 7 to 10 February 2002 in Villa Real, Portugal. Organiser Eduardo Rosa, Universidade de Trás-os-Montes e Alto Douro at Vila Real, Portugal.
4. The fourth project meeting was held from 12 to 16 February 2003 in Catania, Italy. Organiser Ferdinando Branca, Universita degli Studi di Catania, Sicily, Italy.
5. The fifth project meeting was held from 10 to 14 December 2003 in Giessen, Germany. Organiser Wilfried Luehs, Institut für Pflanzenbau und Pflanzenzüchtung, Giessen, Germany.

C. Organisation of workshops (dissemination of results)

Two workshops were organised during the project period.

A half-day workshop was jointly organised with the Working group on *Brassica* of the European Co-operative Program for Crop Genetic Resources Networks (ECP/GR). This workshop was held on 9 February 2002 in Villa Real, Portugal. Project members presented the following papers:

- General presentation of the RESGEN CT99 – 109/112 by the coordinator (Loek van Soest, CGN, The Netherlands
- Report of the subgroup *B. oleracea* (Noor Bas, CGN, The Netherlands)
  Resistance screening for *Xanthomonas camprestris* pv *campestris* and *Mycosphaerella brassicola i*n *Brassica oleracea* (Corrie van Es, Plantum *)*
- Report of the subgroup *B. rapa*: (Dave Astley, HRI, United Kingdom)
  Preliminary results on the glucosinolate content on the seedlings and mature plants of a core collection of *B. rapa* (E. Rosa, A. Aires and R. Paula, UTAD, Spain)
- Report of the subgroup *B. napus*: (Gert Poulsen, NGB, Sweden)
- Report of the subgroup *B. carinata*: (Antonio de Haro Bailon, IAS, Spain)
  Paper on fingerprinting in *B. carinata* (Catherine Chinoy, JIC, United Kingdom

Furthermore a paper on 'The European *Brassica* Database: version 2001' was presented by Noor Bas and Loek van Soest (CGN, The Netherlands) on behalf of Ietje Boukema. 7 papers presented during the workshop were published in the Report of a Working Group on *Brassica.* Extraordinary Meeting,

held jointly with the Third Co-ordination Meeting of the EU project GENRES 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy. 83 Pp. (see publications).

A one-day workshop (symposium) was organised on 11 December 2003 during the final meeting of the project at the Institut für Pflanzenbau und Pflanzenzüchtung, Justus-Liebig University, Giessen, Germany. The program of this workshop is presented in Appendix 1.

Conclusions milestone 5
The project organised 5 meetings and 5 progress reports were produced and forwarded to the European Commission. The project co-ordinator also forwarded cost statements to the European Commission.
The results of the project were disseminated by means of workshops, publications and presentations and the availability of the Bras-EDB on Internet.

5. Publications

Astley, D. & A. Pinnegar, 2003. Progress of the *Brassica rapa* group in the GENRES CT99 109-112 Project. Pp. 59-62. In: Maggioni, L., G. Thomas and E. Lipman, compilers. Report of a Working Group on *Brassica.* Extraordinary Meeting, held jointly with the Third Coordination Meeting of the EU project GENRES 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy. .

Bas, N., I. W. Boukema & L. J. M. van Soest, 2003. Role and progress of the *Brassica oleracea* group in the GENRES CT99 109-112 project after 2 years. Pp. 55-58. In: Maggioni, L. and G. Thomas and E. Lipman, compilers. Report of a Working Group on *Brassica.* Extraordinary Meeting, held jointly with the Third Coordination Meeting of the EU project GENRES 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy.

Boukema, I.W., N. Cristea, Th.J.L van Hintum & F. Menting, 2003. The European *Brassica* Database: version 2001.Pp. 15-18. In: Maggioni, L. and G. Thomas, compilers. Report of a Working Group on *Brassica.* Extraordinary Meeting, held jointly with the Third Coordination Meeting of the EU project GENRES 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy.

Branca F., 2002. III Meeting del progetto europeo RESGEN CT99 – 109/112 sulle *Brassicaceae* organizzato a Catania. Notiziario Risorse Genetiche Vegetali, III, 2, 1-3. Istituto Sperimentale per la Frutticoltura, Roma.

Chinoy, C., E. Arthur, I. Bancroft, A. De Haro-Bailón, C. Morgen, 2002. Genetic Variation in *Brassica carinata* Assessed using Microsatellite Markers and Phenotypic Characters.: 13 th Cruficer Genetics Workshop. Davis, California, 23-26th March 2002

Font, R., M. del Rio, J. Fernández, E. Arthur, I. Bancroft, C. Chinoy, C. Morgan and A. De Haro, 2002 Seed Oil Content Analysis of Ethiopian mustard (*Brassica carinata* A. Braun) by Near Infrared Spectroscopy. Eucarpia Cruciferae Newsletter. 24: 5-6

Font, R., M. del Rio, A. Sillero, E. Arthur, I. Bancroft, C. Chinoy, C. Morgan and A. De Haro, 2002 Using Near Infrared Spectroscopy for Determining Protein content in Ethiopian mustard (*Brassica carinata* A. Braun). Eucarpia Cruciferae Newsletter. 24: 7-8

Font, R., Del Río, M., Arthur, E., Bancroft, I., Chinoy, C., Morgan, C., De Haro, A. 2004.Survey of seed storage components in Ethiopian mustard (Brassica carinata A.Braun).Submitted to Cruciferae Newsletter.

Haro de, A., R. Font, J. Navarrete, J. M. Ferandez, E. Arthur, C. Chinoy, I Bancroft and C. Morgan, 2003. Role and progress of the *Brassica carinata* group in the GENRES CT99 109-112 project after 2 years. Pp. 72-74. In: Maggioni, L. and G. Thomas, compilers. Report of a Working Group on *Brassica.* Extraordinary Meeting, held jointly with the Third Coordination Meeting of the EU project GENRES 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy.

Hasan M., W. Lühs, F. Seyis, W. Friedt and R. Snowdon, 2003: Surveying genetic diversity in the *Brassica napus* gene pool using SSR markers. 11th. Intern. Rapeseed Congr, 6-10 July 2003, Copenhagen, Denmark, Vol. 2, pp. 392-394.

Lühs, W., F. Seyis, M. Frauen, H. Busch, L. Frese, E. Willner, W. Friedt, M. Gustafsson, and G. Poulsen, 2002a: Development and evaluation of a European *Brassica napus* core collection. In: P.B.E. McVetty, K. Schlosser, and C.F. Quiros (Eds.), 13th Crucifer Genetics Workshop, 23-26 March 2002, University of California, Davis, California, USA, Poster abstract, p. 116.

Lühs, W., F. Seyis, M. Frauen, H. Busch, L. Frese, E. Willner, W. Friedt, M. Gustafsson, and G. Poulsen, 2003a: Development and evaluation of a *Brassica napus* core collection. In: H. Knüpffer & J. Ochsmann (eds.), Rudolf Mansfeld and Plant Genetic Resources. Proceedings of a symposium dedicated to the 100th birthday of Rudolf Mansfeld, Gatersleben, Germany, 8-9 October 2001. Schriften zu Genetischen Ressourcen 19, pp. 287-292. ZADI/IBV, Bonn.

Lühs W, B. Ulber, F. Seyis, M. Frauen, H. Busch, W. Friedt, M. Gustafsson and G. Poulsen, 2003b: Evaluation of a *Brassica napus* core collection and prospects of its exploitation through rapeseed breeding. 11th Intern. Rapeseed Congr., 6-10 July 2003, Copenhagen, Denmark, Vol. 2, pp. 371-374.

Lühs, W., F. Seyis, M. Frauen, H. Busch, L. Frese, E. Willner, W. Friedt, M. Gustafsson, G. Poulsen , 2003c. Preliminary Field Evaluation of a Brassica napus Core Collection. Pp. 67-71. In: Maggioni, L. and G. Thomas and E. Lipman, compilers. Report of a Working Group on Brassica. Extraordinary Meeting, held jointly with the Third Coordination Meeting of the EU project GENRES 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy.

Poulsen G, H. Busch, M. Frauen, L. Frese, M. Gustafsson, F. Seyis, E. Willner, W. Lühs, 2003. Development and Evaluation of a *Brassica napus* L. Core Collection. Pp. 63-66. Report of a Working Group on *Brassica*. Extraordinary meeting, held jointly with the Third Coordination Meeting of the EU project GENRES 109-112, 8-9 February 2002 Vila Real, Portugal. IPGRI, Rome, Italy.

Seyis, F., R. Snowdon, W. Friedt, W. Lühs, 2003a: Molecular genetic diversity in resynthesised and conventional spring rapeseed. 11th Intern. Rapeseed Congr., 6-10 July 2003, Copenhagen, Denmark, Vol. 2, pp. 382-384.

Seyis F., R.J. Snowdon, W. Lühs and W. Friedt, 2003b: Molecular characterisation of novel resynthesised rapeseed (*Brassica napus* L.) lines and analysis of their genetic diversity in comparison to spring rapeseed cultivars. Plant Breeding (in press).

Soest van, L. J. M., I. W. Boukema & N. Bas, 2003. The EU GENRES CT99 109-112 project *Brassica*, including *B. carinata.* Pp. 50-54. In: Maggioni, L. and G. Thomas and E. Lipman, compilers. Report of a Working Group on *Brassica.* Extraordinary Meeting, held jointly with the Third Co-ordination Meeting of the EU project GENRES 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy.

Presentations at the Symposium on the EU-RESGEN CT99 109-112 project on 11. December 2003 in Giessen (Germany) are listed in appendix 1 and mentioned in the Subgroup reports. Furthermore short communications on the activities and outcome of the project will be published in the *Cruciferae* Newsletter of 2004.

Appendix 1.
Program of the Symposium on the EU-RESGEN CT99 109-112 project "*Brassica* Collections for Broadening Agricultural Use, including Characterising and Utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

11 December 2003, Giessen, Germany

9.00-9.05 Opening symposium
9.05-9.20 Overview of the work and projects of the Institut für Pflanzenbau und Pflanzenzüchtung (Prof. Dr. Wolfgang Friedt)
9.20-9.40 Highlights of the EU-RESGEN CT99 109-112 *Brassica* project (Loek J. M. van Soest, CGN, the Netherlands)

9.40-10.30 ***Papers of subgroup B. oleracea***
- *Brassica oleracea:* overview of the activities (Ietje Boukema and Noortje Bas, CGN, the Netherlands)
- Evaluation of the resistance to clubroot (*Plasmodiophora brassicae*) in the *Brassica oleracea* core collection (M. Manzanares-Dauleux, P. Glory and G. Thomas, INRA-ENSA, France)
- Evaluation of salt tolerance in the *Brassica oleracea* core collection (Ferdinando Branca, DOFATA, Italy)

10.30-11.00 Coffee break

11.00-11.50 ***Papers of subgroup B. rapa***
- An overview of the activities of the *Brassica rapa* subgroup (Dave Astley, HRI, Wellesbourne, UK)
- Evaluation of the *Brassica rapa* core collection (Eduardo Rosa, Universidade de Trás-os-Montes e Alto Douro, Portugal)

11.50-12.40 ***Papers of subgroup B. napus***
- Establishment and Characterisation of a European *Brassica napus* core collection (Gert Poulsen, NGB, Sweden)
- Evaluation of a *Brassica napus* core collection regarding quality and resistance breeding traits (Wilfried Lühs, Justus-Liebig University, Germany)

12.40-14.00 Lunch

14.00-14.50 ***Papers of subgroup B. carinata***
- *Brassica carinata* - an overview (Antonio de Haro, Instituto de Agricultura Sostenible (IAS)-CSIC, Spain)
- *Brassica carinata* - morphological and molecular characters (Colin Morgan, John Innes Centre, UK)
- *Brassica carinata* - seed storage characters (Antonio de Haro, Instituto de Agricultura Sostenible (IAS)-CSIC, Spain)

14.50-15.20 Coffee/tea Break

15.20-17.15 ***Utilisation of Wild Brassica species in breeding***.

15.20-15.50 Wild species of the *Brassica oleracea* complex: distribution, biology and genetic diversity (Mats Gustafsson, Swedish Agricultural University, Sweden)
15.50-16.10. Use of exotic Brassica germplasm for the improvement of oilseed rape, examples and perspectives (Martin Frauen, NPZ, Germany)
16.10-16.30 The use of wild species in *B. oleracea*-breeding (Ad van den Nieuwenhuizen, Rijk Zwaan, the Netherlands)

16.30-17.15 Discussion on the use of wild *Brassica* species in breeding, possibilities of a new project in the future.

Institut für Pflanzenbau und Pflanzenzüchtung
Justus-Liebig University
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Germany

Contract no: RESGEN CT99 109-112

"*Brassica* Collections for Broadening Agricultural Use" including "Characterising and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

short title:
Brassica*, including *B. carinata

B. Consolidated progress reports of the four sub-coordinators

Fourth year (1st January to 31st December 2003)
Final report (1st January 2000 to 31st December 2003)

Sub-coordinator *Brassica oleracea*
P1 Centre for Genetic Resources, the Netherlands (CGN), Wageningen, the Netherlands (Ietje W. Boukema)
Sub-coordinator *Brassica rapa*
P2 Genetic Resources Unit, Horticulture Research International, Wellesbourne, UK (Dave Astley)
Sub-coordinator *Brassica napus*
P3 Nordic Gene Bank, Alnarp, Sweden (Gert Poulsen)
Sub-coordinator *Brassica carinata*
P15 Consejo Superior de Investigaciones Cientificas, Instituto de Agricultura Sostenible, Cordoba, Spain (Antonio DeHaro)

Consolidated Report of the *Brassica oleracea* subgroup

Contract no: RESGEN CT99-109/112

Project title: "*Brassica* Collections for Broadening Agricultural Use" including "Characterising and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Reporting period: January 1, 2000 to December 31, 2003

Participants

P1 Centre for Genetic Resources, the Netherlands (CGN), Wageningen, the Netherlands. (*sub-coordinator)*
P4 Institute National de Recherche Agronomique, Rennes, France.
P6 National Agricultural Research Foundation, Agricultural Research Center of Makedonia and Thraki, Greek Gene Bank,Thessaloniki, Greece.
P7 Dipartimento di OrtoFloroArboricoltura e Tecnologie Agroalimentari (DOFATA). Università degli Studi di Catania, Italy
P13 Universidad Politechnica Valencia, Valencia, Spain.
P14 Plantum NL, Gouda, The Netherlands.

Tasks of the *B. oleracea* subgroup during the project:

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*
Milestone 1b *Core collection of B. oleracea finalised and tagged in the Bras-EDB.*
Milestone 2a *Part of the B. oleracea collections characterised*
Milestone 2b *Accessions of the core collections, which required regeneration and some other material are regenerated and available for use*
Milestone 3a *Core collection of B. oleracea evaluated for pest and diseases and some other properties such as agronomic characters*
Milestone 3b *Evaluation results available in a format allowing links to the Bras-EDB*
Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed*
Milestone 4b *Gaps in the collection regarding B. oleracea identified and recommendations for appropriate collecting activities made*
Milestone 5 *Individual progress reports of the partners of this subgroup and the consolidated progress report of the whole subgroup B. oleracea over 2003 and the whole period finalised.*

Activities of the fourth year and a summary of results of the tasks and milestones during the whole project:

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*

Fourth year:
Datasets received in 2002 are added to the database (P1). Also some updating of addresses, to be in line with the FAO/IPGRI Multicrop Passport Descriptors, are made. Accessions belonging to the core collections are tagged in the database in order to link the evaluation and characterisation data to the Bras-EDB.

Summary whole period:
All partners have sent the passport data of their collections in the first and second year of the project to P1. The first version of the updated Bras-EDB has been reported in the second annual report. The database was available on the Internet at the end of 2001.
In 2002 some additional datasets were received from non-partner collections.
The Bras-EDB version 2004 will be available on the Internet in the first part of 2004.
More information about the work on the Bras-EDB is given in the individual report of P1.

Milestone 1b *Core collection of B. oleracea finalised and tagged in the Bras-EDB.*
Fourth year:
All core accessions are tagged in the Bras-EDB. Adjustments are made for misclassifications.

Summary whole period:
The *B. oleracea* core collection of 396 collections was established with help of all partners of the subgroup using the *B. oleracea* core of the AIR3 CT920463 *Brassica* project as starting point. The aim was to represent the broadest variation of *B. oleracea* germplasm possible, using the Bras-EDB.
All project partners holding *B. oleracea* collections identified a fixed number of accessions per type from their collection, fulfilling the needs of the evaluation partners regarding quality and quantity, for inclusion in the core. Wild *Brassica* species (n=9) related to *B. oleracea* were generously donated by Dr. Cesar Gomez-Campo from the Universidad Politecnica de Madrid (UPM), Spain. Seeds of the core accessions were sent to P1 who distributed the necessary quantities to the evaluation partners P4, P7 and P14.
During field tests for resistance (P14) and characterisation activities of the *B. oleracea* core (P1 and P13), part of the unknown types of the core could be identified. It also became clear that some core accessions were misclassified. The accessions not belonging to *B. oleracea* are discarded from the core. Accessions belonging to other *B. oleracea* crop types will be kept in the core. The consequence is that the *B. oleracea* core will be slightly smaller and the composition will differ compared to the original core. The modified core is presented in table 1.
Some of the subgroup partners contributed to the core collections of the other subgroups.

Table 1. ResGen core collection of *B. oleracea*. Number of accessions per type and donor genebank (corrected).

Common name *B. oleracea* group	total	P1 CGN	P2 HRI	P3 NGB	P4 INRA	P5 IPK	P6 GGB	P7 IDG	P9 MBG	P10 BGRC	P13 UPV	UPM
Kale	79	21	26	3	10	6		1	10	2		
Chin. Kale	10	5	5									
Cauliflower	63	17	21	2	11	2		8			2	
Broccoli	36		22			2		8			4	
Cabbage	117	34	30	5	5	17	2		4		20	
Brussels Sprouts	40	13	22	4		1						
Kohlrabi	20	4	7			7		2				
Tronchuda	14	2	11						1			
Unknown	1	1										
Wild oleracea	4	2										2
Wild related species n=9	11	1				2						8
Total	395	100	144	14	26	37	2	19	15	2	26	10

Milestone 2a *Part of the B. oleracea collections characterised.*

Five partners of the subgroup were involved in this activity.
Fourth year:
The numbers of accessions characterised in the fourth year are given in table 2. P6 also repeated characterisation of material sown in the first and second year of the project. This material is not included in Table 2.
P1 distributed standard Excel files to the partners to be used as format for the characterisation data. Characterisation data were sent by the subgroup partners to P1.

Summary whole period:

The defined target of the sub-group for the whole project period was to characterise about 180-200 accessions.
The total numbers of accessions characterised per partner are presented in table 2.

Table 2. Number of *B. oleracea* accession characterised

Partner	numbers in 2003	totals during whole project
P1		161
P4		65
P6	41	124
P7	36	100
P13	15	45
total	**92**	**495**

A total of 495 *B. oleracea* accessions have been characterised. This is much more then the target of about 200 accessions.
Characterisation was carried out according to minimum descriptors as defined in 2002 in Vila Real (see Annex, second year report p15). In addition P1 and P13 used other descriptors.
P1 distributed standard Excel files to the partners to be used as format for the characterisation data.
All results will be presented in Excel files linked to the Bras-EDB on the Internet.

Milestone 2b *Part of the B. oleracea collection regenerated*
Five partners of the subgroup were involved in this activity.

Fourth year:
In 2003, 84 accessions have been regenerated by the subgroup. 62 of *B. oleracea*, 16 of *B. rapa* (P1, P7), 2 of *B. napus* (P1) and 4 of *B. carinata* (P1), see Table 3.

Summary whole period:
The target of the subgroup was to regenerate approximately 160 accessions during the project.
Regeneration protocols were discussed in the first years of the project.
During the whole project 287 accessions have been regenerated (see Table 3):
241 of *B. oleracea*, 30 of *B. rapa* (P1 and P7), 10 of *B. napus* (P1) and 6 of *B. carinata* (P1).
Therefore, the target for the subgroup was fully reached, exceeding the target with more than 100 accessions.

N.B. Part of the material regenerated by P6 was sown again in the summer of 2003 to be harvested in 2004, because no or very few seeds were produced as a result of extreme high temperatures during spring 2003.

Table 3. Number of accession regenerated

Partner	Numbers in 2003			totals during whole project		
	oleracea	others	total	oleracea	others	total
P1	11	12	23	18	28	**46**
P4	14		14	72		**72**
P6	22		22	106		**106**
P7		10	10		18	**18**
P13	15		15	45		**45**
total	**62**	**22**	**84**	**241**	**46**	**287**

Of the other subgroups, P9 regenerated 13 *B. oleracea* accessions of the MGB collection and P3: 13 *B. oleracea* accessions of the NGB collection. This makes the total of *B. oleracea* accessions regenerated during the project 267.

Milestone 3a *Core collection of B. oleracea evaluated for pest and diseases and some other properties such as agronomic characters*

Three partners of the subgroup conducted evaluation activities (P4, P7 and P14).

***Plasmodiophora brassicae* (Clubroot)**
Fourth year:
Partner 4 has screened in the fourth year of the project 198 accessions to the second isolate K92-16.

Summary whole period:
During the project the whole core collection of 396 accessions was evaluated against two isolates of clubroot (MS6 and K 92-16). The screening was successful and disease indexes for the two isolates varied between 18-100% and 44-100**%** respectively. One accession (HRI 9566), which turned out to be not an *oleracea* but a *rapa,* was very resistant with a disease index of 0 and 3. The most resistant oleracea's were a kohlrabi (BRA20), a tronchuda (HRI11646), a Brussels Sprout (NGB 2432) and two kales (CGN15120 and CGN 15147).

Xanthomonas campestris* pv *campestris* and *Mycosphaerella brassicicola
Fourth year:
Partner 14 (the 7 Dutch breeding firms) evaluated in 2003 progenies of selected material for resistance to *Xanthomonas campestris* pv *campestris* and *Mycosphaerella brassicicola.*
This material was obtained after selfing resistant plants of accessions that segregated for resistance in the screenings of 2001. The field tests for *Mycosphaerella* did not give reliable results, because of the extremely dry and warm weather. The tests for *Xanthomonas* confirmed the resistance of the selected plants.

Summary whole period:
During the project the whole core was evaluated for resistance to *Xanthomonas campestris* pv *campestris* and *Mycosphaerella brassicicola*
For *Xanthomonas* no resistant accessions were found, but especially in accessions of cauliflower, broccoli and the kale's some plants with a high level of resistance were found. The five most resistant accessions, for which the percentage of resistant plants was more than 50%, were HRI 9846 (kale) and ITAIDG 201503, ITAIDG 203313, CGN11982 and HRI 4250 (all cauliflower),
For *Mycosphaerella* high percentages of partial resistant plants were found in red cabbage accessions. The most resistant accessions for which all the plant tested showed partial resistance were BRA 804, BRA 775,CGN11038, CGN7094 and HRI 6852 (all red cabbages). The Chinese kale accessions could not be evaluated because they were flowering so early that infection had not yet taken place.

Salt tolerance
Fourth year:
Partner 7 evaluated in the last year 32 accessions, which were sown in autumn 2002. A further 36 accessions were sown in spring 2003 and evaluated in August 2003. Of these accessions only the plant weight reduction could be measured because the temperature was not low enough to induce curd formation.

Summary whole period:
During the whole project in total 100 accessions of the core collection, mainly cauliflower and broccoli, were screened for salt tolerance, as was the target for P7. Some other varieties were added as references. The tests were carried out in three cycles. For the first two cycles plant and curd weight reduction by the salt conditions were measured. For the last cycle only the plant weight reduction was measured.
For cauliflower the most tolerant accessions to salt conditions regarding curd weight reduction are CGN 11081, CGN 15135, CNRIDG 203313, CNRIDG 203324, HRI 6247, IPK BRA1398, NGB 1818 and NGB 2429. For broccoli the most tolerant accessions to salt conditions regarding curd weight reduction are CNRIDG 203370, HRI 4707, HRI 4721, HRI 6703, HRI 7514, HRI 9842 and IPK 1427.

Conclusion milestone 3a:
The *B. oleracea* subgroup evaluated during the project the total core collection of 396 accessions for resistance to *Xanthomonas* and *Mycosphaerella* and for two isolates of clubroot. Part of the core (100 accessions, mainly cauliflower and broccoli) were screened for salt tolerance. The evaluations gave

some very interesting results, which can be further exploited in breeding programmes. The target of this milestone was fully reached.

Milestone 3b *Evaluation results available in a format allowing links to the Bras-EDB.*

Fourth year:
P1 sent standard formats in Excel to the EVA partners, to fill in their results. All EVA subgroup partners sent their results to P1. P1 tagged all accessions belonging to the core in the Bras-EDB.

Summary whole period:
During the start-up meeting it was concluded to present the evaluation data in spreadsheets including the most important passport data of the core collection.
The evaluation results are now available and were all sent to P1 in Excel files. Some of the results are given in the individual reports.
All results will be presented in Excel files linked to the Bras-EDB on the Internet in the 2004 Edition.

Milestone 4a *Bras-EDB updated allowing individual PGR partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed*

Fourth year:
The Bras-EDB was further updated by P1.

Summary whole period:
The Bras-EDB was updated allowing the tracing of duplicates between collections. Thus, PGR partners were able to set priorities for regeneration of material unique in their collections.

During the first and later meetings a system for safety duplication was made. The subgroup partners have sent, or are ready to send safety duplicates of the core collections and part of the other material under 'black box' agreements to genebanks of other partners or other centres with agreed standard storage conditions.

Milestone 4b *Gaps in the collection regarding B. oleracea identified and recommendations for appropriate collecting activities made*

During the final project meeting held from 10 to 14 December 2003 in Giessen, Germany gaps in the *B. oleracea* collection were discussed in the *oleracea* group and identified as followed:
For cultivated *B. oleracea* material there are gaps for material from the Balkan, Greece (except the northeastern part), North Africa and Middle East. For wild material there are gaps for material from the Adriatic coasts and the northern part of the Ionic Sea and the Aegean Sea.
It is suggested that there may be more collections of the ex-Yugoslavian countries than included in the Bras-EDB. These should be traced before conclusions can be made about the gaps from this region.

Milestone 5 *Individual progress reports of the partners of this subgroup and the consolidated progress report of the whole subgroup B. oleracea over 2003 and the whole period finalised.*

Fourth year:
Individual progress reports over the third year were sent to the sub-coordinator. These reports were used to produce the third year's consolidated progress report of the sub-group *B. oleracea*, which was discussed during the fourth project meeting in Catania, Italy (February 2003) and included in the Annual Progress report of the third year (March 2003).
All partners participated in the last project meeting 10-14 December 2003 in Giessen, Germany and submitted their fourth year and final progress reports to the sub-coordinator, who wrote the consolidated progress report to be included in the Fourth year and Final progress report.

Summary whole period:
All technical and financial annual reports and the final report were submitted on time.

Summary on the whole period.
The partners of the *Brassica oleracea* subgroup have fulfilled all required milestones as defined in the project Technical Annex. The final *oleracea* core is tagged in the Bras-EDB and updates in the Bras-EDB are made. The group fulfilled their tasks for characterisation (495 accessions), regeneration (287 accessions) and evaluation (1685 samples), with numbers more than the targets set in the Technical Annex. By these activities the access to *B. oleracea* material in the European collections is considerably improved.
The evaluations gave some very interesting results, which can be further exploited in breeding programmes.

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Presentations
Presentations on the Symposium on the EU-RESGEN CT99 109-112 project "Brassica Collections for Broadening Agricultural Use, including Characterising and Utilising genetic variation in Brassica carinata for its exploitation as an oilseed crop" 11. December 2003, Giessen, Germany

Boukema, I. W. and N. Bas. *B.oleracea* subgroup achievements from 1 January 2000 to 31 December 2003.
Soest van, L. J. M., Highlights of the EU-RESGEN CT99 109-112 Brassica project.
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Consolidated Report of the *Brassica rapa* Subgroup

Contract no: RESGEN CT99 109/112

Project title: "*Brassica* Collections for Broadening Agricultural Use" including "Characterising and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Reporting period: 1st January 2000 to 31st December 2003

Participants

P2 Angela Pinnegar & Dave Astley, Horticulture Research International, UK
P5 Klaus Dehmer, Marie-Luise Graichen & Evelin Willner, Institut für Pflanzengenetik und Kulturpflanzenforschung, Germany
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P9 Amando Ordas & Elena Cartea, Mision Biologica de Galicia, Pontevedra, Spain

Tasks of the *B. rapa* subgroup during the project:

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*
Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Milestone 2a *Part of the core collection characterised.*
Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Milestone 3a *Part of the core collection evaluated*
Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*
Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*
Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*
Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Executive Summary

The *B. rapa* group achieved all the milestones set out for year 4 and in doing so completed a very successful project wherein all the project milestones for the group were completed successfully. We believe that the development of the core collection, its characterisation and the analysis of the resistance to a fungal disease and the glucosinolate composition have provided the basis to encourage breeders and other scientists to embark on future work using the fascinating range of diversity found within the *B. rapa* gene pool. The availability of the characterisation and evaluation data on the Internet, in association with the Bras-EDB, will stimulate further evaluation and utilisation of this material. Furthermore we believe that the work of the *B. rapa* group is of direct relevance to the EU Agriculture Policy directed towards the increase in environmentally-friendly production systems for horticultural crops.

Activities of the fourth year and a summary of the project inputs

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*

Fourth year:

CGN (P1) distributed standard formats for the presentation of characterisation and evaluation data. Characterisation files of *B. rapa* data were forwarded from P5 IPK Gatersleben and P9 Misión Biológica de Galicia to HRIGRU. The HRIGRU characterisation data were converted to the standard format and the year files named according to the protocol provided The characterisation data produced by the *B. rapa* sub-group partners were forwarded to Noortje Bas in CGN.

The evaluation data produced by P02 (Albugo screen) and P08 (glucosinolate screen) with respect to the *B. rapa* core collection have been prepared in the format developed by Noortje Bas in CGN suitable for presentation of the data on the Internet, and forwarded to CGN.

Summary whole period***:***
During the project three partners (P2, P5 & P9) of the *B. rapa* sub-group transferred passport data sets for all relevant Brassica accessions to the Bras-EDB manager for incorporation in the database.

All the characterisation and evaluation data produced by the *B. rapa* subgroup partners have been formatted following the standard file structure and file name protocols, and forwarded to CGN. **The components of the milestone 1a were fulfilled.**

Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Fourth year:
All the passport information relevant to the *B. rapa* core collection accessions have been forwarded to the Bras-EDB database manager in CGN. Not all the accessions of the *B. rapa* core were represented in the Bras-EDB. The accessions not represented in the Bras-EDB have been identified and investigations are underway to ascertain why these particular accessions are absent from national *Brassica* database files delivered to the Bras-EDB managers. Six of the *B. rapa* core accessions were obtained from the US Department of Agriculture, the passport data and other information is available via the GRIN system (Genetic Resources Information Network) on the Internet, thus these data will not be duplicated in the Bras-EDB.

Summary whole period:
The *B. rapa* core collection of 100 accessions was established to provide the broadest representation of the available gene pool for use in the characterisation and evaluation programmes (Table 1). The group took note of 4 recent review papers on the taxonomy of *B. rapa* in the development of the project *B. rapa* core collection (Hanelt 1986, Gladis 1989, Gladis & Hammer 1992 & Diederichsen 2001). The group decided not to change the taxonomic names of the accessions in the *B. rapa* core list with the exception of changing *Brassica rapa* L. em. Metzg. ssp. *oleifera* (DC.) Metzg. var. *silvestris* (Lam.) Briggs to *Brassica rapa* L. em. Metzg.*campestris* (L.) A.R. Clapham, but to maintain taxonomic names being utilised in the Bras-EDB. However, these recent taxonomic revisions will be kept under consideration in future use of the project *B. rapa* core collection. All the draft core accessions were cytometry tested, thus providing an additional check on their taxonomic status. Not all the accessions in the *B. rapa* core collection are represented in the Bras-EDB. The project *B. rapa* core collection reflects the range and complexity of the *B. rapa* genepool. It will be important to continue to review the composition of the *B. rapa* core in relation to the changes in the representation of *B. rapa* in the Bras-EDB and to assess an evolving core for a range of characters of interest to breeding programmes.

The *B. rapa* group see the development of the core collection as a major impact in providing a well characterised group of accessions that are available for further usage, and in particular is relevant to the increasing interest in molecular characterisation as shown by various attendees at the project Symposium in Giessen, Germany (11th December 2003).

During the project three partners (P2, P5 & P9) of the *B. rapa* sub-group supplied material to the B. napus core collection development trial and subsequently to the sub-groups for the characterisation and evaluation of the *B. napus, B. oleracea* and *B. rapa* core collections. **The components of the milestone 1b were fulfilled.**

Milestone 2a *Part of the core collection characterised.*
Fourth year:
The core collection accessions had been characterised in years 2 and 3 of the project. The *B. rapa* subgroup partners agreed to prioritise material from their own collections for any further characterisation, where possible. HRIGRU characterised 100 accessions of turnip planted in a field trial and 8 accessions of Italian *B. rapa* received from Dr Ferdinando Branca, DOFATA Catania (P7) in a Dutchlight frame. IPK Gatersleben concentrated their efforts on characterising 6 B. rapa accessions specifically to determine their taxonomic identities. Images of the accessions characterised were captured and have been stored in association with the partner databases.

Summary whole period:
The members of the *B. rapa* sub-group developed four sets of minimum characterisation descriptors for use with different *B. rapa* crop types within the project, namely for turnip rape, root turnip, turnip tops/greens and Asian leaf/head types.

Over the period of the project a total of 216 accessions of *B. rapa* were characterised by the sub-group partners including all the 100 accessions of the *B. rapa* core collection and an additional 116 accessions chosen from the collections in HRIGRU, IPK Gatersleben and MBG Galicia. For most of the accessions characterised digital images were captured and stored. The milestone 2a required partners P2, P5 and P9 to develop minimum characterisation descriptors for *B. rapa* in year 1, and to characterise between 10 – 20 accessions of *B. rapa* per partner in subsequent years. Therefore the *B. rapa* sub-group had a target to characterise between 90 – 180 accessions during the project. **In fact the 3 partners characterised 216 *B. rapa* accession, thus exceeding the milestone.** As reported above for milestone 1a the *B. rapa* characterisation data will be made available on the Internet in association with the Bras-EDB.

Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Fourth year:
A total of 99 accessions were regenerated during the 2002/2003 season by 3 of the *B. rapa* sub-group (P2, P5 & P9) including 90 accessions of *B. rapa*, 6 of *B. oleracea* and 3 of *B. napus*. A majority of accessions produced sufficient seeds to allow the seed populations to be dried, packaged and stored at low temperature.

Summary whole period:
A total of 210 Brassica accessions has been regenerated by 3 of the *B. rapa* sub-group (P2, P5 & P9) including 192 accessions of *B. rapa*, 13 of *B. oleracea* and 5 of *B. napus*. The milestone 2b required partners P2, P5 and P9 to regenerate a total of 165 accessions of *B. rapa* as follows: P2 and P9 to regenerate 15 accessions per annum for 3 years; P5 to regenerate 25 accessions per annum for 3 years. **Therefore the sub-group partners achieved the milestone target, and in fact regenerated 45 additional accessions**. Additionally 12 accessions of *B. rapa* were regenerated by P1, the Centre for Genetic Resources the Netherlands. All the seed produced in the regeneration programmes have been dried, packaged and stored under long-term conditions following international protocols. The group achieved a significant output for the regeneration of *B. rapa*, but this must be viewed in the context of the genepool defined in the Bras-EDB of >3000 accessions. It is important that national programme gene banks continue to collaborate in deciding which material is prioritised for regeneration in order to reduce duplication of effort and the waste of valuable resources.

The seed produced of the core collection and other partner accessions were used in the project characterisation and evaluation work, a majority of which are available for further utilisation depending upon the conditions of the original Material Transfer Agreements.

Milestone 3a *Part of the core collection evaluated*
Pathology Screen with *Albugo candida*
Fourth year:
The *B. rapa* core collection of 100 accessions was screened for reaction to the fungal disease White blister (*Albugo candida*) using a second isolate (Acem2). A majority of the *B. rapa* core accessions were totally resistant to the *Albugo candida* isolate. Five accessions within the core collection exhibited plants that were susceptible to this second Albugo isolate. The Acem2 isolate was collected from a wild plant of *Capsella bursa-pastoris* (L.) Medicus, Shepherd's Purse. This weed plant has long been suspected of acting as a winter host for the White blister fungus. The objective of using the Acem2 isolate was to score the reaction of the *B. rapa* core collection for susceptibility in order to assess the extent cross contamination from a common field crucifer weed. It is interesting to note that the majority of the *B. rapa* core accessions were completely resistant to the Acem2 isolate. However 5 accessions (BRA 1304 *B. rapa pekinensis laxa*, BRA 1247 *B. rapa trilocularis*, PI 165595 *B. rapa trilocularis*, BGRC 19021 *B. rapa dichotoma* & NLDCGN 6790 *B. rapa nipposinica*) show significant numbers of plants that were susceptible to the Shepherd's Purse isolate. Thus for some wild and weedy plants may act as an over-wintering source of the fungus.

The results from screening the *B. rapa* core collection with the 2 isolates of *Albugo candida* have been edited to the agreed format and forwarded to P1 for presentation on the Internet in association with the Bras-EDB.

Summary whole period:
The *B. rapa* core collection of 100 accessions was screened for reaction to the fungal disease White blister (*Albugo candida*) using 2 different isolates, namely 7V and Acem2. The results of the 2 pathology screens showed no obvious relationship between the reactions of the core to the 2 disease isolates. The original milestone 3a intended that the *B. rapa* core collection be screened against 2 fungal diseases, Downy mildew and White blister. In the early stages of the project we experienced significant technical difficulties with establishing the Downy mildew disease on *B. rapa* seedlings in the controlled experimental conditions. Following discussion with the Co-ordinator we decided to test the *B. rapa* core collection against 2 isolates of White blister (*Albugo candida*) rather than waste time and resources within the project. **The 2 screens for the White blister isolates accomplished an equivalent amount of work to the milestone target, although on a single disease**.

The evaluation data produced by P2 during the screening of the *B. rapa* core collection using 2 isolates of *Albugo candida* have been prepared in the format developed by Noortje Bas in CGN suitable for presentation of the data on the Internet, and forwarded to CGN.

Glucosinolates

Fourth year:
In the current year 32 accessions of the *B. rapa* core collection were grown specifically for glucosinolate analysis in a field trial and under controlled conditions in growth cabinets. The material was screened for the content of 8 glucosinolates, namely 2-Hidroxybut-3-enyl; 2-Propenyl; But-3-enyl; Pent-4-enyl; Indol-3-ylmethyl; 2-phenethyl; 4-Methoxyindol; 1-Methoxyindol-3-ylmethyl. The results from year 4 are presented in the P8 partner report.

Summary whole period:
Over years 2, 3 and 4 of the project the *B. rapa* core collection of 100 accessions was screened in the glucosinolate evaluation programme for the 8 glucosinolate compounds listed above. The original work package proposal was designed to study plant material grown in field trials. In fact, the core collection material was grown in field trials and in parallel under controlled conditions in growth cabinets. This dual approach has provided significantly more data in relation to the glucosinolate composition relating to cultural and environmental factors and in relation to growth habit and plant growth stages. **The milestone 3a target for this area of work was achieved completely, namely the glucosinolate analysis of the *B. rapa* core collection**. The evaluation data produced by P8 relating to the glucosinolate content of the accessions of the *B. rapa* core collection have been prepared in the agreed format suitable for presentation of the data on the Internet, and forwarded to CGN.

The analysis of the qualitative and quantitative composition of glucosinolates in the *B. rapa* core collection has provided an insight into the environmental impact on these compounds in relation to flavour, thus providing the possibility of flavour manipulation in the future. The material exhibited significant diversity in the quantitative characteristics in relation to growth stages (seedling, leaf, inflorescence and root).

The data from the *Albugo* screens were compared with data from the glucosinolate analyses to check any relationship between the compounds and the disease. The data revealed no significant interactions. However, it was recognised that further studies should screen the pathogen and glucosinoates on the same plant material for higher accuracy.

Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*

Summary whole period:
The system for the safety duplication of the *B. rapa* collections was agreed by the subgroup during the start-up meeting in Wageningen. Thus early in the project the partners involved in *B. rapa*

regeneration developed black box bilateral agreements for their safety duplicates with other project partners or gene banks with suitable agreed standard storage conditions.

Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*

An analysis of the Bras-EDB for *B. rapa* accessions that can be identified in some way as being of wild origin produces 12 accessions from a total of >3,000. It is interesting to note that even considering these 12 accessions only a proportion can be guaranteed as originating from wild populations. It is evident, therefore, that wild *B. rapa* material is wholly under-represented in genetic resources collections throughout the countries whose data are represented in the Bras-EDB. The *B. rapa* project group agreed with the recommendations of the ECP/GR Brassica Working Report, Vila Real Portugal (2002) and ECP/GR Vegetable Network Report from Skierniewice, Poland (2003) that the collection of wild *B. rapa* material in ECP/GR countries is a major priority. In a wider consultation the NGB representatives noted their particular interest to collect wild *B. rapa* in the 5 NGB representative countries and in the Baltic States (Estonia, Latvia & Lithuania). The Baltic States are particularly interesting because during the Soviet period no *Brassica* oilseed material was grown in these countries, thus offering the opportunity to collect wild *B. rapa* guaranteed not to be contaminated by introgressed genetic material. The *B. rapa* group recognised the collection of wild material in the Baltic countries as a very high priority.

Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Fourth year:

The final technical reports for the *B. rapa* sub-group partners were submitted in November 2003, and the final financial statement for the fourth year will be sent to the Co-ordinator in January 2003.

The achievements of the *B. rapa* group were presented at the project Symposium held at the Institut fur Pflanzenbau und Pflanzenzüchtung, Justus-Liebig University of Giessen, Germany on the 11th December 2003. Two papers were presented providing i) an overview of the *B. rapa* work, ii) details of the 2 evaluation projects on the response to isolates of *Albugo*, and the glucosinolate composition in the core colelction.

Summary whole period:

All technical and financial annual reports and the final report were submitted on time.

Publications

Astley, D. & A. Pinnegar, 2003. Progress of the *Brassica rapa* group in the GENRES CT99 109-112 Project. Pp. 59-62. In: Maggioni, L., G. Thomas and E. Lipman, compilers. Report of a Working Group on *Brassica.* Extraordinary Meeting, held jointly with the Third Coordination Meeting of the EU project GENRES 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy.

Angela Pinnegar, Dave Astley, Klaus Dehmer, Marie-Luise Graichen, Evelin Willner, Eduardo Rosa, Alfredo Aires, Rosa Paula, Amando Ordas & Elena Cartea, 2004. *Brassica* Collections for Broadening Agricultural Use: RESGEN CT99 109/112, *Brassica rapa* Subgroup. Submitted to Cruciferae Newsletter

Presentations

Astley, D. An overview of the activities of the *Brassica rapa* subgroup. Open day at final project meeting. Giessen, Germany, 11 December 2003

Rosa, E. Evaluation of the *Brassica rapa* core collection. Open day at final project meeting. Giessen, Germany, 11 December 2003

Table 1. *Brassica rapa* core collection

INSTCODE	ACCENUMB	ORIGCTY	No. accns
Brassica rapa (undefined)			12
USDA	PI219904	AFG	
	PI220774	AFG	
	PI251326	IRN	
	PI254540	IRQ	
	PI183664	TUR	
DEUIPK	K7177	IRQ	
	BRA1215		
ITADOFATA	DOFATA200348	ITA	
ITADOFATA	DOFATA200933	ITA	
NLDCGN	CGN11061	EGY	
TURAARI	TR40366	TUR	
	TR51560	TUR	
Brassica rapa rapa			19
NLDCGN	CGN06711	IDN	
	CGN10995	FRA	
	CGN07223	PAK	
	CGN15221	JPN	
	CGN06714	POL	
CHERAC	CHERAC 85.5861	CHE	
DEUIPK	BRA1023	CSK	
	BRA1017	HUN	
DEUBGRC	DEUBGRC34824	DEU	
	DEUBGRC49579	SUN	
REGNGB	REGNGB4106	DNK	
	REGNGB11515		
	REGNGB1175		
ESPMBG	BRS 0123	ESP	
HRIGRU	HRIGRU011606	PRT	
	HRIGRU003116	BTN	
	HRIGRU007204	EGY	
	HRIGRU007692	ITA	
	HRIGRU008170	SYR	
Brassica rapa campestris			3
DEUIPK	K4483	RUS	
DEUIPK	BRA1234		
DEUIPKM	CR2211 (BRA1162)		
Brassica rapa chinensis			5
HRIGRU	HRIGRU002488		
	HRIGRU007569		
	HRIGRU007570		
	HRIGRU007573		
NLDCGN	CGN13926		
Brassica rapa chinensis chinensis			5
DEUIPK	BRA0118		
	BRA0228		
	BRA0446		
GBRHRIGRU	HRIGRU007575		
	HRIGRU007576		
Brassica rapa chinensis rosularis			3
SUNVIR	VIR911.631	JPN	
DEUBGRC	DEUBGRC15407		
SUNVIR	VIR911.154	CHN	
Brassica rapa dichotoma			3
NLDCGN	CGN06836		
	CGN06837		
DEUBGRC	DEUBGRC19021		
Brassica rapa japonica			1
DEUIPK	BRA1295		

Brassica rapa nipposinica			1
NLDCGN	CGN06790		
Brassica rapa nipposinica chinoleifera			2
NLDCGN	CGN06843		
GBRHRIGRU	HRIGRU004682		
Brassica rapa oleifera			5
NLDCGN	CGN15218		
GBRHRIGRU	HRIGRU006699		
DEUBGRC	DEUBGRC22534		
PRTEAN	PRTEAN2709		
DEUIPK	BRA1272	LBY	
Brassica rapa oleifera annua			6
NLDCGN	CGN06842		
DEUIPKM	CR2205 (BRA0041)		
	CR1543 (BRA0246)		
	CR2228 (BRA1258)		
	CR1538 (BRA1005)		
REGNGB	REGNGB2383		
Brassica rapa oleifera biennis			6
NLDCGN	CGN07216	PAK	
DEUIPKM	CR1539 (BRA 0184)	DEU	
	CR1542 (BRA 0357)	POL	
DEUBGRC	DEUBGRC28622	BEL	
REGNGB	REGNGB2330	FIN	
	REGNGB0602	SWE	
Brassica rapa pekinensis			11
NLDCGN	CGN07222	PAK	
	CGN07187	CHN	
	CGN07188	YUG	
	CGN15196	CHN	
GBRHRIGRU	HRIGRU006175	AUT	
	HRIGRU006202	THA	
	HRIGRU005165	JPN	
	HRIGRU006143	NZL	
SUNVIR	VIR 911.58	KGZ	
	VIR 911.57	PRK	
	VIR 911.139	KAZ	
Brassica rapa pekinensis glabra			4
DEUIPK	BRA0202		
	BRA0445		
	BRA0981		
	BRA1302		
Brassica rapa pekinensis laxa			4
DEUIPK	BRA1297		
	BRA0472		
	BRA1304		
	BRA1124		
Brassica rapa ruvo			7
ESPMBG	BRS0225	ESP	
	BRS0233	ESP	
GBRHRIGRU	HRIGRU004722		
	HRIGRU005330		
	HRIGRU005274		
	HRIGRU004714		
	HRIGRU004734		
Brassica rapa trilocularis			3
USDA	PI165595		
DEUIPK	BRA1247		
SUNVIR	VIR911.112		
		Total	100

Consolidated subgroup report (*B. napus*)

Contract no: RESGEN CT99-109/112

Project title: *"Brassica* Collections for Broadening Agricultural Use" including "Characterising and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

***Brassica napus* Subgroup**

Reporting period: January 1 2000 to December 31, 2003

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Tasks and milestones in the 4th year:

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluati data resulting from the project made available via Internet*

Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB*

Milestone 2a *Core collection (1500 accessions) characterised for minimum descriptors.*

Milestone 2b *Accessions of all four core collections which required regeneration and some oth material are regenerated and this material will be available for use*

Milestone 3a *All evaluation work as described in chapter 1.3. finished and conclusions abo evaluations made*

Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*

Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities f regeneration;*
Safety duplication of the core collections and part of the other material will be complete

Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecti activities made*

Milestone 5 *Fourth and final progress report finalised and submitted with the cost statements to tl European Commission*

Activities carried out during the fourth project year and the project period

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluati data resulting from the project made available via Internet*

Summary whole period

During the project period all genebank partners have updated their information to the Central Brassica Crop Database BrasEDB. Of particular interest to this subgroup is that the Malchow collection including a large number of oilseeds was integrated. Lately, the BAZ genebank collection has been transferred to the IPK collection. As a consequence of this the material of the former will get new numbers once everything is settled. Changes will be reported to the BrasEDB.

Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB*

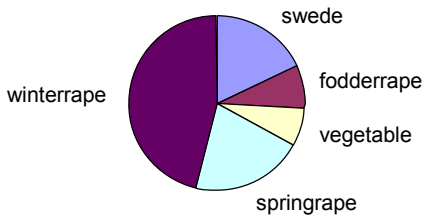
Summary whole period

The Brassica napus core collection is reduced to the final 150 accessions based on the results of characterisations and evaluations performed during this project. During the project period a working collection comprising around 190 accessions was assessed. Each individual morphological characterisation was analysed using multivariate analysis and representatives of each cluster are included into the final core selection. For the disease evaluations the two most susceptible and the two most resistant accessions are selected for the core and for the seed quality analysis the accessions have been selected to represent the two highest values and the two lowest values of each evaluation performed. Initially, the entries for the core collection were selected on basis of taxonomy and country of origin. Now the core collection has been reduced to the previously defined number of entries maintaining a wide variation in the evaluated traits of agronomic value.

The Core collection composition based on subspecies is illustrated below, and it comprises genetic material from 29 countries.

Finally, a few amendments were made. Five swede accessions were replaced by five fodder rapes and Doon major (GBRHRIGRU 3270) replaced Peerless (GBRHRIGRU 3330) in the core collection. Two accessions of oilseed rape DEUBGRC 7295 Lenora was exchanged by DEUIPK 686 and DEUIPK CR807 Nugget was replaced by DEUBGRC 28680 because their oil profiles no longer reflected the originally described varieties. At last one Chinese spring rape accession was included (CR 2264 Rapeseed from Sinkiang). The composition of the core collection is presented in appendix 1.

Composition of the B. napus Core Collection



Milestone 2a *Core collection (1500 accessions) characterised for minimum descriptors*

Fourth year

This year BAZ genebank characterised 25 spring oilseed rape varieties and 26 winter varieties in Germany. 17 accessions of winter material were characterised by NGB in Sweden.

Summary whole period

At the beginning of the project all available material from the BrasEDB was requested from European Genebanks for field screening trials at Rauischholzhaussen (near Marburg in Hessen, Germany) comprising 353 spring type *Brassica napus* accessions and 857 winter type accessions.

For characterisation of the *Brassica napus* core collection a set of minimum descriptors were selected, and presented in 1st ann. report p 35.

Over the whole period the accessions of preliminary working core collection were characterised by the genebank partners as follows:

		2001	2002	2003	Σ
P 3	NGB	42	22	17	81
P 5	IPK	13	65	0	78
P10	BAZ	60	50	51	161
Σ		115	137	68	320

Milestone 2b *Accessions of all four core collections which required regeneration and some oth material are regenerated and this material will be available for use*

Fourth year

39 Brassica napus accessions have been regenerated by P3, P5 and P10.

Summary whole period

For the whole project period 212 accessions of Brassica napus were regenerated by the three subgroup genebank participants

		2000	2001	2002	2003	Σ
P3	NGB	0	2	18	14	34
P5	IPK	0	0	78	0	78
P10	BAZ	10	25	50	25	100
Σ			27	146	39	212

Milestone 3a *All evaluation work as described in chapter 1.3. finished and conclusions abo evaluations made*

Summary whole period

The evaluation work during the whole project is divided into resistance screening and seed quality characterisation. The resistance screening is summarised in the following table:

Disease / Pest	**core accession**	**Pre evaluation analysis**	**Total**
Plasmodiophora brassicae	188		188
Alternaria brassicae, Sclerotinia sclerotiorum, Phor (Leptosphaeria maculans) additional evaluations	(65)		(65)
Cabbage stem flea beetle	111	17	128
Cabbage stem weevil	87	8	95
Rape stem weevil	87	5	95
Field slugs (Deroceras spp.)	177	19	196
Total number of evaluations	**650 (715)**	**49**	**702 (767)**

Under greenhouse conditions 188 accessions from the core collection were screened for resistance to clubroot (Plasmodiophora brassicae). Only two of these, HRI 8679 and HRI 8722 showed resistance to the pathogen.

Parallel to the morphological descriptions 65 accessions of winter rape seed were screened for resistance to Alternaria blight (artificial infection), Sclerotinia (artificial infection) and Phoma (natural infection).

Field trials to evaluate resistance against cabbage stem flea beetles (*Psylliodes chrysocephala*), stem weevils (*Ceutorhynchus pallidactylus* et *C. napi*.) and field slugs (*Deroceras* spp.) were sown in autumn 2001. The material comprised 180 *B. napus* gene bank accessions and 20 species of other cruciferous plants.

Evaluation of infestation level caused by **cabbage stem flea beetles** (P11) was performed on 128 well established genebank accessions. The material was evaluated for feeding damage by adult flea beetles and larval infestation in autumn 2001. Subsequently, the 28 most promising accessions were evaluated for larval attack in spring 2002. In nearly half of the accessions a positive correlation was found between the numbers of larvae/plant assessed in autumn 2001 and the number of larvae/plant found in spring 2002.

The stem weevil evaluation targeted two species **cabbage stem weevil** (*Ceutorhynchus pallidactylus)* and **rape stem weevil** (*C. napi*.) (P12). The evaluation was focused on 87 well established *Brassica napus* genebank accessions.
Regarding the Infestation by *C. pallidactylus* in 55 out of the 95 accessions the larval incidence (= number of plants infested by cabbage stem weevil per 10 sampled plants) was in the same order or even lower than the larval incidence in the standard plots.
Among the *B. napus*, 3 accessions did not show any infestation, at all, and in 13 accessions the incidence of cabbage stem weevil was markedly higher than in standard plants. In 63 out of the 95 accessions the mean number of larvae/plant was lower than the mean number of larvae/plant in standard plots (=1.5 larvae/plant). In 18 of these accessions, the level of larval infestation ranged below 0.5 larvae/plant, being substantially reduced as compared to the larval infestation of standard plants.

Among the same 95 accessions tested for the infestation by *C. napi* 24 accessions did not show any infestation by this pest, however, rape stem weevil infestation in 36 accessions was lower than the standard, which had 3,2 infested plants per 10 plants dissected.

A field trial for the evaluation of **field slugs** (*Deroceras* spp.) attack was conducted in 2002 (P12). 177 *B. napus* accessions of the preliminary core collection were tested. The percentage of intact and damaged plants were recorded six times (18.09./16.09./ 07.10./14.10./24.10.). For this purpose, the loss of plants and leaf area missing from true leaves of the crop, which was entirely attributed to slug damage, were visually determined. The leaf damage was finally assessed (29.11. The occurrence of slugs and carabid beetles (especially *Pterostichus melanarius*) as natural predators were monitored. The feeding damage among the core collection accessions varied from below 10% to above 60%.

The evaluations reveal that a wide diversity in diseases response is contained in the core collection. Detailed reports are found in the individual participants reports from 2002, referring to participant numbers, ex. (P3), in the text.

The seed quality evaluations include analysis of the composition in the protein-, glucosionolate-, oil content and composition in the fatty acids.

Regarding oil, protein and glucosionolate content the genebank material displays considerable variation as compared to the standard varieties. In general, the material shows the well known inverse relationship of oil and protein contents with the consequence that the sum of oil and protein is nearly stable. Details on the seed quality analysis are found in the individual report P11-2003.

Seed Quality Analysis	**# accession**	**Pre evaluati analysis**	**Total**
Seed oil content (% dry matter)	180	892	1,072
Seed protein content (% dry matter)			
Glucosinolate content (µmol/g seed)			
Fatty acid composition of triacylglycerols	183	176	359
Total	**363**	**1068**	**1431**

A total of 2198 individual analysis lies behind the work and the conclusion of the Brassica napus work of which 1078 relates directly to core collection.

Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*
Summary whole period
According to the agreements made during the 3rd Annual Working Group Meeting in Catania evaluation- and characterisation data have been submitted to the BrasEDB manager for inclusion in the database.

Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities fo*

regeneration;
Safety duplication of the core collections and part of the other material will be complete

Summary whole period

In two harvest years, adequate seed amounts of most of the regenerated material were set aside for safety duplication in two independent IPK locations, i.e. at the Gatersleben and Malchow storage facilities. The respective storage capacities are also available for harboring external safety duplicates. Because of a reconstruction of the Gatersleben storage facility (as consequence of the fusion of the two German *ex situ* germplasm collections at BAZ Braunschweig and IPK), delays in the realisation may occur.

In the Nordic Genebank (P3) it is a standard procedure to keep all material accepted for long-term storage in the safety storage.

Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecti activities made*

Summary whole period

There is no French oilseed rape material from France represented in the BrasEDB. We are therefore happy to experience that recently it was decided to start a collection of old oilseed rape material in France.

There are only three Chinese oilseed rape accessions in the BrasEDB. Considering the big production and development that has taken place in China lately, we expect that interesting material is available from there, which may be included in the European collections.

Milestone 5 *Fourth and final progress report finalised and submitted with the cost statements to t European Commission*

Progress report and final report are completed. The cost statements are concluded by the end of the project period.

Executive summary including highlights over the whole period:

Participation in the final working group meeting in Giessen and submissions of characterisation and evaluation data along with the individual and consolidated reports all management tasks are fulfilled. Milestones defined for the fourth year have been met by the partners of the Brassica napus subgroup, a total of 1078 evaluations were performed on the core collection and additionally 1120 analysis were carried out in the pre-evaluation. Scientific goals have been reached.

Task	*Activity*	*Results expected*	*Core collec Result*	*Additional analy in pre-evaluation*
1a	*Database*	*1500 acc. of* B. *napus.*	*ok*	
1b	*Core collections*	*150 acc. of* B. *napus*	*150*	
2a	*Characterisation*	*Total 500 acc. of* B. *species,*	*320 B. napus*	
2b	*Regeneration*	*Total 600 acc. of B. species in 3 years*	*212 B. napus*	
3a	*Evaluation* *Pest /disease resistance* *Clubroot* *Field slugs* *Stem flea beetle and stem weevi* *Quality properties* *Pattern TAGs, fatty ac. Comp.*	*Total of about 1800 samples* *Core (150 acc.)* B. napus *Core (150 acc.)* B. napus *Core (150 acc.)* B. napus *Core (150 acc.)* B. napus	 *188* *177* *285* *363*	 *19* *33* *1068*
3b	*Evaluation data available*	*Evaluation data of about 1800 samp available and linked to Bras-EDB*	*>1000*	
4a	*Tracing duplicates* *Safety duplication*	*In the updated Bras-EDB duplicates be traced.* *Safety duplication of acc. from c realized*	*ok* *ok*	
4b	*Identification of gaps in collectior*	*Recommendations for appropri collecting made*	*ok*	

Publications

Hasan M., W. Lühs, F. Seyis, W. Friedt and R. Snowdon, 2003: Surveying genetic diversity in the *Brassica napus* gene pool using SSR markers. 11th Intern. Rapeseed Congr., 6-10 July 2003, Copenhagen, Denmark, Vol. 2, pp. 392-394.

Lühs, W., F. Seyis, M. Frauen, H. Busch, L. Frese, E. Willner, W. Friedt, M. Gustafsson, and G. Poulsen, 2002a: Development and evaluation of a European *Brassica napus* core collection. In: P.B.E. McVetty, K. Schlosser and C.F. Quiros (Eds.), 13th Crucifer Genetics Workshop, 23-26 March 2002, University of California, Davis, California, USA, Poster abstract, p. 116.

Lühs, W., F. Seyis, M. Frauen, H. Busch, L. Frese, E. Willner, W. Friedt, M. Gustafsson, G. Poulsen, 2002b: Preliminary Field Evaluation of a *Brassica napus* Core Collection. In: L. Maggioni, G. Thomas and E. Lipman, Comp. (2003) Report on a working Group on Brassica. Extraordinary Meeting, held jointly with the Third Coordinating Meeting of The EU Project GEN RES CT99 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy.

Lühs, W., F. Seyis, M. Frauen, H. Busch, L. Frese, E. Willner, W. Friedt, M. Gustafsson and G. Poulsen, 2003a: Development and evaluation of a *Brassica napus* core collection. In: H. Knüpffer and J. Ochsmann (eds.), Rudolf Mansfeld and Plant Genetic Resources. Proceedings of a symposium dedicated to the 100th birthday of Rudolf Mansfeld, Gatersleben, Germany, 8-9 October 2001. Schriften zu Genetischen Ressourcen 19, pp. 284-289. ZADI/IBV, Bonn, (http://www.genres.de/infos/rei-bd22.htm).

Lühs W, B. Ulber, F. Seyis, M. Frauen, H. Busch, W. Friedt, M. Gustafsson and G. Poulsen, 2003b: Evaluation of a *Brassica napus* core collection and prospects of its exploitation through rapeseed breeding. 11th Intern. Rapeseed Congr., 6-10 July 2003, Copenhagen, Denmark, Vol. 2, pp. 371-374.

Poulsen G, H. Busch, M. Frauen, L. Frese, M. Gustafsson, F. Seyis, E. Willner, W. Lühs, 2002: Development and Evaluation of a *Brassica napus* L. Core Collection. In: L. Maggioni, G. Thomas and E. Lipman, Comp. (2003) Report on a working Group on Brassica. Extraordinary Meeting, held jointly with the Third Coordinating Meeting of The EU Project GEN RES CT99 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy.

Poulsen G., H. Busch, M. Frauen, L. Frese, W. Friedt, M. Gustafsson, F. Ottosson, F. Seyis, G. Stemann, B. Ulber, E. Willner, W. Lühs.(2004) The European *Brassica napus* Core Collection – Characterisation, Evaluation and Establishment. Submitted to Cruciferae Newsletter.

Seyis, F., R. Snowdon, W. Friedt, W. Lühs, 2003a: Molecular genetic diversity in resynthesised and conventional spring rapeseed. 11th Intern. Rapeseed Congr., 6-10 July 2003, Copenhagen, Denmark, Vol. 2, pp. 382-384.

Seyis, F., R.J. Snowdon, W. Lühs and W. Friedt, 2003b: Molecular characterization of novel resynthesized rapeseed (*Brassica napus*) lines and analysis of their genetic diversity in comparison with spring rapeseed cultivars. Plant Breeding 122, 473-478.

Presentations on the Symposium on the EU-RESGEN CT99 109-112 project "Brassica Collections for Broadening Agricultural Use, including Characterising and Utilising genetic variation in Brassica carinata for its exploitation as an oilseed crop" 11. December 2003, Giessen, Germany

Poulsen G. Establishment and Characterisation of a European Brassica napus core collection.
Lühs W. Evaluation of a *Brassica napus* core collection regarding quality and resistance breeding traits.
Gustafsson M. Wild species of the Brassica oleracea complex: distribution, biology and genetic diversity.
Frauen M. Use of exotic Brassica germplasm for the improvement of oilseed rape, examples and perspectives.

Appendix 1. The entries of the final Brassica napus Core Collection.

REC_NO	INSTCODE	ACCENUMB	ACCNAME	ORIGCTY	VER_NAME	END_USE
120	GBRHRIGRU	6945	Aberdeenshire Prize	GBR	swede	2
99	DEUIPK	CR 156	Abukuma natane	JPN	winter rape	6
1	DEUBGRC	7310	Akela	DEU	winfodrape	7
207	REGNGB	2336	Alku	FIN	spring rape	6
121	GBRHRIGRU	6724	Altasweet	USA	swede	2
38	DEUIPK	CR 164	Anja	DEU	winter rape	6
205	REGNGB	4408	Ap8308110106	FIN	swede	2
101	DEUIPK	CR 167	Aphid Resistant Rape	NZL	winter rape	6
102	DEUIPK	CR 172	Askari	DEU	winter rape	6
123	GBRHRIGRU	3268	Balmoral PT	GBR	swede	2
155	NLDCGN	6868	Baltia	POL	winter rape	6
124	GBRHRIGRU	3277	Bangholm PT	GBR	swede	2
86	DEUIPK	CR 181	Bienvenue	FRA	winter rape	6
39	DEUIPK	CR 182	Binera	DEU	winter rape	6
60	DEUIPK	CR 192	Bladkool	NLD	winter rape	3
94	DEUIPK	CR 853	Bolko	POL	winter rape	6
179	REGNGB	5015	Brandhaug	NOR	swede	2
61	DEUIPK	BRA175	Brauner Schnittkohl	DEU		3
172	REGNGB	588.1	Brink	SWE	winter rape	6
170	POLIHAR	PL160014	Bronowski Ihar	POL	spring rape	6
18	DEUBGRC	34392	Brutor	FRA	spring rape	6
87	DEUIPK	CR 279	Ceres	DEU	winter rape	6
62	DEUIPK	CR 280	Ceska	CSK	spring rape	6
63	DEUIPK	CR 2198	Chuosenshu	PRK	winter rape	6
103	DEUIPK	CR 283	Clubrot resistant	NZL	winter rape	6
40	DEUIPK	CR 285	Collo	DEU	winter rape	6
128	GBRHRIGRU	3470	Conqueror Bronze Green Top	GBR	swede	2
41	DEUIPK	CR 286	Coriander	DEU	winter rape	6
129	GBRHRIGRU	9522	Couve Nabica	PRT	couve nabica	3
64	DEUIPK	CR 2272	Cubs Root	PRK	spring rape	6
42	DEUIPK	2275	Daichousen	JPN	leafy type	3
130	GBRHRIGRU	9139	Darmor	FRA	winter rape	6
131	GBRHRIGRU	3367	Devon Champion	GBR	swede	2
104	DEUIPK	CR 298	Dippes	DEU	winter rape	6
142	GBRHRIGRU	3270	Doon Major	GBR	swede	2
132	GBRHRIGRU	5878	Drummonds Purple Top	GBR	swede	2
43	DEUIPK	CR303	Duplo	DEU	spring rape	6
105	DEUIPK	CR 304	Dwarf Essex	GBR	winter rape	6
44	DEUIPK	CR 307	Edita	DEU	winter rape	6
157	NLDCGN	CGN15178	Elsoms Giant	GBR	fodder rape	7
4	DEUBGRC	28653	Emerald	IRL	winfodrape	7
133	GBRHRIGRU	3258	English Giant	GBR	winfodrape	7
134	GBRHRIGRU	5860	Essex Model	GBR	swede	2
46	DEUIPK	CR 2186	Express	DEU	winter rape	6
65	DEUIPK	CR 327	Fertoedi	HUN	winter rape	6
135	GBRHRIGRU	6479	Fido	GBR	spring rape	6
182	REGNGB	2768	Fora	SWE	forage rape	7
22	DEUBGRC	29620	Gloria	DEU	winfodrape	7
66	DEUIPK	CR 2284	Gogatsuna	JPN	spring rape	6
47	DEUIPK	BRA 176	Goldgelber Zarter	DEU		3
106	DEUIPK	CR 629	Groß-Lüsewitzer Pollux	DEU	winter rape	6
183	REGNGB	585	Gulle	SWE	spring rape	6
159	NLDCGN	CGN06897	Hakuran	JPN	spring rape	3
173	REGNGB	597	Hektor	SWE	winter rape	6
174	REGNGB	13603	Helios	DNK	spring rape	6
107	DEUIPK	CR 646	Hokkai 3-go	JPN	winter rape	6
160	NLDCGN	7237	Hollandse Gele Roodkop	NLD	swede	2
48	DEUIPK	CR 241	Idol	DEU	winter rape	6
211	REGNGB	13500	Industry	DNK	spring rape	6
108	DEUIPK	CR 658	Janetzkis Schlesischer	AUT	winter rape	6
6	DEUBGRC	31208	Janetzkis Sommerraps	AUT	spring rape	6
88	DEUIPK	CR 659	Janpol	POL	winter rape	6
93	DEUIPK	CR 743	Jantar	POL	winter rape	6
152	CHERAC	896 407	Jaune Beurre	CHE	swede	2
161	NLDCGN	CGN07227	Jet Neuf	FRA	winter rape	6

175	REGNGB	2703	Jupiter	SWE	winter rape	6
69	DEUIPK	CR 2187	Krapphauser	DEU	winter rape	6
23	DEUBGRC	32545	Kroko	DEU	spring rape	6
162	NLDCGN	CGN06869	Kromerska	CSK	winter rape	6
49	DEUIPK	CR680	Kubanskij	SUN	spring rape	6
184	REGNGB	9914	Laugabolsrofa	ISL	swede	2
70	DEUIPK	CR 686	Lembkes Malchower	DEU	winter rape	6
	DEUipk	686	Lenora	DEU	winter rape	6
89	DEUIPK	CR 689	Lesira	DEU	winter rape	6
8	DEUBGRC	61797	Libritta	DEU	winter rape	6
90	DEUIPK	CR 561	Liglory (Gelbsamige)	DEU	winter rape	6
50	DEUIPK	CR704	Liho	DEU	spring rape	6
163	NLDCGN	CGN13907	Limburgse Bladkool	NLD	fodder rape	7
212	REGNGB	1794	Line	DNK	spring rape	6
91	DEUIPK	CR 707	Lingot, R-26	DEU	winter rape	6
92	DEUIPK	CR 715	Lirafit, WRF 22	DEU	winter rape	6
51	DEUIPK	CR 718	Liragrün	DEU	winter rape	7
137	GBRHRI	6899	Lord Derby	GBR	swede	2
53	DEUIPK	CR 740	Madora	DEU	winter rape	6
138	GBRHRI	4027	Magnificent	GBR	swede	2
203	REGNGB	1612	Magres Pajberg	DNK	swede	2
71	DEUIPK	CR 754	Mansholts Hamburger	DEU	winter rape	6
12	DEUBGRC	28661	Markus	FRA	winter rape	6
27	DEUBGRC	34719	Marnoo	AUS	spring rape	6
209	REGNGB	594	Matador	SWE	winter rape	6
171	POLIHAR	PL160003	Mazowiecki	POL	spring rape	6
164	NLDCGN	CGN06871	Mestnij	SUN	winter rape	6
72	DEUIPK	CR 774	Michinaku nat	JPN	winter rape	6
111	DEUIPK	CR 773	Michinoko	JPN	winter rape	6
112	DEUIPK	CR 780	Moana, Moana Rape	NZL	winter rape	6
54	DEUIPK	CR 299	Moldavia	MDA	winter rape	6
165	NLDCGN	CGN06880	Mytnickij	UKR	winter rape	6
200	GBRHRI	8679	Nabica Greleira	PRT	rape kale	3
73	DEUIPK	CR 2277	Nakate Chousen	PRK	spring rape	6
113	DEUIPK	CR 787	Nemertschanskij 1	SUN	winter rape	6
176	REGNGB	593	Norde	SWE	winter rape	6
114	DEUIPK	CR 800	Norin	JPN	winter rape	6
	DEUBGRC	28680	Nugget	CAN	spring rape	6
140	GBRHRI	5133	Nunsdale	GBR	winter rape	6
13	DEUBGRC	62066	Nura	DEU	winter rape	6
28	DEUBGRC	34395	Olimpiade	ITA	spring rape	6
29	DEUBGRC	28678	Oro	CAN	spring rape	6
74	DEUIPK	CR 834	PALU	ITA		3
141	GBRHRIGRU	5873	Parkside	GBR	swede	2
30	DEUBGRC	16223	Petranova	DEU	spring rape	6
95	DEUIPK	CR 858	Primor, P-R	FRA	winter rape	6
143	GBRHRIGRU	6939	Purple Top	GBR	swede	2
15	DEUBGRC	7302	Quinta	DEU	winter rape	6
144	GBRHRIGRU	5671	Ragged Jack	GBR	rape kale	3
166	NLDCGN	CGN07233	Ramon	NLD	winfodrape	7
77	DEUIPK	CR 872	Ramses	FRA	winter rape	6
186	REGNGB	7795	Ranakaalrot	NOR	swede	2
	DEUIPK	CR 2264	Rapeseed from Sinkiang	CHN	Spring rape	6
16	DEUBGRC	7306	Rapol	DEU	winter rape	6
78	DEUIPK	CR 880	Regal	SWE	winter rape	6
56	DEUIPK	CR 884	Ridana	DEU	winter rape	6
153	FRAINRAREN	550	ru 38.01	FRA	swede	2
145	GBRHRIGRU	6234	Russian Kale	GBR	rape kale	3
31	DEUBGRC	28631	Salamander	DEU	winter rape	6
177	REGNGB	2767	Samo	SWE	spring fodder rape	7
146	GBRHRIGRU	3271	Scotia	GBR	swede	2
167	NLDCGN	CGN06894	Siberische Boerenkool	NLD		3
189	REGNGB	2769	Silona	SWE	winfodrape	7
168	NLDCGN	CGN06885	Skziverskij	SUN	winter rape	6
82	DEUIPK	CR 948	Slovenska Krajova	CSK	winter rape	6
33	DEUBGRC	16225	Spaeths Zollerngold	DEU	spring rape	6
97	DEUIPK	CR 972	Start	POL	winter rape	6
169	NLDCGN	CGN06893	Tantal	FRA	spring rape	6
149	GBRHRIGRU	8722	Tina	NZL	swede	2

150	GBRHRIGRU	3283	Tipperary (Magnificent)	GBR	swede	2
208	REGNGB	2695	Topas	SWE	spring rape	6
35	DEUBGRC	28637	Towe	CAN	spring rape	6
57	DEUIPK	CR1026	Trebicska	CSK	winter rape	6
58	DEUIPK	CR2005	Tribute	CAN	spring rape	6
201	REGNGB	4569	Troendersk Kvithamar	NOR	swede	2
85	DEUIPK	CR 1050	Weihenstephaner	DEU	spring rape	6
59	DEUIPK	CR1055	Wesway	AUS	spring rape	6
178	REGNGB	590.2	Victor	SWE	winter rape	6
36	DEUBGRC	34819	Wilhelmsburger	DEU	swede	2
190	REGNGB	8385	Wilhelmsburger; Reform	DNK	swede	2
37	DEUBGRC	28635	Winfred	NLD	winter rape	7
98	DEUIPK	CR 1059	Wipol	POL	winter rape	6
118	DEUIPK	CR 1060	Wolynski	SUN	winter rape	6
199	GBRHRIGRU	6927	York	GBR	swede	2
119	DEUIPK	CR 1191	Ölquell, Gülzower	DEU	winter rape	6

Consolidated Report of the *Brassica carinata* subgroup

Contract no: RESGEN CT99 109/112

Project title: "*Brassica collections for Broadening Agricultural Use*" including 'Characterizing and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Participants:
P15- Instituto de Agricultura Sostenible (IAS), Cordoba, Spain (subcoordinator)
P16-John Innes Centre (JIC), Norwich, UK

Reporting period: 1st January to 31st December 2003 and summary over the whole period

Role in the project:

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*
Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Milestone 2a *Part of the core collection characterised.*
Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Milestone 3a *Part of the core collection evaluated*
Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*
Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*
Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*
Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Activities carried out during the fourth year and summary over the whole period

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*

Fourth year:
After selecting the accessions that constitute the *Brassica carinata* core collection, passport data of these accessions have been linked with their characterisation and evaluation data, and submitted to the Bras-EDB.

Summary whole period:
All the available information on passport data from the Brassica carinata collection has been updated and submitted to the Bras-EDB.
In relation to the accessions obtained in the 1980s from Prof. Knowles (Dept. of Agronomy, University of California-Davis) that have been included in the germplasm collection studied in this project, we have tried to complete the previously available information by contacting with the Office Staff of the Genetic Resources Conservation Program of this University. The only information, therefore, available at this moment, is the original code numbers provided by Prof. Knowles together with the accessions, and has been included in Bras-EDB.

Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*

Fourth year:
Data from all the accessions grown at JIC (Norwich) and IAS (Córdoba) during three seasons (years 2000 to 2003) have been combined and analysed to established the *Brassica carinata* core collection.

Summary whole period:

Eighty accessions have been chosen for the core collection. An initial core collection of 73 accessions has been selected initially through calculating a similarity matrix and consequent dendrogram using the minimal descriptors previously defined (see Milestone 2a) using data from JIC trials. Because the accessions show considerable heterogeneity it was decided to include only the most uniform accessions as assessed through the determination of individual coefficients of variation (CV%). The accessions chosen for the core collection have been selected by eliminating individuals from groups with similarities greater than 95%. Subsequent selection has been carried out at progressively lower levels of similarities. This core has been tested against the full range of data and shows similar means, maximum and minimum values but greater variances. Where gaps appeared in the coverage of individual characters additional lines have been included to fill gaps. Seven new accessions have been selected based on its variability for the main seed storage characters (protein, acid detergent fiber, oil, glucosinolates and fatty acid composition) using data from IAS trials.

The *Brassica carinata* core collection has been defined. Details of this core collection have been submitted to the Bras-EDB. The information given includes details of passport data for each accession, where possible, descriptor data adjusted to a score to enable easier use under different environments.

Milestone 2a *Part of the core collection characterised.*

Fourth year:
A new set of 100 accessions from the collections at CGN (Wageningen) and IAS (Córdoba) for possible inclusion in the B. carinata core collection have been grown in field plots in two randomised blocks at Córdoba (Spain). Accessions showing novel variants in morphological, agronomic, molecular and and seed storage characters were considered to be included in the core collection. A wide range of morphological and agronomic characters have been assessed during the growth cycle of the plants. After harvesting, other morphological and agronomic seed traits have been evaluated including: dimensions of siliques, angles of pedicel to rachis, and silique to rachis, number of seeds in 50 siliques, 1000-seed weight. Microsatellite marker analysis of the DNA from plants grown at Norwich has been completed. Additionally, at Córdoba has been performed the study of seed yield per plant, acid detergent fibre content, oil content, fatty acid composition and glucosinolate content for selfed seed obtained at both Cordoba and Norwich.
Multivariate analysis has been used to evaluate the stability of these traits in different environments and assess the intra- and inter-accession variability.
Molecular (microsatellite markers) analysis has been used to evaluate the homogeneity degree among and within accessions.

Summary whole period:
A total of 222 accessions of *Brassica carinata* have been characterised throughout the four years of the project by performing field plots at two localities, Norwich (UK) and Córdoba (Spain).

Each year, the selected accessions were germinated in Petri dishes (IAS) or compost (JIC), grown in small pots and, transplanted to field plots in two randomised blocks of 5 plants. All the plants have been grown as spaced plants in self-pollinating conditions. Important differences among the accessions in characters as time to flowering, time to ripening and seed yield have been detected and recorded. A wide range of morphological and agronomic characters were assessed during the growth cycle of the plants: anthocyanins, margins and glaucousness of leaves, time to flowering, flower colour, stem diameter, plant height, degree of branching, time to ripening, pod colour, homogeneity of the accession etc. After harvesting, other morphological, agronomic and seed traits have been evaluated including: dimensions of siliques, angles of pedicel to rachis, and silique to rachis, seed colour, number of seeds in 50 siliques, 1000-seed weight. These traits were measured in both Norwich and Cordoba and follow the methodologies developed jointly by both groups.

Define minimum descriptors for *B. carinata*

Plant morphology, raceme and seed data have been combined for all accessions grown at JIC, Norwich and used to define the most appropriate minimum descriptors. A total of 26 characters were

measured from which seven have been selected. These are plant anthocyanin pigmentation (score), date of first flower (after 1st May), flower colour (score), natural height (cm), pod depth (mm), seed size (mg) and branch density (height of plant / number of primary branches). These have been selected using the following criteria: stability of the trait across environment (estimated from four control lines grown in each year), high genetic component determining variation, large range of values for the trait among accessions, ease of measurement (scoring) and minimising heterogeneity of the accessions (CV%).

Milestone 2b *Part of the core collection regenerated and this material will be available for use.*

Fourth year:
As in previous years, sixty accessions from the *B. carinata* collection have been regenerated, thirty at IAS (Córdoba – Spain), and thirty at JIC (Norwich – UK) by using isolated field plots, thus allowing self-pollination among *circa* 50 plants of each accession.

Summary whole period:
Regeneration of the accessions has been done throughout this project and an average of 30 accessions per partner per year have been regenerated giving a total of 180 accessions, including those selected as core material.

Milestone 3a *Part of the core collection evaluated*

Fourth year:
Selfed seeds from all the third set of accessions grown both at Norwich and Cordoba have been evaluated for seed storage components by scanning 3 g of intact seed using a Near Infrared Reflectance Spectroscopy monochromator to record reflectance spectra from 400 to 2500 nm. The application to these spectra of the calibration equations obtained in years 2001 and 2002 allowed us to evaluate all the accessions grown in both environments (Norwich and Córdoba) for oil, protein, acid detergent fibre (ADF) and glucosinolate contents, and for fatty acid composition of the oil.

Summary whole period:
The two hundred accessions characterised during 2001 and 2002 were drilled as small field plots (1 m^2) at normal agronomic field spacing during March 2002 at Norwich (UK). These accessions were assessed for flea beetle damage at the fourth – fifth leaf stage. A wide range of variation was seen during early vegetative development ranging from very resistant to very susceptible accessions.

Seed storage component analysis of *B. carinata* collection: In order to optimise the analysis of the seed storage components of the accessions grown in the two environments, and to enable the rapid analysis of large numbers of seed quality characters, reference standards methods have been developed on samples of our *B. carinata* collection obtained from a sub-set of the initial core collection. These have been analysed using the following methods: Soxhlet and Nuclear Magnetic Resonance for oil content, gas chromatography of methyl esters for fatty acid composition, Kjeldahl for protein content, Van Soest for acid detergent fiber content, and liquid chromatography of desulphoglucosinolates for glucosinolates content. These reference standards have been used to develop the calibration equations that allow us to analyze each seed storage component by Near Infrared Reflectance Spectroscopy.

Selfed seeds from all the accessions grown both at Norwich and Cordoba throughout the years of the project have been evaluated for seed storage components by scanning about 3 g of intact seed using a monochromator to record reflectance spectra from 400 to 2500 nm and applying the calibration equations previously obtained.

A total of 222 accessions of *B. carinata* have been evaluated for agronomic and seed quality characters throughout the four years of the project through field trials at two localities, Norwich (UK) and Córdoba (Spain), growing and harvesting selfed plants as described in Milestone 2a.

Differences among and within the accessions have been detected and recorded.

Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*

Fourth year:
Tables of the evaluation data obtained for all the measured characters for all accessions assessed have been presented in the annual report and submitted to be linked to the Bras-EDB (Tables 1 and 2 of annual report Partner 15).

Summary whole period:
Standardized formats received from CO for evaluation data have been filled out with the passport and evaluation data generated throughout the project. These data have been submitted separately for JIC and IAS data to be linked to the Bras-EDB.

Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*

Fourth year:
After selecting the *Brassica carinata* accessions of the core collection, contacts with the managing director of the Centro de Recursos Fitogenéticos (CRF) at Madrid (Spain) has been made in order to allow the storage at this Centre of a duplicate of the *B. carinata* core collection.

Summary whole period:
Safety duplication of the *B. carinata* core collection will be done at Centro de Recursos Fitogenéticos (Madrid, Spain), belonging to the Instituto Nacional de Investigaciones Agrarias (INIA).

Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*

Fourth year:
The partners of this subgroup discussed about this subject during the last project meeting at Giessen and established priorities for collecting activities related with *B. carinata* germplasm.

Summary whole period:
Considering the existence of others *B. carinata* collections stored in different Germplasm banks which have not been studied, our group suggest that the characterisation, regeneration and evaluation of this germplasm should be done before collecting new material.

Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Fourth year:
The Fourth annual progress report were finalised and submitted on time

Summary whole period:
Final report comprising overall results from the project, and the cost statements have been submitted on time.

Executive summary including highlights over the whole period:

- ✓ Substantial progress on the characterisation, regeneration and evaluation of *Brassica carinata* under European conditions has been made.
- ✓ Minimum descriptors on a “scientific” basis have been identified in *B. carinata*.
- ✓ A core collection of 80 accessions has been defined in this species based on seven minimum descriptors (morphological characters) and seed quality characters.
- ✓ Calibration equations for the analysis of seed quality characters by Near Infrared Reflectance Spectroscopy has been developed in this species, and applied to the rapid, simultaneous and non destructive analysis of 9 seed storage components in the accessions grown at two environments: Norwich UK) and Córdoba (Spain).
- ✓ Molecular techniques (micro-satellites) for genetic fingerprinting of *B. carinata* germplasm have been developed and optimised.
- ✓ Genotypes showing characteristics of potential interest in relation with morphological, agronomical or seed quality features have been selected for future research programmes.
- ✓ Extensive databases for selecting “appropriate” *B. carinata* germplasm for scientific research and breeding programmes have been created and linked to the Bras-EDB.

Publications

Chinoy, C., E. Arthur, I. Bancroft, A. De Haro-Bailón, C. Morgen, 2002. Genetic Variation in *Brassica carinata* Assessed using Microsatellite Markers and Phenotypic Characters.: 13 th Cruficer Genetics Workshop. Davis, California, 23-26th March 2002

Font, R., M. del Rio, J. Fernández, E. Arthur, I. Bancroft, C. Chinoy, C. Morgan and A. De Haro, 2002 Seed Oil Content Analysis of Ethiopian mustard (*Brassica carinata* A. Braun) by Near Infrared Spectroscopy. Eucarpia Cruciferae Newsletter. 24: 5-6

Font, R., M. del Rio, A. Sillero, E. Arthur, I. Bancroft, C. Chinoy, C. Morgan and A. De Haro, 2002 Using Near Infrared Spectroscopy for Determining Protein content in Ethiopian mustard (*Brassica carinata* A. Braun). Eucarpia Cruciferae Newsletter. 24: 7-8

Font, R., Del Río, M., Arthur, E., Bancroft, I., Chinoy, C., Morgan, C., De Haro, A. 2004.Survey of seed storage components in Ethiopian mustard (Brassica carinata A.Braun). Submitted to Eucarpia Cruciferae Newsletter.

Haro de, A., R. Font, J. Navarrete, J. M. Ferandez, E. Arthur, C. Chinoy, I Bancroft and C. Morgan, 2003. Role and progress of the *Brassica carinata* group in the GENRES CT99 109-112 project after 2 years. Pp. 72-74. In: Maggioni, L. and G. Thomas, compilers. Report of a Working Group on *Brassica.* Extraordinary Meeting, held jointly with the Third Coordination Meeting of the EU project GENRES 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy.

Presentations

Font, R,. A. Seed storage characters in *B.carinata.* Open day at final project meeting. Giessen, Germany, 11 December 2003

Haro de, A. An overview of the activities of the *B. carinata* subgroup Open day at final project meeting. Giessen, Germany, 11 December 2003

Morgan, C. Morphological and molecular characters in *B.carinata.* Open day at final project meeting. Giessen, Germany, 11 December 2003

Contract no: RESGEN CT99 109-112

"*Brassica* Collections for Broadening Agricultural Use" including "Characterising and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

short title:
Brassica*, including *B. carinata

C. Individual progress reports

Fourth year (1st January to 31 December 2003)
Final report (1st January 2000 to 31 December 2003)

Partners

P1 Centre for Genetic Resources, the Netherlands (CGN), Wageningen, the Netherlands
P2 Genetic Resources Unit, Horticulture Research International, Wellesbourne, UK.
P3 Nordic Gene Bank, Alnarp, Sweden.
P4 Institute National de Recherche Agronomique, Rennes, France.
P5 Institut für Pflanzengenetik und Kulturpflanzenforschung, Gatersleben, Germany.
P6 National Agricultural Research Foundation, Agricultural Research Center of Makedonia and Thraki, Greek Gene Bank,Thessaloniki, Greece.
P7 Dipartimento di OrtoFloroArboricoltura e Tecnologie Agroalimentari (DOFATA) Università degli Studi di Catania, Italy (formerly IOF-CT)
P8 Universidade de Trás-os-Montes e Alto Douro, Vila Real, Portugal.
P9 Consejo Superior de Investigaciones Cientificas, Mision Biologica de Galicia, Pontevedra, Spain.
P10 Federal Centre for Breeding Research on Cultivated Plants, Gene Bank, Braunschweig, Germany.
P11 Norddeutsche Pflanzenzucht Hans Georg Lembke KG, Hohenlieth, Holtsee, Germany.
P12 Deutsche Saatveredelung Lippstadt - Bremen Gmbh, Lippstadt, Germany.
P13 Universidad Politechnica Valencia, Valencia, Spain
P14 Nederlandse Vereniging voor Zaaizaad en Plantgoed, Zeist, The Netherlands.
P15 Consejo Superior de Investigaciones Cientificas, Instituto de Agricultura Sostenible, Cordoba, Spain.
P16 John Innes Centre, Norwich, UK

Contract no: RESGEN CT99 109/112

Project title: "*Brassica collections for Broadening Agricultural Use*" including 'Characterizing and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Participant no. P1 (coordinator): Wageningen Universiteit & Research Centre
Plant Research International B.V.,
Centre for Genetic Resources, The Netherlands (CGN)
P.O. Box 16, 6700 AA Wageningen, The Netherlands

Names of participants: Ir. Loek. J.M. van Soest (managing coordinator
Ir. Ietje W. Boukema (sub-coordinator)
Drs. Noor Bas
Dr. Theo v. Hintum
Ing. Frank Menting

Reporting period: 1st January to 31st December 2003 and summary over the whole period

Role in the project: Overall co-ordination of the project including scientific, technical and financial issues.
Responsible for the progress reports together with the sub-coordinators.
Responsible for the common database (Bras-EDB) and the updating with new data received from the project partners.
Sub-coordinator of *Brassica oleracea*.
Responsible for the establishment of the core collection of *B. oleracea*.
Regeneration and characterisation of *Brassica* species.
Long term storage and distribution of seeds for evaluation.

Tasks for the fourth year.
The tasks and milestones for P1 in year 4 include:

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*
Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Milestone 2a *Part of the core collection characterised.*
Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*
Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*
Milestone 5 *Management of RESGEN CT99 109-112 project.*
The organisation of the third project meeting and preparation of the fourth meeting
Responsible for the production of the following third year reports

- *Progress annual report of the fourth year of P1,*
- *Consolidated progress report of the sub-group Brassica oleracea*
- *Consolidated progress report of the coordinator*
- *Submission of Annual progress report of RESGEN CT99 109-112 to the European Commission*
- *Final report comprising overall results from the project, submitted with the cost statements to the European Commission*
- *Collecting the cost statements of all partners, preparation of an overall cost statement of the whole project and submission to the European Commission.*

Activities carried out during the fourth year and summary over the whole period

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*

Fourth year and summary whole period
The 2001 version of the Bras-EDB was further updated and improved. The new version includes additional data sets from non-GENRES partners of Slovakia, Yugoslavia, Spain, Russia and Austria. The 2001 edition was updated to be in line with the latest FAO/IPGRI Multi-crop Passport Descriptors.
Changes and additions of passportdata of accessions, obtained by different partners during their characterisations and evaluations have been prepared for importing into the Bras-EDB.
Formats have been designed for the results of characterisations and evaluations to be linked to the Bras-EDB. 50 formats have been received and adapted by P01. The validation and actual linking to the Bras-EDB of these formats and the actual updating of collections, addresses and passport data has been carried out by Frank Menting and Theo v. Hintum. The money which has been transferred from P14 to P01 has been used for this. The 2004 version of the Bras-EDB includes c. 19.600 accessions and will be available on the homepage of CGN (www.cgn.wur.nl/pgr/) mid 2004.

Summary whole period:
All partners have sent the passport data of their collections in the first and second year of the project to P1. The first version of the updated Bras-EDB has been reported in the second annual report. The database was available on the Internet at the end of 2001.
In 2002 some additional datasets were received from non-partner collections.
The Bras-EDB version 2004 will be available on the Internet before summer 2004.

Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*

Fourth year:
All subgroups have sent their final core collection to P1. Accessions belonging to the four core collections are tagged in the database in order to link the evaluation and characterisation data to the Bras-EDB.

Summary whole period:
Accessions belonging to the core collections are tagged in the database in order to link the evaluation and characterisation data to the Bras-EDB.

Milestone 2a *Part of the core collection characterised.*
Fourth year:
No characterisation was performed in the fourth year

Summary whole period:
161 *B. oleracea* accessions, including 21 accessions from the core collection have been characterised according to the minimum descriptors, established in the first year by the *B. oleracea*-subgroup. The CGN's kohlrabi- and broccoli-collections, which had not been characterised previously, have now been described. All data of the minimum descriptors have been presented in the right format to be linked to the Bras-EDB. Of five CGN accessions included in the core collection, subspecific names could be established to be added in the Bras-EDB.

Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Fourth year:
13 new samples of cabbage have been regenerated. In 2002, these samples have been characterised and it was decided that they make a valuable contribution to the B.oleracea collection. Plants have been either uprooted or cuttings were made, and after overwintering in the glasshouse, 60 – 80 plants per sample were placed in isolation cages and pollinated by blow flies for regeneration.
Of 11 samples enough seed was produced and when germination is above 80% they will be taken up in the collection of CGN.
In the winter of 2002/2003 and in spring 2003 4 accessions of *B. carinata*, 6 of *B. rapa* and 2 of *B. napus* were sown in boxes and later transplanted in small pots. In April the plants (70 – 80 per accessions) were planted out in field plots spatially isolated in Triticale. The isolation plots were at least 50 m apart. The regeneration of all accessions was successful.

Summary whole period:
In the project period the following regenerations have been successful.

Species	no. accessions in regeneration	no. of accessions successfully regenerated
B. napus	10	10
B. rapa	12	12
B. carinata	6	6
B. oleracea	23	18
Total	**51**	**46**

Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*

Fourth year:
The Bras-EDB has been updated with passport data of 570 accessions of 5 institutes, received in 2002. During evaluations and characterisations mistakes in passportdata have been found by several partners and gaps in passport data (mostly subspecific names) could be filled. Preparations have been made for tagging accessions of the four core collections in the new version of the Bras-EDB, which will be online mid 2004. The *B. oleracea* core collection which was established in the EU Fair 0463 project has also been tagged.

Summary whole period:
The Bras-EDB has been updated with passport data of 570accessions of 5 institutes, received in 2002. During evaluations and characterisations mistakes in specific and/or subspecific names have been found by several partners and gaps in mostly subspecific names could be filled. Preparations have been made for tagging accessions of the four core collections in the new version of the Bras-EDB, which will be online before summer 2004. The *B. oleracea* core collection which was established in the EU Fair 0463 project has also been tagged.

Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*

Fourth year and summary whole period
During the final meeting gaps in the collections were identified and recommendations made for appropriate collecting activities, see *B. oleracea*-subgroup report

Milestone 5 *Management of RESGEN CT99 109-112 project.*

Fourth year:

A. The organisation of the fourth and fifth (final) project meetingr

The fourth project meeting was organised by Dr. Fernando Branca Universita degli Studi di Catania, Sicily, Italy from 12 to 16 February 2003 in Catania, Italy. The fifth and final project meeting was held from 10 to 14 December 2003 in Giessen, Germany by Dr. Wilfried Luehs, Instituut fur Pflanzenbau und Pflanzenzuchtung, During this final meeting an open day was organised with 13 papers presented by the project partners. 45 persons including representatives of breeding firms, universities and institutes participated in this open day.
In the final project meeting the outcome of the project and the final reporting to the European Commission was discussed.

B. Responsible for the production of the following fourth year and final reports

Progress reports and financial matters

During the project meeting in Catania the draft version of the Third Annual Progress Report was discussed. The co-ordinator (CGN) submitted this report in March 2003 to the European Commission and was in September 2003 informed that the report was accepted.
P1 was responsible for the fourth and final reports of P1 and P14 and the Consolidated fourth and final reports of the coordinator and of the *B. oleracea subgroup*.
The cost statements of all project partners were submitted to the EU in June 2003. The advance payment of the EU for the fourth year came at the end of 2003 and the money is tranferred to the partners.

Summary whole period:
See the consolidated report of the coordinator.

Executive summary including highlights over the whole period:

161 accessions, including 21 of the core collection, have been characterised according to the minimum descriptor list, established in the first year of the project. In total 46 accessions of *B. rapa, B. napus, B. carinata* and *B. oleracea* have been successfully regenerated. passport data of new accessions and with additional or revised passport data
Formats have been made to present the characterisation- and evaluation results obtained by all partners during the project. 50 formats of have been received and have been adapted by P1 to be linked to the Bras-EDB before summer 2004.
Passport data of 5 collections with 570 accessions have been adapted to be included in the Bras-EDB before summer 2004, together with corrections in (sub) specific names in the Bras-EB 2001-version.

Publications

Bas, N., I. W. Boukema & L. J. M. van Soest, 2003. Role and progress of the *Brassica oleracea* group in the GENRES CT99 109-112 project after 2 years. Pp. 55-58. In: Maggioni, L. and G. Thomas and E. Lipman, compilers. Report of a Working Group on *Brassica.* Extraordinary Meeting, held jointly with the Third Coordination Meeting of the EU project GENRES 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy.

Boukema, I.W., N. Cristea, Th.J.L van Hintum & F. Menting, 2003. The European *Brassica* Database: version 2001.Pp. 15-18. In: Maggioni, L. and G. Thomas, compilers. Report of a Working Group on *Brassica.* Extraordinary Meeting, held jointly with the Third Coordination Meeting of the EU project GENRES 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy.

Loek J. M. van Soest, Ietje W. Boukema & Noor Bas, 2004. The achievements of the EU GENRES CT99 109-112 project Brassica, including B. carinata. Submitted to Cruciferae Newsletter.

Soest van, L. J. M., I. W. Boukema & N. Bas, 2003. The EU GENRES CT99 109-112 project Brassica, including B. carinata. Pp. 50-54. In: Maggioni, L. and G. Thomas and E. Lipman, compilers. Report of a Working Group on Brassica. Extraordinary Meeting, held jointly with the Third Co-ordination Meeting of the EU project GENRES 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy.

Contract no: RESGEN CT99 109/112

Project title: "*Brassica collections for Broadening Agricultural Use*" including 'Characterizing and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Participant no. P2: The Genetic Resources Unit, Horticulture Research International, UK

Names of participants: Angela Pinnegar & Dave Astley

Reporting period: 1st January to 31st December 2003 and summary over the whole period

Role in the project: Subco-ordinator of *Brassica rapa,* responsible for the development of *B.rapa* core collection, preparation and donation of data to Bras-EDB, regeneration of accessions, evaluation of *B.rapa* accessions for disease resistance to downy mildew and white blister and long term conservation and distribution of seeds for evaluation.

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*
Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Milestone 2a *Part of the core collection characterised.*
Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Milestone 3a *Part of the core collection evaluated*
Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*
Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*
Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*
Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Activities carried out during the fourth year and summary over the whole period

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*

Fourth year:
Following the discussion at the year 3 project meeting standard formats for the presentation of characterisation and evaluation data were distributed by CGN (P1). The characterisation data produced at HRIGRU during 2001, 2002 and 2003 were converted to the standard format and named according to the protocol provided. Characterisation files of *B. rapa* data were received from P5 IPK Gatersleben and P9 Misión Biológica de Galicia. All the *B. rapa* characterisation files were forwarded to Noortje Bas in CGN.

The evaluation data produced from screening the *B. rapa* core collection against 2 isolates of *Albugo candida* have been edited to a format suited to presentation on the Internet and forwarded to Noortje Bas in CGN.

Summary whole period:
The transfer of the HRIGRU data to the Bras-EDB was completed via the provision of a complete new passport data set to the Bras-EDB manager.

All the relevant HRIGRU characterisation and evaluation data have been formatted following the standard file structure and file name protocols, and forwarded to CGN. The characterisation and evaluation data produced by the *B. rapa* subgroup partners were collected and forwarded to CGN.

Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Fourth year:

All the passport information relevant to the *B. rapa* core collection accessions have been forwarded to the Bras-EDB database manager in CGN. Not all the accessions of the *B. rapa* core were represented in the Bras-EDB. We have identified the accessions not represented in the Bras-EDB and investigations are underway to ascertain why these particular accessions are absent from national *Brassica* database files delivered to the Bras-EDB managers. Certainly the USDA accessions with PI numbers were originally included in the Bras-EDB under DEUBGRC numbers. However, these items have been subsequently removed from the BAZ collection and hence from the Bras-EDB. However, the passport data for the 6 *B. rapa* core accessions obtained from the US Department of Agriculture are available via the GRIN system (Genetic Resources Information Network) on the Internet.

Summary whole period:
The *B. rapa* core collection was established to provide the broadest representation of the available gene pool. Therefore not all the accessions in the *B. rapa* core collection were represented in the Bras-EDB. The structure of the *B. rapa* core collection has been developed continuously throughout the project wherein the results of the characterisation have directed changes in the core based on changes in taxonomy. All the draft core accessions were cytometry tested, thus providing an additional check on their taxonomic status.

HRIGRU supplied material to the core collection development trial for *B. napus* and subsequently to the sub-groups for the characterisation and evaluation of the *B. napus, B. oleracea* and *B. rapa* core collections.

Milestone 2a *Part of the core collection characterised.*
Fourth year:
All the relevant core collection accessions were characterised in years 2 and 3 of the project. The *B. rapa* subgroup partners agreed to prioritise material from partner collections for any further characterisation. Therefore HRIGRU planted a field trial of 100 accessions of turnip for characterisation. The seeds were prepared for sowing using a Seeder Plant tape drill enabling seed to be spaced along a water soluble tape that is subsequently bound in fine cotton string. The seed in the tape were sown on 15th April 2003. The plot was covered with fleece and treated with a range of prophylactic pesticides throughout the growing period. The plants were harvest on 7th July and characterised for the minimum turnip descriptors. A digital camera was used to capture several images of each accession. The images are stored in association with the HRIGRU database.

In addition, the 8 seed samples of Italian *B. rapa* received from Dr Ferdinando Branca, DOFATA Catania (P7) in 2002 were grown in a Dutchlight frame and characterised using the minimum descriptors for turnip tops/greens. All 8 accessions were cytometry tested leading to the conclusion that one accession was not *B. rapa*.

Summary whole period:
The members of the *B. rapa* sub-group developed 4 subsets of minimum characterisation descriptors for use in the project, namely for turnip rape, root turnip, turnip tops/greens and the Asian leaf/head types.

Over the period of the project a total of 143 accessions of *B. rapa* have been characterised for the relevant minimum descriptors. Of the 143, a total of 38 core collection accessions were characterised, 18 in 2001, 18 in 2002 and 2 of the Italian accessions in 2003. Also in 2003 a total of 100 HRIGRU turnip accessions and the other 6 Italian *B. rapa* representatives were characterised. The milestone 2a required partner P2 to characterise between 10 – 20 accessions of *B. rapa* in years 2, 3 and 4. Therefore P2 had a target to characterise between 30 – 60 accessions during the project. In fact partner P2 characterised 143 *B. rapa* accessions, thus significantly exceeding the milestone. As reported above for milestone 1a the *B. rapa* characterisation data have been sent to P1 to be made available on the Internet in association with the Bras-EDB. In addition at HRIGRU, digital images were captured using both a digital camera and a flat-bed scanner for all the accessions in the characterisation trials. The images are stored in association with the HRIGRU database.

Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Fourth year:

A total of 52 accessions of biennial material, mainly turnip, was sown in 2002 to provide the plants for seed production during 2003, Table 1. The 52 accessions were from the HRIGRU collection and included 7 accessions that were sown again following their poor performance in the 2002 seed production programme. Seeds were sown and the plants grown on in a cool glasshouse in order to promote vernalisation over the winter. In spring, the plants were potted up and transferred into isolation compartments, where flies were used for pollination. Of the 52 accessions, 1 landrace was identified as *B oleracea* by morphology and cytometry, 2 other landraces were *B rapa* and *B napus* mixtures, 1 accession showed no germination and 2 others produced fewer than expected plants. The 3 poor performers have been sown again in 2003. A majority of accessions produced sufficient seeds to allow storage. The seed populations were germination tested, dried, packaged hermetically in foil laminate pouches and stored in the –20^{0}C cold room.

Summary whole period:
A total of 92 Brassica accessions have been regenerated during the project including 18 from the *B. rapa* core collection and the remainder from the HRIGRU collections. The seeds of the regenerated core collection accessions were distributed to the project partners for use in their characterisation and evaluation programmes. A majority of the core collection accessions regenerated are available for utilisation depending upon the conditions of the original Material Transfer Agreements. The seed populations of all the HRIGRU accessions regenerated were germination tested, dried, packaged hermetically in foil laminate pouches and stored in the long-term -20^{0}C cold room, and are available. The milestone 2b required partner P2 to regenerate 15 accessions per annum for 3 years, a total of 45 accessions. Therefore partner P2 achieved the milestone target, and in fact regenerated 47 additional accessions.

Milestone 3a *Part of the core collection evaluated*
Fourth year:
The *B. rapa* core collection of 100 accessions was screened for reaction to the fungal disease White Blister (*Albugo candida*) using *a second* isolate*, namely* Acem2. The pathology method was adapted from that developed to screen a core collection of *B. oleracea* germplasm in the EU funded project: "The location and exploitation of genes for pest and disease resistance in European genebank collections of horticultural brassicas" (AIR3-CT920463). The details of the methodology used in the pathology screen were reported in the year 2 annual project report, specifically for the production of seedlings for pathogen inoculation, the preparation of *A. candida* inoculum, the inoculation of seedlings, the scoring of the response of seedlings to *Albugo candida* and the presentation of the results.

The Acem2 isolate was collected from a wild plant of *Capsella bursa-pastoris* (L.) Medicus, Shepherd's Purse. This weed plant has long been suspected of acting as a winter host for the White blister fungus. The objective of using the Acem2 isolate was to score the reaction of the *B. rapa* core collection for susceptibility in order to assess the extent cross contamination from a common field crucifer weed. The results from the second pathogen screen showed that virtually all the accessions of the *B. rapa* core collection were totally resistant to the *Albugo candida* isolate Acem2. Only 5 accessions within the core collection exhibited plants that were susceptible to Acem2, namely BRA 1304 *B. rapa pekinensis laxa*, BRA 1247 *B. rapa trilocularis*, PI 165595 *B. rapa trilocularis*, BGRC 19021 *B. rapa dichotoma* and NLDCGN 6790 *B. rapa nipposinica*. Thus some wild and weedy plants may act as an over-wintering source of the fungus.

There is no obvious relationship between these results and the screen results produced in year 2 of the project using the *Albugo candida* isolate 7V.

The evaluation data produced from screening the *B. rapa* core collection against the Acem2 isolate of *Albugo candida* were collected and stored in a format consistent with that agreed by the project partners. The 2 data sets were forwarded to Noortje Bas in CGN for presentation on the Internet.

Summary whole period:
The *B. rapa* core collection of 100 accessions was screened for reaction to the fungal disease White Blister (*Albugo candida*) using 2 different isolates, namely 7V and Acem2, Table 2. The screening work was carried out by Eddie Byrne and Pam Gordon in the Sustainable Disease Resistance Team at HRI Wellesbourne. The results of the 2 pathology screens showed no obvious relationship between the reactions of the core to the 2 disease isolates. The original milestone 3a intended that

the *B. rapa* core collection be screened against 2 fungal diseases, Downy mildew and White blister. In the early stages of the project we experienced significant technical difficulties with establishing the Downy mildew disease on *B. rapa* seedlings in the controlled experimental conditions. Following discussion with the Co-ordinator we decided to test the *B. rapa* core collection against 2 isolates of White blister (*Albugo candida*) rather than waste time and resources within the project. The 2 screens for the White blister isolates accomplished an equivalent amount of work to the milestone target, although on a single disease.

The evaluation data produced from screening the *B. rapa* core collection against the 2 isolates of *Albugo candida* were forwarded to Noortje Bas in CGN for presentation on the Internet.

Milestone 4a *Bras-EDB updated allowing individual* ***PGR*** *partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*

Fourth year:
Seeds of all the HRIGRU accessions grown for regeneration have been harvested and cleaned. In due course sub-samples of these accessions will be sent to CGN as safety duplicates to be stored under a formal Memorandum of Understanding for black box security storage.

Summary whole period:
Seed of all the HRIGRU accessions regenerated during the project have been safety duplicated with CGN under a Memorandum of Understanding for black box security storage. Seed of the core collections regenerated during the project have been stored in the HRIGRU long-term seed store. These samples can be seen as a safety duplicate, but there is no formal agreement, other than with CGN, to maintain these samples as black box safety duplicates. Priorities for regeneration are to continue assessing all *Brassica* collections in HRIGRU and to prioritise accessions taking into account their cross-compatibility. Currently for *B. rapa* the HRIGRU collection contains 695 accessions, of which 95 require regeneration. However, this must be taken in the context of HRIGRU having 81 accessions of *B. napus* and >1900 *B. oleracea* awaiting regeneration.

Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*

In developing the *B. rapa* core collection we tried to identify accessions of wild *B. rapa* in the Bras-EDB. However, it was evident that very few collections of wild *B. rapa* exist in the collections represented in the Bras-EDB. In fact in a total of >3000 *B. rapa* accessions in the Bras-EDB only 12 had the Sample Status score of 1, i.e. a collection from the wild. Even a total of 12 may be an exaggeration because a closer look at the passport data revealed that some of these 12 accessions are probably not collections from wild populations. The ECP/GR *Brassica* Working Group Report, Vila Real, Portugal (2002) and the ECP/GR Vegetable Network Report from Skierniewice, Poland (2003) recommended that the collection of wild *B. rapa* material in ECP/GR countries be a major priority; the conclusions from this GENRES project concur fully with this proposal.

Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Fourth year:
The P2 HRIGRU final report was submitted November 2003, and the final financial statement for the fourth year will be sent to the Co-ordinator in January 2003.

Dave Astley made a presentation giving an overview of the achievements of the *B. rapa* group at the project Symposium held at the Institut fur Pflanzenbau und Pflanzenzüchtung, Justus-Liebig University of Giessen, Germany on the 11th December 2003.

Summary whole period:
All technical and financial annual reports and the final report were submitted on time.

Executive summary including highlights over the whole period:
Partner P2 achieved the milestones for year 4 and the Albugo work carried over from year 3.
Therefore over the whole project all milestones were met and in some cases exceeded significantly, particularly the characterisation and regeneration programmes.

Table 1. Accessions Regenerated in 2002/03

INSTCODE	ACCENUMB	ACCNAME	COMMONNAME
HRIGRU	003439	GREEN TOP STONE	TURNIP
HRIGRU	005141	BALLATER	TURNIP
HRIGRU	006588		TURNIP
HRIGRU	006825	04 CLUBROOT RESISTANT	TURNIP
HRIGRU	007003	NAVET LONG DU PALATINAT	TURNIP
HRIGRU	007203	BELADI (BALADY)	TURNIP
HRIGRU	007423	GELRIA R	TURNIP
HRIGRU	007424	GELRIA A	TURNIP
HRIGRU	007429	WAASLANDER	TURNIP
HRIGRU	007687	TIGRA	TURNIP
HRIGRU	007702	ABERDEEN McCOMBIES YELLOW	TURNIP
HRIGRU	007707	HARBINGER	TURNIP
HRIGRU	007709	GOLDEN SUNRISE	TURNIP
HRIGRU	007719	BLUE CAP (CLUCAS)	TURNIP
HRIGRU	007720	MILAN EARLY RED TOP	TURNIP
HRIGRU	007723	EARLY SNOWBALL IMPROVED (WHITE STONE)	TURNIP
HRIGRU	007724	INVINCIBLE GOLDEN YELLOW TOP	TURNIP
HRIGRU	007729	CHALLENGE GOLDEN GREEN TOP YELLOW	TURNIP
HRIGRU	007742	MASCHINELLA	TURNIP
HRIGRU	007743	BORTFELDER	TURNIP
HRIGRU	007748	NAVET MILAN ROND A FORCER	TURNIP
HRIGRU	009103	PURPLE TOP MAMMOTH	TURNIP
HRIGRU	009104	GREEN TOP WHITE	TURNIP
HRIGRU	009110	THE WALLACE (GREENGLOBE)	TURNIP
HRIGRU	009118	GREEN TOP YELLOW	TURNIP
HRIGRU	009488	NABO DA REGIAO	TURNIP
HRIGRU	010023	NABO	TURNIP
HRIGRU	011497	NABICA	B oleracea by cytometry
HRIGRU	011511	NAVAL SERODIO	TURNIP + TURNIP TOPS
HRIGRU	011535	NABO PARA GRELOS	TURNIP + FLW SHOOTS
HRIGRU	011564	NABAL CEDO	TURNIP + FLW SHOOTS
HRIGRU	011598	NABICA	TURNIP + FLW SHOOTS
HRIGRU	011610	NABAL	TURNIP + FLW SHOOTS
HRIGRU	011699	SHIN TSUDA	TURNIP
HRIGRU	012022	CAMPA - LEAF TURNIP	No plants produced
HRIGRU	012027	EARLY TENNOJI	TURNIP
HRIGRU	012029	EXTRA EARLY WHITE BALL	TURNIP
HRIGRU	012030	FORAGE STAR	STUBBLE TURNIP
HRIGRU	012033	PASJA	LEAF TURNIP
HRIGRU	012038	RONDO	TURNIP
HRIGRU	012045	TOKYO MARKET	TURNIP
HRIGRU	012071	NABO BRANCO + GRELOS	Resown 2003
HRIGRU	012107	NABO	TURNIP + FLW SHOOTS
HRIGRU	012114	NABO PARA GRELOS	TURNIP + FLW SHOOTS
HRIGRU	012180	NABINHA PARA NABO	Resown 2003
HRIGRU	012208	NABAL	TURNIP
HRIGRU	012340	GRELOS BRANCOS OU GRELEIROS	B rapa & B napus mix
HRIGRU	012344	NABOS - TURNIP	B rapa & B napus mix
HRIGRU	012664	KANAMACHI KOKABU	TURNIP
HRIGRU	013169	GOLDANA	TURNIP
HRIGRU	013171	KASKINAURIS	TURNIP
HRIGRU	013556	SOLANEPE	TURNIP

Contract no: RESGEN CT99 109/112

Project title: "*Brassica collections for Broadening Agricultural Use*" including 'Characterizing and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Participant no. P3: The Nordic Gene Bank (NGB), Box 41,S-230 53, Alnarp, Sweden

Names of participants: Gert Poulsen

Reporting period: 1st January to 31st December 2003 and summary over the whole period

Role in the project:
- Subordinator of *Brassica napus*
- Establishment of the core collection of *B .napus*
- Regeneration in order to make material available for evaluation
- Evaluation of core collection of *B .napus* for resistance to clubroot
- Supply of information to Bras-EDB

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*
Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Milestone 2a *Part of the core collection characterised.*
Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Milestone 3a *Part of the core collection evaluated*
Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*
Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*
Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*
Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Activities carried out during the fourth year and summary over the whole period

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*

Fourth year:
No task.

Summary whole period:
Updated NGB data were reported to the Bras-EDB in year 2000
All description and evaluation data originating from the project was reported using the agreed format.

Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Summary whole period:
In the beginning of 2002 a preliminary core collection af approximately 200 accessions were designed for evaluation during the present project
Based on the the characterization and evaluation performed in this project the core collection was reduced to 150 accessions

Milestone 2a *Part of the core collection characterised.*
Fourth year:
17 accessions of winter oilseed rape were sown at the Swedish Agricultural University research station at Torslunda (1627-E : 5639-N) 19th September 2002. These accessions were characterized this summer using the minimum descriptor list for oilseeds. In total 81 accessions were characterised.

Summary whole period

	2001	2002	2003	Σ
Swedes	42			42
Spring oilseed rape		12	0	12
Vegetables		10		10
Winter oilseed rape			17	17
Σ	42	22	17	81

Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Fourth year:
18 Brassica accessions were received from regeneration (see table below) while another 9 accessions are still in the field.

Table of Brassica accessions regenerated.		Recieved	In field
Brassica napus ssp. Oleifera DC.	Oilseed rape	6	0
Brassica napus var. napobrassica (L.) Rchb.	Swede	8	0
Brassica oleracea var. capitata f. alba DC.	White Cabbage	1	3
Brassica oleracea var. Gemmifera Zenker	Brussel sprouts	0	1
Brassica rapa ssp. Oleifera (DC.) Metzg.	Turnip Rape	0	1
Brassica rapa ssp. Rapa L.	Turnip	3	4

Summary whole period
In the whole project period 80 Brassica accessions were regenerated at NGB

Milestone 3a *Part of the core collection evaluated*
Fourth year:
Seeds of 40 swede accessions have been harvested and sent for oil quality analysis

Summary whole period
In 2002 188 accessions of the *Brassica napus* core collection were screened for resistance to clubroot (*Plasmodiophora brassicae*). Only two highly resistant accessions were identified

Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*
Summary whole period
According to agreements made in 3rd annual meeting, evaluation data in Excel sheets have been submitted for inclusion by the database manager.

Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*
Summary whole period
All accessions accepted for long term storage in NGB are safety stored under permafrost conditions at – 4 °C.

Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*
See Consolidated subgroup report (*B. napus*)

Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*
Technical reports and cost statements have been completed

Executive summary including highlights over the whole period:
188 accessions of the *Brassica napus* core collection were screened for resistance to clubroot (*Plasmodiophora brassicae*). Only two highly resistant accessions were identified: HRI 8722 and HRI 8679. 81 *B. napus* accessions have been characterised and 80 *Brassica* accessions have been regenerated.

Contract no: RESGEN CT99 109/112

Project title: "*Brassica collections for Broadening Agricultural Use*" including 'Characterizing and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Participant no. P4: UMR INRA ENSA Amélioration des plantes et biotechnologies végétales
BP 29
35653 LE RHEU

Names of participants: Pr. G.Thomas and P. Glory

Reporting period: 1st January to 31st December 2003 and summary over the whole period

Role in the project: Supply information for updating the common database.
Regeneration and characterization of *Brassica oleracea*.
Evaluation of the core collection for resistance to clubroot

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*
Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Milestone 2a *Part of the core collection characterised.*
Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Milestone 3a *Part of the core collection evaluated*
Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*
Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*
Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*
Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Activities carried out during the fourth year and summary over the whole period

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette*
Summary whole period:
All data of the French collection have been transmitted to Bras-EDB curator and included in the present Internet version.

Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Summary whole period:
The French P4 accessions with the requested amounts of seed have been provided for the constitution of the Core collections.

Milestone 2a *Part of the core collection characterised.*
Fourth year:
No more characterisation has been achieved in 2003
Summary whole period:
According to the minimum descriptor list revised by the *Brassica oleracea* subgroup, 65 accessions have been characterised among which:

26 accessions Of the French collection included in the *B. oleracea* core collection
39 Of the French global collection

Tables with characterisation data have been transmitted to P1 for inclusion in the Bras EDB.

Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Fourth year:
14 accessions of the French collection have been regenerated. Accessions regenerated:
5 *Brassica oleracea* var. *capitata*

9 *Brassica oleracea* var. *botrytis*

Summary whole period:
A total of 72 accessions of *B. oleracea* have been regenerated.
Seeds of this material are available for use.

Milestone 3a *Part of the core collection evaluated*
Fourth year:
For 2003, the last 198 accessions of the *Brassica oleracea* core collection have been evaluated with the second isolate (isolate K 92) of clubroot *(Plasmodiophora brassicae).* The whole *Brassica oleracea* core collection has thus been evaluated with this isolate. The test was performed under good conditions (good glasshouse environment and pathological conditions).

Summary whole period:
Evaluation for clubroot resistance has been performed for the whole *Brassica oleracea* core collection (396 accessions) with two different isolates MS 6 and K 92-16 (two single spore isolates from fields in France).
The disease index varies from 0 to 100 for one isolate and from 3 to 100 for the other isolate, see figure 1. However, the most resistant accession with a disease index of respectively 0 and 3 turned out to be a *B. rapa* in stead of a *B. oleracea* (see Table 1 and 2). Therefore the most resistant oleracea accession showed a disease index of respectively 18 and 44.

Fig. 1. Disease indexes for isolates Ms6 and K92-16

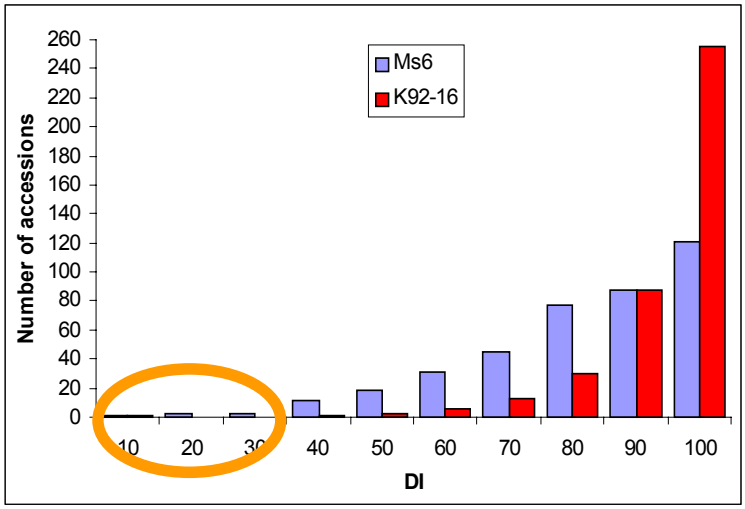


Table 1. Results of the most resistant accessions tested with both isolates

	Isolate Ms6			Isolate K92-16		
Accession	**DI**	**Class 0+1**	**Class 0**	**DI**	**Class 0+1**	**Class 0**
9566	0.00	100.00	100.00	3.04	97.06	90.78
BRA20	18.38	79.41	47.06	44.72	15.83	5.28
11646	24.79	63.33	55.28	60.49	15.13	5.00
2432	30.48	51.32	43.42	59.48	19.58	9.58
CGN15120	37.43	33.53	16.76	58.75	15.00	2.50
CGN15147	44.38	22.50	5.00	57.50	10.00	2.50

Table 2. Holding institute and cultivargroup of the most resistant accessions tested with both isolates

Accession	Holding institute	cultivargroup/name
9566	HRI	tronchuda (characterized as *B. rapa* in 2003)
BRA20	IPK	gongylodes / Knaufs Ideal
11646	HRI	tonchuda / Couve Tronchuda
2432	NGB	gemmifera / Tidlig Dvaerg 33
CGN15120	CGN	acephala sabellica / Westerwoldse Grove
CGN15147	CGN	acephala sabellica / Sel. Mars

Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*

Fourth year:

The data for clubroot resistance, obtained during second, third and fourth year of the project, have been sent to P1 in the requested format allowing links to the bras EDB.

Summary whole period:

The whole *Brassica oleracea* Core collection (396 accessions) has been evaluated for clubroot resistance. Data (disease index for each isolate and each accession) are available and have been transmitted to P1 for inclusion in the Bras EDB.

Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*

Fourth year:

Safety duplication prepared.

Summary whole period:

Seeds for Safety duplication are ready and will be sent to CGN under the blackbox arrangement.

Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*

Fourth year:

The gaps were discussed in the last project meeting in Giessen, Germany

Summary whole period:

Conclusions are given in the *B. oleracea* subgroup report.

Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Fourth year:

P4 annual report is transmitted.

Financial report for 4th year report is prepared.

Third Cost statement is submitted

Summary whole period:

All P4 annual reports and cost statements have been submitted.

Executive summary including highlights over the whole period:

Passport data of the P4 accessions have all been transmitted and included in the Bras-EDB.

A total of 65 accessions have been characterized and data sent to P1 to be linked to the Bras-EDB.

A total of 72 accessions have been regenerated and material is available for use.

The whole *Brassica oleracea* Core collection (396 accessions) has been evaluated for resistance to two French isolates of clubroot. Data are available (disease index for each accession with two isolates) and will be linked to the Bras EDB.

Contract no: RESGEN CT99 109/112

Project title: "*Brassica collections for Broadening Agricultural Use"* including 'Characterizing and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Participant no. P5: IPK Gatersleben (including Malchow branch station)

Names of participants: Klaus J. Dehmer, Marie-Luise Graichen, Evelin Willner
(KJD for *B. rapa* and *B. napus*, MLG only for *B. rapa,* EW only for *B. napus*)

Reporting period: 1st January to 31st December 2003 and summary over the whole period

Role in the project: Regeneration of *Brassica* accessions and seed supply for evaluation; Characterisation of primary descriptors; Supply information for updating common database and verification of database inputs; Participation in rationalisation and safety duplication of collections

Tasks during the project:

The tasks and milestones in which IPK participated in the fourth year/during the entire project include:

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*
Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Milestone 2a *Part of the core collection characterised.*
Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*
Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Activities carried out during the fourth year and summary over the whole period

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*

B. rapa
Fourth year:
IPK delivered a file containing all characterisation data on *B. rapa* produced within the project in due time to the co-ordinator.

Summary whole period:
Passport data on all *Brassica* accessions stored at IPK Gatersleben and at IPK Malchow/Poel were donated to the Bras-EDB, including the characterization data collected within the project. While the Malchow accessions constitute mainly fodder and oilseed type brassica's, the vegetable types are maintained at Gatersleben.

B. napus
Fourth year:
IPK delivered a file containing all characterization data on *B. napus* produced within the project in due time to the coordinator.

Summary whole period:
Passport data on the all *Brassica* accessions stored at IPK Gatersleben and at IPK Malchow/Poel were donated to the Bras-EDB, including the characterization data collected within the project. While the Malchow accessions constitute mainly fodder and oilseed type Brassicas, the vegetable types are maintained Gatersleben.

Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
B. rapa
Fourth year:

No activities were due by IPK in 2003.

Summary whole period:
IPK participated in the development of both the *B. rapa* and the *B. napus* core collection.

For all subgroups except *B. carinata*, IPK was donating the seed material requested by the sub-co-ordinators for either core collection development trials (*B. napus*) or already for the evaluations planned within the project (*B. oleracea, B. rapa*) in the required quantities.

B. napus
Fourth year:
No activities in 2003 were requested from IPK by the sub-coordinator.

Summary whole period:
IPK participated in the development of both the *B. napus* and the *B. rapa* core collection.

For all subgroups except *B. carinata*, IPK was donating the seed material requested by the sub-coordinators for either core collection development trials (*B. napus*) or already for the evaluations planned within the project (*B. oleracea, B. rapa*) in the required quantities.

Milestone 2a *Part of the core collection characterised.*
B. rapa
Fourth year:
As the minimum number of characterisations was already accomplished in 2002, IPK conducted only a taxonomic re-determination of six putative *Brassica rapa* L. em. Metzg. ssp. *oleifera* (DC.) Metzg. var. *silvestris* (Lam.) Briggs accessions of the IPK collection [more correct designation according to Rothmaler (2002): *Brassica rapa* L. em. Metzg. subsp. *campestris* (L.) A. R. Clapham]. Here, only two accessions (K4483, K7540) turned out to be true var. *silvestris*, while the others differed at least at the subspecies level from subsp. *oleifera* (table 1).

Summary whole period:
- minimum descriptors

Together with the other members of the *B. rapa* subgroup, IPK participated in the development of a *B. rapa* minimum descriptor list to be used in the characterisation tasks.

- characterisation

Within the framework of the *Brassica* RESGEN project, IPK did characterisations of a total of 43 accessions at their optimal harvesting stage according to its best local practice and to the *B. rapa* minimum descriptors developed within the project (plus three repetitions using different seed lots plus taxonomic re-determinations of six putative *B.r.* subsp. *oleifera* var. *silvestris* types, see table 1) As reported above for milestone 1a the *B. rapa* characterisation data have been sent to P1 to be made available on the Internet in association with the Bras-EDB. In addition, all accessions were photo-documented. Besides the generation of the desired characterisation data, the deviation from the characters expected according to the passport data led to changes in the respective taxonomic data of eight plus four accessions (BRA0338, BRA1236, BRA1272, BRA1594, CR1538, CR2228, K5098, K7599, table 2; BRA0430, K8511, K8532 and K9270. Thus, botanical determinations from 12 out of 49 accessions were corrected) and/or to the discarding of six entries (BRA0119, BRA0338, BRA1236, BRA1313, BRA1595 and K6629) after a second characterisation or where no other seed lots were available.

Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Fourth year:
36 *B. rapa* accessions were spring-sown, grown separately in isolation cabins and their seeds harvested in summer. As seeds of not all entries were processed by the reporting deadline, no 2003 average values on amounts of seeds harvested and average germination rates were calculated.

Summary whole period:
In characterization independent, spring-sown trials, a total of 93 accessions (plus three in comparison to the technical annex; all German accessions of the *B. rapa* core collection included) was sown during the project period, and seeds from 85 of these entries could be harvested, see table 2. (one accession not germinating, seven accessions of wrong type). Germination rates ranged from 34% to 100% (average 94.6%; four accessions. not yet processed and thus not taken into account – also in

following calculations). The average amount of seeds harvested was 112.6 g (minimum 1.8 g, maximum 726.1 g; four accessions. not yet processed and thus not taken into account), with TGM between 1.13 g and 4.00 g (average 2.31 g).

B. napus
Fourth year:
No activities in 2003 were requested from IPK by the sub-coordinator.

Summary whole period:
In addition to the characterization, seeds from all 78 of the above-mentioned entries were harvested, thus simultaneously safeguarding the regeneration of the respective material; seed amounts harvested were between 17.9 to 220.6 g (average 81.3 g), with germination rates between 90 and 100% (average 99.1 %) and TGMs between 1.97 g and 6.49 g (average 4.12 g; for all data see table 3.). Added to the 85 regenerations (excluding 8 accessions not harvested because of non-germination or off-type character) from the *B. rapa* part of the project, IPK did a total of 163 regenerations within the project.

Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*

B. rapa* and *B. napus
Fourth year:
As in previous years, respective amounts of the regenerated seeds were set aside as safety duplicates at the corresponding other IPK facility (Malchow for Gatersleben produced seeds, and vice versa).

Summary whole period:
In all three harvest years, adequate seed amounts of most of the regenerated material were set aside for safety duplication in two independent IPK locations, i.e. at the Gatersleben and Malchow storage facilities.
The respective storage capacities are also available for harboring external safety duplicates. Because of a reconstruction of the Gatersleben storage facility in 2003/2004 (as consequence of the fusion of the two German *ex situ* germplasm collections at BAZ Braunschweig and IPK), delays in the realization of respective agreements can possibly be unavoidable.

Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

B. rapa* and *B. napus
Fourth year:
The final report including all characterisation and regeneration data was submitted by IPK in November 2003, while its cost statement for the fourth year will be sent to the co-ordinator in January 2004.

Summary whole period:
All annual reports and the final report, including all characterisation and regeneration data, were submitted by IPK on time. The cost statements were delivered as soon as possible after the end of the respective financial years.

Executive summary including highlights over the whole period:
B. rapa
During the RESGEN CT99-109/112 project, IPK/IPKM contributed to a number of tasks within the *B. rapa* part of the project. It participated in the set-up of the *B. rapa* core collections and the minimum descriptors. In addition, passport and newly generated characterization data on 43 accessions of *B. rapa* were donated to the Bras-EDB.
During the characterizations, a total of 16 accessions exhibited characters deviating from the ones expected according to their passport data. In three cases, alternative seed lots were grown in the next growing season (total of characterizations: 46). In 12 out of 49 accessions, re-determinations

were performed (eight re-determinations in total; plus four re-determination of putative *B. rapa oleifera silvestris* accesssions), and six accessions will be discarded from the IPK *Brassica* collection. Seed material was delivered to all subprojects except *B. carinata*, while new seed material was generated for a total of 85 entries (93 sown, but eight not harvested because of non-germination or off-type character) and safety-duplicated.
Together with the 78 characterisations/regenerations from the *B. napus* part of the project, IPK with 121 accessions characterised and 163 accessions regenerated clearly surpassed the numbers due within the project (40/90).

B. napus
During the two years of voluntary participation in the *B. napus* part of the *Brassica* RESGEN CT99-109/112 project, IPK/IPKM contributed to a number of tasks within the project. It participated partially in the set-up of the *B. napus* core collections and the minimum descriptors. In addition, passport and newly generated characterization data on 78 *B. napus* accessions were donated to the Bras-EDB. Seed material was delivered to all subprojects except *B. carinata*, while new seed material was generated for all characterized 78 entries and safety-duplicated.
Together with the 43 characterizations and the 85 regenerations from the *B. rapa* part of the project, IPK with 121 characterizations and 163 regenerations clearly surpassed the numbers due within the project (40/90).

Table 1. *Brassica*/RESGEN CT99 109/112, Partner 5 (IPK Gatersleben) - *B. rapa oleifera silvestris* characterisations/re-determinations 2003 -

accession	botanical name	botanical name (re-determined)	remarks
BRA0430	*Brassica rapa* L. em. Metzg. ssp. *oleifera* (DC.) Metzg. var. *silvestris* (Lam.) Briggs	*Brassica rapa* L. em. Metzg. *pekinensis* (Lour.) Hanelt *pandurata* (Sun) Gladis	re-determined by U. Lohwasser
K4483	*Brassica rapa* L. em. Metzg. ssp. *oleifera* (DC.) Metzg. var. *silvestris* (Lam.) Briggs	*Brassica rapa* L. em. Metzg. *campestris* (L.) A. R. Clapham	confirmed by U. Lohwasser; synonym: *B. r. o.* var. *silvestris* (Lam.) Briggs
K7540	*Brassica rapa* L. em. Metzg. ssp. *oleifera* (DC.) Metzg. var. *silvestris* (Lam.) Briggs	*Brassica rapa* L. em. Metzg. *campestris* (L.) A. R. Clapham	confirmed by U. Lohwasser; synonym: *B. r. o.* var. *silvestris* (Lam.) Briggs
K8511	*Brassica rapa* L. em. Metzg. ssp. *oleifera* (DC.) Metzg. var. *silvestris* (Lam.) Briggs	*Brassica rapa* L. em. Metzg. *pekinensis* (Lour.) Hanelt *pandurata* (Sun) Gladis	re-determined by U. Lohwasser
K8532	*Brassica rapa* L. em. Metzg. ssp. *oleifera* (DC.) Metzg. var. *silvestris* (Lam.) Briggs	*Brassica rapa* L. em. Metzg. *chinensis* (Jusl.) Hanelt *rosularis* (Tsen & Lee) Hanelt	re-determined by U. Lohwasser
K9270	*Brassica rapa* L. em. Metzg. ssp. *oleifera* (DC.) Metzg. var. *silvestris* (Lam.) Briggs	*Brassica juncea* (L.) Czern. *juncea*	r re-determined by U. Lohwasser

Table 2. *Brassica*/RESGEN CT99 109/112, Partner 5 (IPK Gatersleben) – *B. rapa* regenerations 2001-2003 –

accession	no. of plants	seed weight	TGM	germ.
		[g]	[g]	[%]
K7177/00	5	4.7	1.63	98
K10409 orig. *	20	70.4	1.93	96
K10418 orig. *	20	278.3	1.93	90
K10420 orig. 98 *	20	401.2	2.27	98
K10420 orig. 99 *	20	278.0	2.47	94
K10424 orig. *	20	165.2	2.13	94
K10425 orig. *	20	80.5	2.77	90
K10430 orig. *	20	726.1	2.93	94
K10434 orig. *	20	492.3	2.40	96
K10439 orig. *	20	410.3	2.00	98
K10453 orig. *	20	402.5	2.37	98
K10465 orig. *	20	216.7	2.00	94
K10469 orig. *	20	315.4	1.93	98
BRA0341/85	11	40.7	1.63	98
BRA1017/00	11	20.9	1.47	92
BRA1023/00	6	12.8	1.80	94
BRA1594/95	(20)	-	-	-
K5987/91	20	60.8	1.83	98
DEUBGRC34824	15	37.9	1.60	98
DEUBGRC49579	10	24.3	2.17	100
DEUBGRC15407	20	82.5	1.57	36
BRA1295/96	20	91.5	2.07	94
K6629/89	20	73.9	2.33	98
K10211/orig.	20	134.1	2.23	98
BRA0118/76	20	101.7	1.90	98
BRA0118/78	20	99.7	1.50	98
BRA0118/92	20	70.5	1.43	100
BRA1122/80	20	77.4	2.40	100
BRA1125/77	20	144.8	2.73	100
BRA1130/80	20	99.5	2.50	100
BRA1137/91	20	131.7	2.47	100
BRA1302/87	20	39.0	2.33	95
BRA1313/90	20	33.7	2.43	96
BRA1591/90	20	16.0	1.97	94
BRA1640/95	20	38.8	2.43	99
BRA0210/78	20	123.3	3.20	98
BRA0456/80	20	185.3	3.77	98
BRA0472/83	20	40.0	2.27	80
BRA0989/79	20	303.7	2.97	100
BRA1119/80	20	68.2	3.40	100
BRA1124/77	20	109.6	2.67	95
BRA1297/98	20	44.8	2.17	99
BRA1304/88	20	348.4	2.97	98
BRA1596/99	(20)	-	-	-
BRA1596/orig.	(20)	-	-	-
BRA1596/99	(20)	-	-	-
DEUBGRC19021 *		31	4.00	100
CR2217/88 * (=BRA1247/88)		41	2.97	100
BRA1234/87	20	60.4	2.17	96
BRA1234/87	20	238.6	1.97	98

accession	no. of plants	seed weight	TGM	germ.
		[g]	[g]	[%]
BRA0228/79	20	69.3	1.53	98
BRA0459/79	20	70.3	1.87	100
BRA0464/78	20	38.5	2.03	100
BRA0469/79	20	51.7	2.53	100
BRA1299/85 orig.	-			
BRA1316/88	20	74.8	1.47	98
BRA0446/79	20	65.6	1.77	98
BRA0446/85	20	96.8	2.13	90
BRA1597/92	20	166.3	1.77	99
BRA0119/80	20	97.8	1.93	98
BRA1215/87	(20)			
BRA1215	20			
BRA0193/80	20	229.3	3.17	100
BRA 0202/81	20	106.1	2.47	64
BRA0202/81	20			
BRA0224/76	20	161.2	2.87	98
BRA0445/78	20	72.2	1.73	99
BRA0449/79	20	226.7	2.37	81
BRA0450/83	20	89.4	3.00	100
BRA0454/77	20	112.6	2.10	100
BRA0458/79	20	79.0	2.47	100
BRA0981/81	20	74.5	3.17	95
BRA0982/96	20	4.4	2.93	99
BRA0982/96*	20			
BRA1272/86	20	71.8	2.03	100
BRA1272/98	20	119.7	2.53	100
K5098/79	20	41.2	2.53	98
CR2211/92 *		38	1.32	38
K9836/97	20	74.4	1.13	34
K9836/97*	20			
CR1538/95 *		10	2.1	100
CR1543/87 *		26	2.00	100
CR2205/79 *		31	1.85	100
CR2228/88 *		42	1.86	100
DEUBGRC22534 *		57	1.74	99
CR1539/79 * (=BRA0184)		9	3.48	100
CR1542/87 * (=BRA0357)		5	3.9	100
DEUBGRC28622 *		28	3.06	100
K7599/94	20	564.9	2.30	98
BRA1236/96	20	1.8	3.20	96
BRA1236/86	(20)	-	-	-
K10407 orig. *	4	120.7	2.60	98
K10466 orig. *	20	-		-

total 2001-2003: 93/85 accs. (sown/harvested; including 10/8 repetitions); **bold:** core collection. Red accessions to be discarded from collection.

Table 3. *Brassica*/RESGEN CT99 109/112, Partner 5 (IPKM Malchow) – *B. napus regenerations* 2001-2002

Inst.code	Acc.no.	seed weight	TGM	germ. rate	Inst.code	Acc.no.	seed weight	TGM	germ. rate
spring types		[g]	[g]	[%]			[g]	[g]	[%]
					*DEUIPKM	CR0686/77	79.1	4.16	99
*DEUIPKM	CR0280/78	127	3.45	98	*DEUIPKM	CR0689/86a	48.2	3.46	99
*DEUIPKM	CR0303/95	80	3.04	100	*DEUIPKM	CR0707/99	60.6	3.45	100
*DEUIPKM	CR0637/93	135	3.02	95	*DEUIPKM	CR0715/89	86.3	3.90	99
*DEUIPKM	CR0680/96	85	3.89	97	*DEUIPKM	CR0718/96	131.6	4.75	99
*DEUIPKM	CR0704/91	100	3.51	98	*DEUIPKM	CR0719/98	120.5	4.59	100
*DEUIPKM	CR0807/79	107	2.43	90	*DEUIPKM	CR0740/90	91.4	4.50	100
*DEUIPKM	CR1050/93	111	1.97	93	*DEUIPKM	CR0743/90	55.5	4.18	98
*DEUIPKM	CR1055/95	50	3.84	95	*DEUIPKM	CR0754/79	53.6	4.38	99
*DEUIPKM	CR2005/94	73	2.50	95	*DEUIPKM	CR0759/97	68.8	3.42	100
*DEUIPKM	CR2272/94	63	3.71	99	*DEUIPKM	CR0773/92	108.9	3.97	100
*DEUIPKM	CR2275	61	3.23	99	*DEUIPKM	CR0774/88	100.4	4.13	100
*DEUIPKM	CR2277/94	69	3.53	96	*DEUIPKM	CR0780/79	118.7	4.30	100
*DEUIPKM	CR2284/93	26	3.76	99	*DEUIPKM	CR0787/92	102.4	4.14	100
					*DEUIPKM	CR0800/92	220.6	4.84	100
winter types					*DEUIPKM	CR0834/99	135.4	3.82	100
*DEUIPKM	CR0156/79	78.9	4.82	100	*DEUIPKM	CR0837/75	147.9	4.34	99
*DEUIPKM	CR0160/73	26.4	5.21	100	*DEUIPKM	CR0853/00	159.2	4.73	100
*DEUIPKM	CR0164/96	17.9	4.03	100	*DEUIPKM	CR0858/77a	60.5	3.93	99
*DEUIPKM	CR0167/92	66.6	3.49	100	*DEUIPKM	CR0862/97	85.3	4.80	100
*DEUIPKM	CR0172/92	65.9	4.32	100	*DEUIPKM	CR0870/94	78.8	5.12	99
*DEUIPKM	CR0181/86a	87.8	3.41	99	*DEUIPKM	CR0872/79	76.6	4.66	99
*DEUIPKM	CR0182/90b	87.4	4.52	100	*DEUIPKM	CR0880/79	104.2	4.28	100
*DEUIPKM	CR0192/79	58.5	4.34	100	*DEUIPKM	CR0884/94	91.4	4.12	100
*DEUIPKM	CR0241/90	78.9	3.30	100	*DEUIPKM	CR0904/79	89.8	4.65	99
*DEUIPKM	CR0279/88a	120.1	4.41	100	*DEUIPKM	CR0925/82	63.5	4.73	100
*DEUIPKM	CR0283/98	92.8	4.11	100	*DEUIPKM	CR0948/79	38.4	4.36	98
*DEUIPKM	CR0285/96	116.8	4.36	100	*DEUIPKM	CR0950/79	70.4	4.60	100
*DEUIPKM	CR0286/94	39.3	3.66	99	*DEUIPKM	CR0954/79	81.7	4.43	99
*DEUIPKM	CR0298/92	93.1	4.58	100	*DEUIPKM	CR0972/96	101.8	6.49	100
*DEUIPKM	CR0299/73	36.8	4.98	100	*DEUIPKM	CR1008/92	29.8	3.96	100
*DEUIPKM	CR0304/95	86.3	3.79	100	*DEUIPKM	CR1026/98a	67.2	5.49	100
*DEUIPKM	CR0307/84	56.8	3.72	100	*DEUIPKM	CR1039/92a	64.7	4.05	99
*DEUIPKM	CR0318/98	78.5	4.15	100	*DEUIPKM	CR1059/83a	34.2	3.41	100
*DEUIPKM	CR0327/91	54.6	5.23	99	*DEUIPKM	CR1060/95	43.5	4.68	98
*DEUIPKM	CR0561/96	62.1	2.94	99	*DEUIPKM	CR1191/81	48.9	3.56	100
*DEUIPKM	CR0629/76a	109.4	5.23	100	*DEUIPKM	CR2186/97	76.5	4.19	100
*DEUIPKM	CR0629/76a	104.3	4.99	100	*DEUIPKM	CR2187/87	82.6	4.53	100
*DEUIPKM	CR0646/92	106.0	3.74	99	*DEUIPKM	CR2198/98	49.6	4.00	99
*DEUIPKM	CR0658/86	73.2	4.62	99					
*DEUIPKM	CR0659/97	73.4	4.75	100					
*DEUIPKM	CR0682/92	55.5	3.98	98					

Contract no: RESGEN CT99 109/112

Project title: "*Brassica collections for Broadening Agricultural Use"* including 'Characterizing and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Participant no P6: National Agricultural Research Foundation (N.AG.REF)
Agricultural Research Centre of Makedonia and Thraki
Greek Gene Bank
Thessaloniki, Greece

Name of participant: Nikolaos Stavropoulos

Reporting period: January 1 to December 31, 2003 and summary whole period

Role in the project:
- Regeneration and characterisation of *Brassica* germplasm
- Seed distribution for evaluation to other partners
- Contribution to the formation of the core collections
- Documentation of data in GGB database and contribution to the Bras- EDB
- Contribution to the identification of duplicates

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*
Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Milestone 2a *Part of the core collection characterised.*
Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Milestone 4a *Bras-EDB updated allowing individual PGR partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*
Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*
Milestone 5 *Final report comprising overall results from the project submitted with the cost statements to the European Commission.*

Activities carried out during the fourth year and summary over the whole period

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*

Summary whole period:
Partner P6 has sent the passport data of the Greek Gene Bank collection, which were included in the Bras-EDB

Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Summary whole period:

P6 identified two cabbage accessions, to be included in the core collection.

Milestone 2a *Part of the core collection characterised.*
Fourth year:
A set of 22 new accessions was sown on 1st August 2002 for regeneration and characterisation in the last year (2 *B. cretica* and 20 *B. oleracea*, list given in third year report). Plantlets were transplanted in pots on October 2nd and in the field and cages on 21-25th November 2002. In addition, another set of 85 accessions of year 2001-2002, represented by only 10 plants each, were resown on September 26th 2003 for characterisation and complementary seed production, since most accessions in the second year bolted before producing a sizeable head. However, as a result of the extremely high temperatures prevailing in spring 2003 premature bolting and limited head formation occurred.
For these reasons it was decided to resow very early another set of 70 accessions to produce heads for full characterisation and get additional seed. Seed was sown on June 17, 2003, transplanted in pots in

July and finally in the field on August 11, 2003. Head formation was satisfactory and continues to date. Characterisation records on most accessions were taken in October- November 2003 and will be completed in December when heading will be expected to be completed.
All results were sent to P1.

Site data for 3rd- 4th year characterisation/regeneration:

Country of characterisation and evaluation	GREECE
Site (Research Institute)	Thessaloniki
Name of person in charge	Stavropoulos N
Sowing date	1-8-2002, 17-6-2003
Transplant date	21/11/02, 17-8-03
First harvest date	
Last harvest date	

Summary whole period:
In total 124 accessions were characterised according the minimum descriptors.
All data were sent to P1 for inclusion in the Bras-EDB.

Milestone 2b *Part of the (core) collection regenerated and this material will be available for use.*
Fourth year:
The material sown for characterisation (milestone 2a) was also used for regeneration. Seed was harvested from 3 July to 25 July 2003. Only 40 accessions produced seed. Seed production (Table 1) was extremely variable (ranging from 0.3 to 255 g) and in many accessions very limited, due to the unusually high temperatures (28-35^{0}C) in spring 2003 which probably affected pollen fertility. Satisfactory seed set was only recorded in accessions grown in reproductive isolation cages covered with green plastic fabric, that provided partial shade and more normal temperature regime. Early high spring temperatures resulted also in premature bolting and limited head formation.
It was also decided to resow very early a set of 70 accessions to produce heads for full characterisation and get additional seed (see milestone 2a). Seed was sown on June 17 2003, transplanted in pots in July and finally in the field on August 11, 2003. These accessions will be maintained until summer 2004 to get an additional lot of seed.

Summary whole period:
In total 106 accessions were regenerated.
The seed is available to the partners for further evaluation work and for safety duplication.

Milestone 4a *Bras-EDB updated allowing individual PGR partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*

The material at the Greek Gene Bank collection is unique. However the possibility to trace duplicates of this material to other European gene banks now exists, through the cross- check using the Bras-EDB.

Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*

For cultivated *B. oleracea* material there are gaps for material from Greece (except the northeastern part). For wild material there are gaps for material from the coasts of the northern part of the Ionic Sea and the Aegean Sea.

Milestone 5 *Final report comprising overall results from the project submitted with the cost statements to the European Commission.*

All Technical annual reports and the financial statements were send to the coordinator.

Summary
P6 characterised 124 accessions of *B. oleracea* and regenerated 106 accessions under which a few accessions of the near related wild species *B. cretica.*

All characterisation data were sent to P1.
P6 identified gaps in the collection for material originating from Greece.

Table 1 Seed Production in 2003 (2002-2003)

NR	COLLNO	ACCNO	GEN	SP	SS	g
1	BR019/82	631	BRAS	OLER	CA	0,29
2	GR204/83	2675	BRAS	OLER		0,30
3	BR016/82	628	BRAS	OLER	CA	0,58
4	GR122/82	1019	BRAS	OLER		1,61
5	GR184/83	2654	BRAS	OLER		1,73
6	GR189/83	2660	BRAS	OLER		1,80
7	GR183/83	2654	BRAS	OLER		2,00
8	GR177/83	2648	BRAS	OLER		2,03
9	BR017/82	629	BRAS	OLER	CA	2,05
10	GR129/82	1026	BRAS	OLER		2,06
11	BR009/82	621	BRAS	OLER	CA	2,46
12	BR021/82	633	BRAS	OLER	CA	2,51
13	BR011/82	623	BRAS	OLER	CA	2,53
14	GR208/83	2679	BRAS	OLER		3,00
15	BR018/82	630	BRAS	OLER	CA	3,08
16	GR218/83	2689	BRAS	OLER		3,32
17	GR211/83	2682	BRAS	OLER		3,48
18	GR001/82	898	BRAS	OLER		3,90
19	GR076/82	973	BRAS	OLER		4,17
20	GR100/82	997	BRAS	OLER		5,33
21	GR187/83	2658	BRAS	OLER		6,70
22	BR023/82	635	BRAS	OLER	CA	6,72
23	GR083/82	980	BRAS	OLER		7,15
24	GR194/83	2665	BRAS	OLER		7,36
25	GR175/83	2646	BRAS	OLER		7,78
26	GR181/83	2652	BRAS	OLER		8,72
27	GR016/82	653	BRAS	CRET	CR	9,26
28	GR217/83	2688	BRAS	OLER		9,80
29	GR215/83	2686	BRAS	OLER		12,13
30	GR192/83	2663	BRAS	OLER		13,22
31	BR002/82	614	BRAS	OLER	CA	13,30
32	GR207/83	2678	BRAS	OLER		14,60
33	GR176/83	2647	BRAS	OLER		26,66
34	GR209/83	2680	BRAS	OLER		28,80
35	BR014/82	626	BRAS	OLER	CA	42,34
36	GR216/83	2687	BRAS	OLER		53,72
37	GR027/83	1964	BRAS	CRET	CR	77,61
38	GR118/82	1015	BRAS	OLER		98,73
39	GR226/83	2697	BRAS	OLER		201,00
40	GR229/83	2700	BRAS	OLER		254,66

Contract no: RESGEN CT99 109/112

Project title: "Brassica collections for Broadening Agricultural Use" including 'Characterizing and utilising genetic variation in Brassica carinata for its exploitation as an oilseed crop"

Participant no. P7: DOFATA – UNIVERSITA' DI CATANIA (Italy)

Names of participants: Ferdinando Branca

Reporting period: 1st January 2003 to 31st December 2003 and summary over the whole period

Role in the project: Regeneration and characterisation of some accessions of the B. oleracea core collection.
Evaluation for salt tolerance of a set of accessions of B. oleracea core collection
Updating central data base with new data in co-operation with IGB, Bari

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*
Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Milestone 2a *Part of the core collection characterised.*
Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Milestone 3a *Part of the core collection evaluated*
Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*
Milestone 4a *Bras-EDB updated allowing individual PGR partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*
Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*
Milestone 5 *Final report comprising overall results from the project submitted with the cost statements to the European Commission.*

Activities carried out during the fourth year and summary over the whole period

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*

Summary whole period:

The Istituto del Germoplasma di Bari (CNRIDG) up-dated the Bras-EDB and listed 528 accessions belonging to Brassica genera of which 261 belonging to B. oleracea Of these accessions conserved by CNRIDG 333 were collected in Italy and 195 in several foreign countries. All passport data available related to the above cited accessions were inserted in Bras-EDB.

Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*

Summary whole period:

In order to identify the Italian accessions to insert into the project core collection, a specific meeting was held in Bari at the Istituto del Germoplasma (IGB), belonging to National Research Council (CNR), with dr. Pietro Perrino (director and collection curator) and dr. Gaetano Laghetti (researcher). In this occasion the Brassica collection held at CNRIGB was observed and the related passport data in view to update Bras-EDB was analysed. In particular, it was ascertained that most accessions collected in Italy are not well characterised as consequence of the great variability of the main biological and morphological characters, which contribute to widespread several cultivated forms in different Italian regions. In spite of these difficulties we decided to choose the accessions in relation to the regions of origin and to the availability of seed amount requested for characterisation and evaluation activities. In particular, we identified two accessions of B. acephala, eight of B. oleracea convar. botrytis, eight of B. oleracea convar. italica and two of B. oleracea convar. gongylodes
The seed samples related to the Italian accessions were sent directly from IGB to CGN. One kale accession did not have enough seed and was not included in the core

Milestone 2a. *Part of the four Brassica collections characterised*

Fourth Year:
In the fourth year of the project the accessions sown in August 2002 (34 accessions of the core) were characterised for the minimum descriptors. In March 2003 also 25 cauliflower and 10 broccoli accessions of the core collection were sown and characterised in August 2003 before the end of the project.

Summary whole period:
Characterisation for the minimal descriptors was carried out on 100 accessions of the B. oleracea core collection: 67 accessions of cauliflower, 30 of broccoli, and of cabbage, kale and kohlrabi each one accession. Two commercial accessions, one of broccoli (Lord F1 hybrid) and one of cauliflower (CV 116 – DOFATA collection) were utilised as controls during all years. This activity was carried out on the same material as used for the salt tolerance evaluations. There were three growing cycles: transplanting on 12-10-2001, on 23-09-2002 and on 30-05-2003. The plants were transplanted in pots of about 10 litre containing as substrate peat and sand (1:1 in volume) and placed in a cold greenhouse. The characterisation was carried out after the inflorescence appeared in all accessions.
For cauliflower and broccoli not all accessions reached the reproductive stages during the growing period; in particular, six accessions of cauliflower and three of broccoli did not reach flower induction in the first two cycles. Four cauliflower accessions did not reach the reproductive stages probably as a consequence of their high cold requirements for flower induction. All accessions tested during the third cycle did not reach flower induction because they were sown March and characterised in August in order to have results before the end of the project.
The accessions were in general more uniform for cauliflower than for broccoli, but showed significant differences between accessions. In particular, of the 67 accessions of cauliflower 24 were less uniform whereas for broccoli only six of the 30 accessions were uniform.
The variation between cauliflower accessions was mainly for leaf, flower head solidity, curd colour and harvest time. Broccoli accessions showed variation for most of the descriptors observed except for leaf division and curd colour. The cabbage accession characterised belongs to the white cabbage group, the kale to “Cavolo Nero” type, and kohlrabi to the white kohlrabi group.

The results of the first cycle were given in the third year report.
All characterisation data were sent to P1 for linking to the Bras-EDB.

Milestone 2b. *Part of the four Brassica collections regenerated*
Fourth Year:
In the third year no seed samples were received from IDG, Bari. Therefore twelve *B. rapa* accessions of the DOFATA collection were regenerated: CM1, CM2, CM3, CM6, CM8, CM10, CM13, CM14, CM18, CM21, CM22 and CM24. All accessions were sown, transplanted in pots for regeneration in isolations, using flesh fly (*Sarcophaga carnaria* L.) as cross-pollinator.

Summary whole period:
Eight accessions of *B. rapa* from the collection of the Italian National Germplasm Bank of Bari and twelve *B. rapa* accessions of DOFATA collection were regenerated during the second and fourth year respectively. The seeds were sent to the National Germplasm Bank of Bari and to the Horticultural Research International to use for the project tasks.

Milestone 3a. *Evaluation of part of the B. oleracea core collection*
Fourth Year:
In the fourth year of the project the accessions sown in August 2002 (34 accessions of the core) were evaluated for salt tolerance. In March 2003 also 25 cauliflower and 10 broccoli accessions of the core collection were sown and evaluated for salt tolerance in August 2003 in order to obtain results before the end of the project.

Summary whole period:
Evaluation activities for salt tolerance were carried out on 100 accessions of the core collection and are the same accessions which were characterised during the project. The transplanting dates were 12th of October 2001 for the first evaluation cycle, 23rd of September 2002 for the second and 30th of May 2003 for the third one. The plants were transplanted in 9 litre pots with a substrate of peat and sand (1:1) sixty plants per accessions were placed in a cold greenhouse. Twenty plants per accession where evaluated for each of three salt conditions. Plants were irrigated with a nutrient solution with the addition of the three different doses of NaCl (0, 2 and 4 g l^{-1}) corresponding respectively at 1500, 5200 and 8400 µS cm^{-1}. At

the commercial stage the harvest date, the plant fresh and dry weight and the main characteristics of the commercial product were recorded. All growing data are given in tables 1 and 2.

Table 1. Growing data

	1st cycle	2nd cycle	3rd cycle
Transplanting date	12/10/01	23/09/02	30/05/03
Last harvest	15/05/02	27/03/03	08/08/03
Growing cycle length (d)	215	185	70
Mean temperature (°C)	18.7	22.4	33.7
Mean radiation (W m^{-2} d^{-1})	1950	1280	3940
Water supply (litre $plant^{-1}$)	96.8	68.5	38.4
N (g $plant^{-1}$)	69.7	49.3	61.9
P (g $plant^{-1}$)	52.2	37.0	43.8
K (g $plant^{-1}$)	61.9	20.7	24.6

Table 2. Electrical conductivity (EC) and pH registered during the three growing cycles

NaCl dose (g $litre^{-1}$)	EC (µS cm^{-1})	pH
0	1120±628	6.9±0.2
2	5248±863	7.0±0.4
4	8259±1112	7.0±0.2

Six accessions of cauliflower (HRI7440, INRALR 634, CNRIDG 203297, CGN 15129, HRI4292 and INRALR 633) and three of broccoli (HRI 3516, CNRIDG 203329 and HRI 3566) did not form a curd during the first two growing cycles probably as a consequence of their high cold requirement for flower induction. During the third cycle the temperatures were not low enough to induce flowering for both the cauliflower and broccoli accessions, because the plants were sown in March and evaluated in August in order to have the data before the end of the project. For the latter growing cycle only plant weight was considered as a parameter to measure salt stress because during the first and the second evaluation cycles a significant correlation was observed between plant and curd weight.
For all cauliflower accessions salt conditions affected significantly all the parameters registered (Table 3). Plant and curd fresh weight was strongly reduced by the highest salt solution (4g^{-l} NaCl). The reduction for plant weight was round 35% in the first two cycles, but around 55% in the last cycle. The reduction for curd weight was 37% in the first and about 45% in the second cycle compared to the control solution.
Broccoli accessions seem to be somewhat more resistant to salt conditions in comparison with cauliflower. The reduction observed for the fresh weight of the plants grown with the nutritive solution with the highest EC compared to the control solution was about 23% in the first 33% in the second, but 70% in the third cycle (Table 4). The reduction of curd weight under the highest salt condition was about 41% in the first and 33% in the second cycle compared to the plants grown under the control solution.
From the above results it is clear that the three cycles differed considerably. In the third cycle the reduction caused by salt stress was much higher than in the first. This makes the comparison between accessions tested in different cycles difficult.

For scoring tolerance to salt stress conditions, the values of plant and curd weight registered for dose 0 (g $litre^{-1}$ NaCl), were considered equal to 100. The values registered for doses 2 and 4 (g $litre^{-1}$ NaCl) were calculated as the relative reduction from the 0 dose.
On the basis of the relative reduction of plant and curd weight at the salt conditions tested, the accessions were scored as followed:

score 1 = plant and curd weight reduction < 20%;
score 2 = plant and curd weight reduction between 21÷40%;
score 3 = plant and curd weight reduction > 41%.

Results
For cauliflower the most tolerant accessions to salt conditions regarding curd weight reduction are CGN 11081, CGN 15135, CNRIDG 203313, CNRIDG 203324, HRI 6247, IPK BRA1398, NGB 1818 and NGB 2429.
The most sensitive are: CGN 15133, CNRIDG 201563, CNRIDG 203360, HRI 4861, HRI 7521, INRALR 630, INRALR 631, VALUPV CB 11, VALUPV CB 14 and VALUPV CB 40 (Table 5)

For broccoli the most tolerant accessions to salt conditions regarding curd weight reduction are CNRIDG 203370, HRI 4707, HRI 4721, HRI 6703, HRI 7514, HRI 9842 and IPK 1427.
The most sensitive are CNRIDG 203228 and HRI 7528 (Table 6).
For the three accessions of each cabbage (CGN7127), kale (CNRIDG 203331), and kohlrabi (CNRIDG 203035), the cabbage accession was the most sensitive to salt conditions with a reduction at the highest salt dose of more than 50% of the plant weight in relation to the control. The kale accession and the kohlrabi accession showed high tolerance to soil salinity with a very modest reduction.

Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*
The results of the characterisation and evaluation data were sent to P1.

Milestone 4a *Bras-EDB updated allowing individual PGR partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*
no task for Partner 7.

Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*
no task for Partner 7

Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*
Fourth year
P7 organised the fourth project meeting in Catania from 12th to 16th February 2003. Partners could also enjoy the huge variation of Sicilian cauliflower. Locations of wild n=9 *Brassica* species were visited.
Annual report was prepared and submitted.

Summary whole period
All annual and financial reports were submitted

Publications:
Branca F., 2002. III Meeting del progetto europeo RESGEN CT99 – 109/112 sulle *Brassicaceae* organizzato a Catania. Notiziario Risorse Genetiche Vegetali, III, 2, 1-3. Istituto Sperimentale per la Frutticoltura, Roma.
Branca F., Argento S., 2004. Valutazione di una "*Core collection*" europea di cavolfiore e di cavolo broccolo per la tolleranza alla salinità. To present at the next Scientific meeting of the Italian Society of Horticulture planed at Naples in May 2004

Table 3. Means of biometrical parameters in relation to salt concentration for cauliflower.

first evaluation cycle

	Harvest time (d)	Leaves (n)	Plant weight (g)	Leaves weight (g)	Stem weight (g)	Curd weight (g)
Salt doses						
0	114	31.4	983	593	236	193
2	111	30.9	886	504	200	176
4	117	30.0	670	437	129	123

second evaluation cycle

	Harvest time (d)	Leaves (n)	Plant weight (g)	Leaves weight (g)	Stem weight (g)	Curd weight (g)
Salt doses						
0	138.9	30	894.8	481.0	256.1	250.6
2	135.3	29	704.2	383.9	177.2	181.0
4	128.3	29	578.2	342.3	130.5	135.0

third evaluation cycle

	Harvest time (d)	Leaves (n)	Plant weight (g)	Leaves weight (g)	Stem weight (g)	Curd weight (g)
Salt doses						
0	-	20	600.7	464.0	135.5	-
2	-	20	452.6	387.5	65.1	-
4	-	17	250.7	224.0	25.3	-

Table 4. Means of biometrical parameters in relation to salt concentration for broccoli.

first evaluation cycle

	Harvest time (d)	Leaves (n)	Plant weight (g)	Leaves weight (g)	Stem weight (g)	Curd weight (g)
Salt doses						
0	118	26.8	839	437	322	109
2	116	26.8	772	417	292	79
4	123	25.9	644	405	187	65

second evaluation cycle

	Harvest time (d)	Leaves (n)	Plant weight (g)	Leaves weight (g)	Stem weight (g)	Curd weight (g)
Salt doses						
0	135.8	26	779.7	408.3	350.3	75.3
2	127.2	25	700.5	386.6	259.4	69.5
4	119.8	24	524.0	299.5	182.6	50.8

third evaluation cycle

	Harvest time (d)	Leaves (n)	Plant weight (g)	Leaves weight (g)	Stem weight (g)	Curd weight (g)
Salt doses						
0	-	21	597.0	446.3	150.7	-
2	-	19	371.1	308.4	62.7	-
4	-	16	182.9	161	21.8	-

Table 5. Cauliflower accessions. Scoring for tolerance to salt stress conditions in relation to plant and curd fresh weight

Cycle	INSTCODE	ACCENUMB	SPECIES	SUBTAXA	ACCNAME	Plant fresh weight	Curd fresh weight
						score*	score*
1	IPK	BRA 290	B. oleracea	var. botrytis	Wartburgland	2	2
3	CGN	11073	B. oleracea	var. botrytis	G.d.N.Tardif-Rubaco	2	-
1	CGN	11081	B. oleracea	var. botrytis	Herfstreuzen-Kibo Reuzen	1	1
1	CGN	11103	B. oleracea	var. botrytis	Lecerf-Lero	2	2
3	CGN	11114	B. oleracea	var. botrytis	Selfblanche-Brendo	2	-
3	CGN	11982	B. oleracea	var. botrytis	Ceratus	2	-
3	CGN	13962	B. oleracea	var. botrytis	Alpha-Kassa	2	-
1	CGN	14027	B. oleracea	var. botrytis		1	2
3	CGN	14059	B. oleracea	var. botrytis	Balady	2	-
3	CGN	14065	B. oleracea	var. botrytis	Mechelse-Panda	2	-
3	CGN	14102	B. oleracea	var. botrytis	Goodman	2	-
1	CGN	15129	B. oleracea	var. botrytis	Wal.Wi.-Armado Tardo	2	-
3	CGN	15131	B. oleracea	var. botrytis	Fermalba	2	-
2	CGN	15133	B. oleracea	var. botrytis	Erfurter-Helios	2	3
1	CGN	15135	B. oleracea	var. botrytis	Alpha-Record	1	1
2	CGN	15136	B. oleracea	var. botrytis	Danova	1	2
3	CGN	07131	B. oleracea	var. botrytis	Snowball	2	-
3	CGN	07135	B. oleracea	var. botrytis	Balady	2	-
2	CNRIDG	201563	B. oleracea	var. botrytis		2	3
3	CNRIDG	203279	B. oleracea	var. botrytis		2	-
1	CNRIDG	203281	B. oleracea	var. botrytis		2	1
1	CNRIDG	203284	B. oleracea	var. botrytis		2	2
3	CNRIDG	203288	B. oleracea	var. botrytis		3	-
1	CNRIDG	203297	B. oleracea	var. botrytis		2	-
2	CNRIDG	203305	B. oleracea	var. botrytis		1	2
2	CNRIDG	203313	B. oleracea	var. botrytis		1	1
1	CNRIDG	203320	B. oleracea	var. botrytis		2	2
1	CNRIDG	203324	B. oleracea	var. botrytis		1	1
1	CNRIDG	203360	B. oleracea	var. botrytis		2	3
	CV 116		B. oleracea	var. botrytis		2	2
2	HRI	2838	B. oleracea	var. botrytis	Algromajo No 2	2	3
3	HRI	2891	B. oleracea	var. botrytis	St Malo Half Hatif	3	-
2	HRI	3419	B. oleracea	var. botrytis	Albado	1	2
2	HRI	4250	B. oleracea	var. botrytis	Kangaroo	2	2
2	HRI	4492	B. oleracea	var. botrytis	Winter Roscoff	3	-
3	HRI	4814	B. oleracea	var. botrytis	Bianco Napoletano Natalino	3	-
3	HRI	4847	B. oleracea	var. botrytis	Verde Di Macerata	3	-
1	HRI	4861	B. oleracea	var. botrytis	Romanesco Natalino	2	3
3	HRI	4988	B. oleracea	var. botrytis	Italian Pyramid Type	3	-
3	HRI	4991	B. oleracea	var. botrytis	All the Year Round	2	-
2	HRI	6247	B. oleracea	var. botrytis	Urozanaya	2	1
3	HRI	6254	B. oleracea	var. botrytis	Tasman	3	-
1	HRI	7440	B. oleracea	var. botrytis	Lenormand A Pied Court	3	-
1	HRI	7458	B. oleracea	var. botrytis	Bola De Neve	2	2
1	HRI	7474	B. oleracea	var. botrytis	Bondi	2	2
3	HRI	7520	B. oleracea	var. botrytis	Romanesco	3	-
2	HRI	7521	B. oleracea	var. botrytis	Adlerskaja Zimniaja	3	3
3	HRI	8265	B. oleracea	var. botrytis	Nurit	3	-
3	HRI	8718	B. oleracea	var. botrytis	Carter's Late	3	-
2	INRALR	449	B. oleracea	var. botrytis	fle 62.03	2	2
1	INRALR	629	B. oleracea	var. botrytis	FM 48	2	2
1	INRALR	630	B. oleracea	var. botrytis	J 73	2	3
1	INRALR	631	B. oleracea	var. botrytis	M 90 B	3	3
1	INRALR	632	B. oleracea	var. botrytis	MA 85	2	2
2	INRALR	633	B. oleracea	var. botrytis	A 91	3	-

1	INRALR	634	B. oleracea	var. botrytis	A MI 116	1	-
3	INRALR	635	B. oleracea	var. botrytis	MI 118	3	-
3	INRALR	636	B. oleracea	var. botrytis	ND 125	3	-
2	INRALR	637	B. oleracea	var. botrytis	DJ 128	2	2
1	INRALR	638	B. oleracea	var. botrytis	F 147	1	2
1	IPK	BRA 1398	B. oleracea	var. botrytis	Maximus	1	1
3	MG	203332	B. oleracea	var. botrytis		3	-
2	NGB	1818	B. oleracea	var. botrytis	Igloo	1	1
2	NGB	2429	B. oleracea	var. botrytis	Erfurter Vali	1	1
3	VALUPV	C-B-105	B. oleracea	var. botrytis		3	-
2	VALUPV	C-B-11	B. oleracea	var. botrytis		3	3
1	VALUPV	C-B-14	B. oleracea	var. botrytis		2	3
1	VALUPV	C-B-40	B. oleracea	var. botrytis		1	3

*1= < 20% of value reduction at 4 g l-1 salt doses with reference to the control (0 g l-1)
2= 21-40% of value reduction at 4 g l-1 salt doses with reference to the control (0 g l-1)
3= > 41% of value reduction at 4 g l-1 salt doses with reference to the control (0 g l-1)

Table 6. Broccoli accessions. Scoring of plant salt resistance in relation to plant and curd fresh weight.

Cycle	INSTCODE	ACCENUMB	SPECIES	SUBTAXA	ACCNAME	Plant fresh weight	Curd fresh weight
						score*	score*
1	CNRIDG	203220	B. oleracea	var. italica		2	2
3	CNRIDG	203221	B. oleracea	var. italica		2	-
1	CNRIDG	203228	B. oleracea	var. italica		1	3
2	CNRIDG	203229	B. oleracea	var. italica		2	2
2	CNRIDG	203329	B. oleracea	var. italica		2	-
2	CNRIDG	203370	B. oleracea	var. italica		1	1
2	HRI	2398	B. oleracea	var. italica	Picolini Di Palermo	2	2
3	HRI	3228	B. oleracea	var. italica	Ramoso Calabria Tardivo	3	-
1	HRI	3516	B. oleracea	var. italica	Purple Sprouting Early	1	-
3	HRI	3543	B. oleracea	var. italica	Purple Sprouting Late Im	2	-
3	HRI	3546	B. oleracea	var. italica	White Sprouting Early	3	-
2	HRI	3566	B. oleracea	var. italica	Late White Sprouting	3	-
3	HRI	3577	B. oleracea	var. italica	Purple Cape	3	-
2	HRI	4707	B. oleracea	var. italica	Ramoso Atlantic (Local)	1	1
2	HRI	4721	B. oleracea	var. italica	Broccolo Natalino Di Sar	1	1
3	HRI	4872	B. oleracea	var. italica	Violetto Di Sicilia	3	-
3	HRI	4885	B. oleracea	var. italica	Broccolo Nero Spigariello	3	-
3	HRI	5256	B. oleracea	var. italica	Violetto Precoce di Sicilia	3	-
3	HRI	5416	B. oleracea	var. italica	Cavolo Cavolina Rizza	3	-
3	HRI	6223	B. oleracea	var. italica		3	-
2	HRI	6703	B. oleracea	var. italica	Early Purple Head	1	1
2	HRI	7514	B. oleracea	var. italica	Broccolo Verde Di Calabria	1	1
1	HRI	7518	B. oleracea	var. italica	Precoce Di Calabria	1	2
2	HRI	7528	B. oleracea	var. italica	Couve Broculo Roxo De Ca	2	3
2	HRI	8631	B. oleracea	var. italica	Sicilian Purple Lake	2	2
2	HRI	8658	B. oleracea	var. italica	Waltham	3	2
2	HRI	9842	B. oleracea	var. italica	Green Valiant (F1)	1	1
2	HRI	10702	B. oleracea	var. italica	Red Lion	1	2
2	IPK	BRA 1422	B. oleracea	var. italica	Primo	3	2
1	IPK	BRA 1427	B. oleracea	var. italica		2	1
	LORD HY		B. oleracea	var. italica		2	2
	LORD HY		B. oleracea	var. italica		2	1

*1= < 20% of value reduction at 4 g l-1 salt doses with reference to the control (0 g l-1)
2= 21-40% of value reduction at 4 g l-1 salt doses with reference to the control (0 g l-1)
3= > 41% of value reduction at 4 g l-1 salt doses with reference to the control (0 g l-1)

Contract no: RESGEN CT99 109/112

Project title: "*Brassica collections for Broadening Agricultural Use*" including 'Characterizing and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Participant no. P8: Universidade de Trás-os-Montes e Alto Douro, Portugal.

Names of participants: Eduardo Rosa, Alfredo Aires, Rosa Paula

Reporting period: 1st January to 31st December 2003 & overview of project

Role in the project:
Milestone 3a *Part of the core collection evaluated*

Activities carried out during the fourth year and summary over the whole period

Milestone 3a *Part of the core collection evaluated*
Fourth year:
Growing plant material, starting from seeds, of defined accessions of the core collection (the last accessions, see table 1.. Analysis of glucosinolates in plant material from the core collection and evaluation on the same material.

Summary whole period:
During the fourth and last year of the project, we proceed with the identification and quantification of glucosinolates (GSs) content of 32 accessions by HPLC system, according the current methodology used in our laboratory, which has been described in several papers.

During this year and similar to the last years, field experiments were conducted with 68 accessions of *Brassica rapa* to evaluate the glucosinolate content. Sowing was made in 2 different periods in peat blocks (6x6x6 cm) and seedlings were transplanted into field at the 3-true leaf stage and set in raise beds in 35 x 60 cm spacing. The experiment was set in a complete randomized block design with 3 replicates with 6 plants of each cultivar. Harvest was done when plants reached the maturity stage, collecting different kind of plant parts (inflorescence, leaves and roots), according to plant species.

As in previous years, another experiment was set in growth cabinets under controlled conditions to evaluate the glucosinolate content at 3-true leaf stage of Brassica rapa, within the core collection. In this experiment were used 3 replicates with 5 plants per replicate, all used for sampling. From sowing to emergence light was set at 400 µmoles.m.-2.s-1 and at constant day/night temperature of 22ºC. From emergence to harvest date, light was kept at as previous and temperature was changed to a regime of 20/16ºC day/night, according to plant requirements. Following the harvest the samples were homogenized in liquid nitrogen, and an aliquot was freeze-dried for further analysis. The analytical method for GSs identification and quantification was the same as mentioned above.

The results showed that the glucosinolates were higher in the field experiment than in the controlled conditions. On average in the field experiment the total glucosinolates were 3164.9 µmoles/100g of dry weight and in controlled conditions were 1403.4 µmoles/100g of dry weight. For the field experiment the total level of glucosinolates were between 275.4 µmoles/100g of dry weight for CGN 06842 and 5322.6 µmoles/100g of dry weight for PI 251326. The major glucosinolates were 2-propenyl and pent-4-enyl with an average content of 1288.9 and 655.2 µmoles/100g of dry weight respectively. The minimum level detected was for but-3-enyl with 54.7 µmoles/100g of dry weight.

For the controlled conditions the levels of glucosinolates were between 112.3 and 2791.4 µmoles/100g of dry weight (CHGN 06842 and BRA 1272 respectively). The major glucosinolates were 2-propenyl with 866.0 µmoles/100g of dry weight and pent-4-enyl with 200.9 µmoles/100g of dry weight. In the controlled conditions the glucosinolate with lowest content was 1-methoxyindol-3-ylmethyl with in average 24.1 µmoles/100g of dry weight. The evaluation data obtained in the whole period have been forwarded to P1 to be made available on the Internet in association with the Bras-EDB.

Data from the *Albugo* screen of the core collection carried out by P2 were compared with the data from the glucosinolate analysis to assess any relationship between this class of compounds and the reaction

to the disease. The data revealed no significant interactions, but it was recognised that any further such studies should be conducted using the same plant material to ensure comparability and higher accuracy.

Table 1 - Sowing and harvest dates for the accessions grown in field

Accession	Sowing	Harvest	Plant Material
DICHOTOMA CGN 6837	17.04.03	29.05.03	Inflorescences
DICHOTMA CGN 06836	17.04.03	20.05.03	Inflorescences
DICHOTMA CR 2228	17.04.03	29.05.03	Inflorescences
ANNUA CR 1543	17.04.03	29.05.03	Inflorescences
ANNUA CGN 06842	17.04.03	20.05.03	Inflorescences
ANNUA REGNGB 2383	17.04.03	29.05.03	Inflorescences
BRA 1272	17.04.03	31.05.03	Inflorescences
DEUBGRC 22534	17.04.03	17.05.03	Inflorescences
HRIGRU 6235	17.04.03	11.06.03	Inflorescences
PI 219904	17.04.03	10.05.03	Inflorescences
PI 220774	17.04.03	11.06.03	Inflorescences
BIENNIS CR 1539	17.04.03	05.06.03	Leaves
BIENNIS CGN 07216	17.04.03	04.06.03	Leaves
BIENNIS REGNGB 2330	17.04.03	04.06.03	Leaves
BIENNIS REGNGB 602	17.04.03	04.06.03	Leaves
BIENNIS DEUBGRC 28622	17.04.03	04.06.03	Leaves
BIENNIS CR 1542	17.04.03	04.06.03	Leaves
ANNUA CR 2205	17.04.03	05.06.03	Leaves
BRS 0123	17.04.03	05.06.03	Leaves
BRA 1023	17.04.03	06.06.03	Leaves
HRIGRU 011606	17.04.03	05.06.03	Leaves
PI 25 1326	17.04.03	05.06.03	Leaves
CGN 10995	17.04.03	12.06.03	Roots
CGN 06711	17.04.03	12.06.03	Roots
CGN 11061	17.04.03	31.05.03	Roots
CGN 06714	17.04.03	12.06.03	Roots
CGN 07223	17.04.03	06.06.03	Roots
CGN 15221	17.04.03	11.06.03	Roots
DEUBGRC 49579	17.04.03	06.06.03	Roots
DEUBGRC 34824	17.04.03	31.05.03	Roots
REGNGB 4106	17.04.03	11.06.03	Roots
CHERAC 85.5861	17.04.03	06.06.03	Roots

Table 2 – Sowing/harvest dates for the accessions grown in the controlled conditions.

Accession	Sowing	Harvest	Plant Material
Biennis CR1539	10.02.03	21.02.03	Seedlings
Biennis CGN 07216	10.02.03	21.02.03	Seedlings
Biennis REGNGB 2330	10.02.03	21.02.03	Seedlings
Biennis REGNGB 602	10.02.03	21.02.03	Seedlings
Biennis DEUBGRC 28622	10.02.03	21.02.03	Seedlings
Biennis CR 1542	10.02.03	21.02.03	Seedlings
Annua CGN 06842	10.02.03	21.02.03	Seedlings
Annua CR 1543	10.02.03	21.02.03	Seedlings
Annua REGNGB 2383	10.02.03	21.02.03	Seedlings
Annua CR 2205	10.02.03	21.02.03	Seedlings
Dichotoma CGN 06836	10.02.03	21.02.03	Seedlings
Dichotoma CGN 06837	10.02.03	21.02.03	Seedlings
Dichotoma CR 2228	10.02.03	21.02.03	Seedlings
Rapa BRA 1023	10.02.03	21.02.03	Seedlings
Rapa BRA 1272	10.02.03	21.02.03	Seedlings
Rapa BRS 0123	10.02.03	21.02.03	Seedlings
Rapa CGN 06714	24.02.03	07.03.03	Seedlings
Rapa CGN 07223	24.02.03	07.03.03	Seedlings
Rapa CGN 15221	24.02.03	07.03.03	Seedlings
Rapa CHERAC 85.5861	24.02.03	07.03.03	Seedlings
Rapa DEUBGRC 34824	24.02.03	07.03.03	Seedlings
Rapa DEUBGRC 49579	24.02.03	07.03.03	Seedlings
Rapa HRIGRU 0011606	24.02.03	07.03.03	Seedlings
Rapa REGNGB 4106	24.02.03	07.03.03	Seedlings
Rapa (underfined) PI220774	24.02.03	07.03.03	Seedlings
Rapa (underfined) PI251326	24.02.03	07.03.03	Seedlings
Rapa (underfined) PI219904	24.02.03	07.03.03	Seedlings
Rapa CGN 06711	24.02.03	07.03.03	Seedlings
Rapa CGN 11061	24.02.03	07.03.03	Seedlings
Rapa CGN 10995	24.02.03	07.03.03	Seedlings
Rapa DEUBGRC 22534	24.02.03	07.03.03	Seedlings
Rapa (underfined) HRIGRU 6235	24.02.03	07.03.03	Seedlings

Contract no: RESGEN CT99 109/112

Project title: "*Brassica collections for Broadening Agricultural Use*" including 'Characterizing and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Participant no. P9: Misión Biológica de Galicia- Consejo Superior de Investigaciones Científicas, Spain.

Names of participants: Amando Ordás, Elena Cartea.

Reporting period: 1st January to 31st December 2003 and summary over the whole period

Role in the project: Regeneration of accessions with low viability or with small amount of seed; characterisation of the B. rapa accessions; establishment of the Spanish database of the genus *Brassica* (*B. oleracea*, *B. rapa* and *B. napus*), and donation of data to Bras-EDB; assist coordinators in the preparation of core collections; preparation of annual reports.

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*
Milestone 2a *Part of the core collection characterised.*
Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*
Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Activities carried out during the fourth year and summary over the whole period

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*

Summary whole period:
The Spanish database of the *Brassica* species was established and passport data were donated to central database (Bras - EDB). During these years, we included new accessions of three species *Brassica oleracea*, *B. rapa*, and *B. napus* in the germplasm bank at MBG. The whole database of *Brassica* species has been sent to the Bras-EDB. Germination tests were performed over the new accessions included in the *Brassica* germplasm bank at the MBG. The *B. rapa* characterisation data have been sent to P1 to be made available on the Internet in association with the Bras-EDB.

Milestone 2a *Part of the core collection characterised.*
Fourth year:
No characterisation was made at MBG during 2003.

Summary whole period:
Attendance of Dr. Ordás to the first meeting in Wageningen where the different partners established the minimum descriptors for the characterisation of *Brassica* species. Fifteen accessions of *Brassica rapa* were characterised at MBG during 2001 according to the draft list of minimum descriptors agreed by the *B. rapa* subgroup for use in the project characterisation. Three accessions were chosen from the Spanish collection and 12 accessions from the core collection were sent by HRI. These accessions of *B. rapa* belonged to different groups and origins. Twenty plants of each accession were sown in March and transplanted in April. Entries had a good germination rate in environmental conditions of northwestern Spain.
As in previous year, another 15 *Brassica rapa* accessions from different origin were characterised by the *B. rapa* minimum descriptors according to best local practice at their optimal harvesting time. Twenty-five plants each of 15 *B. rapa* accessions from the core collection (14) and MBG collection (1) were chosen. Accessions were sown in January and transplanted in February 2002; all accessions were photo-documented. Most of them were not homogeneous and had a great morphological variability mainly for root shape and colour. For these traits, two or three numbers were indicated, the first digit indicating the

most common trait. The characterisation data were presented in previous annual report and sent to P1 to be made available on the Internet in association with the Bras-EDB.

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Characterisation of samples of *Brassica rapa* grown at MBG Pontevedra, Spain 2001:

- *B. rapa ruvo:* MBG-BRS0125, MBG-BRS0233, HRIGRU 004714, HRIGRU 004722, HRIGRU 004734, HRIGRU 005274, HRIGRU 005330.
- *B.rapa perviridis :* CGN06843, HRIGRU 004682
- *B.rapa dichotoma:* CGN06837, CGN06836
- *B. rapa trilocularis:* VIR911.112
- *B. rapa*: CGN11061, MBG-BRS0320, HRIGRU 6235

Characterisation samples of *Brassica rapa* grown at MBG Pontevedra, Spain 2002:

- *B. rapa rapa*: CGN 06711, CGN 15221, CGN 10995, CGN 07223, CGN 06714, CHERAC85.5861, MBG-BRS0123, HRIGRU 011606, HRIGRU 007692, HRIGRU 003116, HRIGRU 008170, HRIGRU 007204, REGNGB 4106, NGB 1175.1, NGB 11515

Milestone 2b *Part of the core collection regenerated and this material will be available for use.*

Fourth year:

A total of 25 accessions from Spanish collection were grown for seed production during 2003.

Part of the material conserved at germplasm bank at MBG needs regeneration in order to obtain enough seeds of good quality for characterisation, evaluation, and subsequent breeding. Accessions were sowed in greenhouse and transplanted in September in isolated cabins during the fourth year at the MBG (Table 1). All accessions of B. rapa are annual and presently, they are still on the vegetative phase. Therefore, they will be collected during 2004.

Some entries of Brassica oleracea transplanted in previous years were biennual and they have been collected during 2003. Results of regeneration of these accessions are shown in table 2.

Summary whole period:

Part of the accessions from the Spanish collection requiring regeneration because of a low viability or with a small amount of seed was chosen during these years. Fifteen entries were multiplied during 2001. On average, seed amounts harvested were 155g with germination rates of 95%. Some entries were regenerated in the following years because of insufficient numbers of harvestable plants (MBG-BRS0333, MBG-BRS0337), or insufficient amount of seeds harvested (MBG-BRS0123 and MBG-BRS0225). A majority of the B. oleracea accessions were biennial, mainly kales.

As in the previous year, 30 *Brassica* accessions were multiplied during 2002 and 2003 at the MBG (15 accessions per year). All accessions of *B. rapa* and *B. napus* were annual and therefore they were collected during the same year. However, most *B. oleracea* accessions were biennual and they were collected in the following years. On average, seed amounts harvested were 168 g with germination rates of 92.5%. However, in some cases renewed regenerations were conducted because of insufficient germination of the harvested seeds, insufficient numbers of harvestable plants or insufficient amount of seeds harvested. The regeneration data were presented in previous annual reports.

Regeneration samples of *Brassica* grown at MBG, Pontevedra, Spain 2000/01

- *Brassica rapa*: MBG-BRS0099, MBG-BRS0123, MBG-BRS0225, MBG-BRS0263, MBG-BRS0231, MBG-BRS0222
- *Brassica napus*: MBG-BRS0333, MBG-BRS0337
- *Brassica oleracea*: MBG-BRS0158, MBG-BRS0166, MBG-BRS0182, MBG-BRS0198, MBG-BRS0226, MBG-BRS0343, MBG-BRS0355

Regeneration samples of *Brassica* grown at MBG, Pontevedra, Spain 2001/02

- *Brassica rapa*: MBG-BRS0123, MBG-BRS0225, MBG-BRS0233, MBG-BRS0249, MBG-BRS0278, MBG-BRS0265.
- *Brassica napus*: MBG-BRS0333, MBG-BRS0337.
- *Brassica oleracea* (entries sowed in 2000 and collected in 2002): MBG-BRS0158, MBG-BRS0166, MBG-BRS0182, MBG-BRS0198, MBG-BRS0226, MBG-BRS0343, and MBG-BRS0355.
- *Brassica oleracea*: MBG-BRS0121, MBG-BRS0103, MBG-BRS0308, MBG-BRS0321, MBG-BRS0336, MBG-BRS0174

Regeneration samples of *Brassica* grown at MBG, Pontevedra, Spain 2002/03

- *Brassica rapa*: MBG-BRS0245, MBG-BRS0273, MBG-BRS0263, MBG-BRS0220, MBG-BRS0307, MBG-BRS0341.
- *Brassica napus*: MBG-BRS0039, MBG-BRS0044, MBG-BRS0063.
- *Brassica oleracea* (entries sowed in 2001 and presumably collected during 2003): MBG-BRS0121, MBG-BRS0103, MBG-BRS0308, MBG-BRS0321, MBG-BRS0336, MBG-BRS0174

Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*

Fourth year:
As in the previous years, adequate seed amounts of the material regenerated in the course of the project were set aside for safety duplication. The storage conditions at MBG are available for providing external safety duplicates.

Summary whole period:
A part of the collection is at present duplicated in Valencia (Polytechnic University).

Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Fourth year:
The MBG annual progress reports were finalised and submitted on time. The fourth year cost statement for the fourth year will be sent to the co-ordinator at the end of February 2004.

Summary whole period:
The MBG individual progress reports were finalised and submitted to subco-ordinator on time while the cost statements were sent to the European Commission.

Executive summary including highlights over the whole period:
During these years of the *Brassica* RESGEN CT99-109/112 project, MBG contributed on both characterisation (30 *Brassica rapa* accessions) and regeneration (70 Spanish accessions of *Brassica rapa*, *B. oleracea*, and *B. napus* species). Some of them are being multiplied during this year 2003 and they will be collected during 2004. In addition, MBG *Brassica* collection was increased and passport data were donated to central database (Bras- EDB).
MBG identified some accessions to add to the new core of landraces from Galicia of the following *B. oleracea* groups: kale, tronchuda, broccoli, and cabbage with enough seeds for the evaluations, which were included in the Bras-EDB.
MBG supplied *Brassica* samples of *B. oleracea*, *B. rapa* and *B. napus* in order to provide material for evaluation to different partners during 2000. Ten entries of *Brassica oleracea acephala*, four accessions of *Brassica oleracea capitata* and one accession of *B. oleracea costata* were sent to Dr. Ietje Boukema; three entries of *Brassica rapa*: MBG-BRS0123 (turnip), MBG-BRS0225 (turnip and turnip greens) and MBG-BRS0233 (turnip greens) were sent to Dr. Dave Astley; all *B. napus pabularia* accessions (300 seeds of each one) maintained at the germplasm bank at the MBG were sent to Dr. Wilfried Lühs.

Table 1. Accessions of *Brassica rapa* for regeneration in 2003/2004

ACCESSION	COMMON NAME	SOWING DATE	TRANSPLANT DATE	PLANT NUMBER
MBG-BRS0222	Turnip	30/08/03	23/09/03	70
MBG-BRS0234	Turnip greens	27/08/03	23/09/03	68
MBG-BRS0324	Turnip	12/08/03	23/09/03	25
MBG-BRS0232	Turnip greens	29/08/03	23/09/03	57
MBG-BRS0263	Turnip	12/08/03	10/09/03	100
MBG-BRS0341	Turnip	12/08/03	10/09/03	27
MBG-BRS0195	Turnip greens	12/08/03	23/09/03	100
MBG-BRS0256	Turnip	12/08/03	10/09/03	50
MBG-BRS0495	Turnip	12/08/03	23/09/03	40
MBG-BRS0461	Turnip	12/08/03	05/09/03	100
MBG-BRS0338	Turnip greens	12/08/03	05/09/03	100
MBG-BRS0139	Turnip	12/08/03	05/09/03	100
MBG-BRS0359	Turnip	12/08/03	05/09/03	40
MBG-BRS0344	Turnip greens	12/08/03	05/09/03	100
MBG-BRS0140	Turnip	12/08/03	05/09/03	10
MBG-BRS0184	Turnip	12/08/03	05/09/03	100
MBG-BRS0342	Turnip greens	12/08/03	08/09/03	39
MBG-BRS0206	Turnip	12/08/03	08/09/03	52
MBG-BRS0178	Turnip	12/08/03	08/09/03	100
MBG-BRS0458	Turnip	12/08/03	08/09/03	25
MBG-BRS0179	Turnip	12/08/03	08/09/03	34
MBG-BRS0361	Turnip	12/08/03	08/09/03	36
MBG-BRS0124	Turnip	12/08/03	19/09/03	100
MBG-BRS0181	Turnip	12/08/03	22/09/03	35
MBG-BRS0191	Turnip	12/08/03	22/09/03	100
MBG-BRS0101	Turnip greens	28/08/03	26/09/03	65

Table 2. Accessions of *Brassica oleracea* regenerated in 2002/2003.

ACCESSION	BOTANICAL NAME	COMMON NAME	SOWING DATE	TRANSPL. DATE	FIRST HARVEST	LAST HARVEST	SEED WEIGHT
MBG-BRS0103	*B. oleracea* acephala	Kale	10/11/00	23/2/01	23/6/03	17/7/03	91.2
MBG-BRS0121	*B. oleracea* costata	Portuguese kale	29/8/01	16/10/01	6/5/03	23/6/03	115.2
MBG-BRS0174	*B. oleracea* acephala	Kale	28/8/01	09/10/01	6/6/03	4/7/03	250.1
MBG-BRS0308	*B. oleracea* costata	Portuguese kale	28/8/01	11/10/01	23/6/03	4/7/03	54.6
MBG-BRS0336	*B. oleracea* acephala	Kale	29/8/01	11/10/01	23/6/03	4/7/03	25.8

Contract no: RESGEN CT99 109/112

Project title: "*Brassica collections for Broadening Agricultural Use*" including 'Characterizing and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Participant no. P10 Federal Centre for Breeding Research on Cultivated Plants (BAZ) – Gene Bank

Names of participants: Lothar Frese

Reporting period: 1st January to 31st December 2003 and summary over the whole period

Role in the project: Updating the BGRC database and provision of data to the Bras-EDB
Contribution to the development of core collections
Regeneration of accessions under isolation
Characterisation of accessions during seed production

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*
Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Milestone 2a *Part of the core collection characterised.*
Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*
Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Activities carried out during the fourth year and summary over the whole period

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*

Fourth year:
The BAZ Gene Bank has neither collected nor received new accessions in the year 2002. Hence, an update of the database and donation of new passport data to the Bras-EDB was not required.
In the period of October 2002 to June 2003 most of the BAZ Gene Bank collection has been transferred to the IPK genebank. IPK will integrate the collection, including the Brassica holding, into the central federal genebank holding. The co-ordinator has been informed on this matter. The BAZ accessions receive a new IPK accession number which will be provided to the Bras-EDB. For the time being seed samples can of course be ordered using the BGRC number; however, in future the new accession number should be used preferentially.

Summary whole period:
All characterisation data recorded by the BAZ Gene Bank within the framework of this project were made available as Excel files in a standard format to the coordinator.

Milestone 2a *Part of the core collection characterised.*

Fourth year:
Accessions were characterised during seed regeneration. In addition summer canola material was sown in the field, winter types were sown in February, cultivated in pots and vernalised artificially to shorten the vegetative period. As the growing and cultivation conditions differed three data set were produced (see Appendix 1). Set 1 (sheet "napus-P10-2003-1") contains data on summer canola recorded in the field, set 2 (sheet "napus-P10-2003-2") data recorded during seed production in isolation tents (winter canola) and set 3 (sheet "napus-P10-2003-3") data recorded on plants cultivated in pots (winter canola, core collection material). The latter material was received from the subcoordinator in late January 2003.

The following number of data were recorded: set 1 (25 accessions x 10 traits), set 2 (13 accession x 10 traits) and set 3 (13 accessions x 10 traits). Collectively, 51 accessions were characterised. All data recorded in 2003 were sent to the co-ordinator.

Summary whole period:

Between 2001 and 2003 one hundred and seventy one accessions have been characterised (Figure 2). A part of the accessions belong to the core collection. The germplasm was characterised in the field or in isolation greenhouses as well as isolation tents. Each individual data set was described accordingly and made available to the coordinator. The BAZ Gene Bank agreed to characterize 100 accessions of *Brassica napus.* The overall milestone is fulfilled.

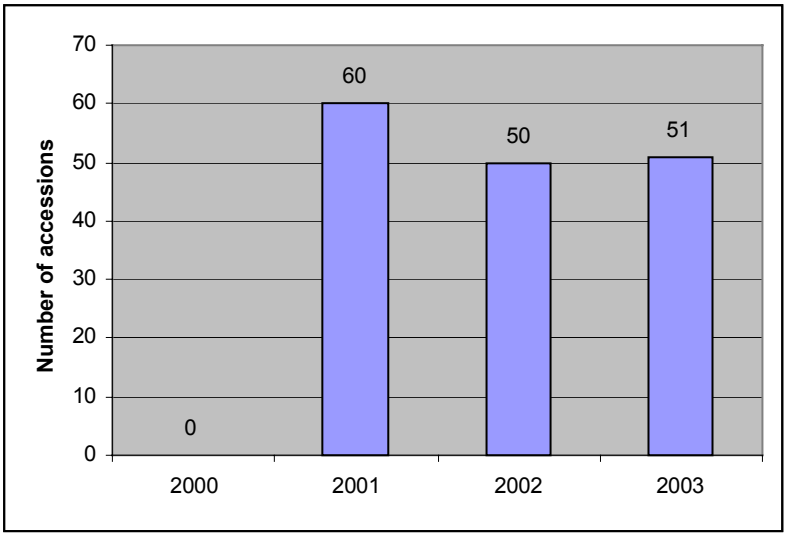

Figure 1. Year of characterisation and number of characterised accessions

Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Fourth year:
Thirteen accessions of the IPK genebank were sown in late 2002, vernalised in a cold greenhouse and transferred to isolation tents or insect proof foil tunnels in spring 2003. About 50 pots with 1-3 plants per pot were placed in each isolation. Solitary bees were used as pollinating insects. This year the seed production in isolation tents has been quite successful as shown in Table 1.
Twelve accessions were sown in the field. At flowering branches of 30-40 single plants per accessions were isolated with bags to guarantee self-pollination. It was planned to produce additional seeds required by the IPK genebank to allow splitting of accessions into active and base samples. Due to hard to control aphid infestation on branches covered by bags the seed yield per population ranged between 0 to 28 gr. All the 25 reproduced accessions were transferred to the IPK genebank in the year 2003.

Table 1: Seed yield in 2003

Isolation tents		**Bag isolation in the field**	
Accession number	Seed yield in gr	Accession number	Seed yield in gr
CR 1059/02	410	CR 2273	5,2
CR 160/02	420	CR 2274	2,5
CR 1060/02	1466	CR 2278	0
CR 700/02	113	CR 2282	4,6
CR 1191/02	841	CR 883	28,4
CR 2198/02	482	CR 891	4,4
CR 164/02	1967	CR 1011	19,4
CR 320/02	599	CR 1016	27,8
CR 758/02	551	CR 1000	25,1
CR 286/02	642	CR 2257	0,6
CR 299/02	379	BGRC 54592	1,1
CR 689/02	986	BGRC 16302	2,6
CR 948/02	1706		

Summary whole period:
The BAZ Gene Bank was obliged to multiply seed of 100 accessions of *Brassica napus*.On request core collection accessions were made available to the project group. During the lifetime of the project seed of 110 accessions was produced. The individual overall milestone is fulfilled as shown in Figure 2.

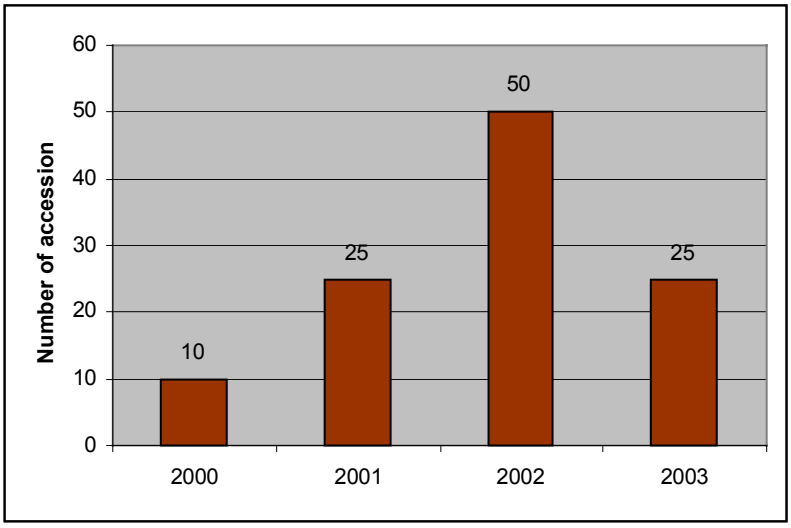

Figure 2. Year of seed harvest and number of accessions with seed set

Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*
Summary whole period:
All characterisation data recorded by the BAZ Gene Bank within the framework of this project were made available as Excel files in a standard format to the coordinator.

Contract no: RESGEN CT99 109/112

Project title: "*Brassica collections for Broadening Agricultural Use*" including 'Characterizing and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Participant no. P11: Norddeutsche Pflanzenzucht Hans-Georg Lembke KG (NPZ)

Names of participants: Dr. M. Frauen, J. Noack, Dr. W. Lühs, Dr. B. Ulber, M. Horschig

Reporting period: 1st January to 31st December 2003 and summary over the whole period

Role in the project:
NPZ is carrying out extensive analytical investigations with respect to seed oil and protein content as well as triacylglycerol fatty acid composition and glucosinolates in the seed. In collaboration with DSV (Partner P12) NPZ is involved in the evaluations of pest resistance/tolerance.

Milestone 3a *Part of the core collection evaluated*
Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*

Activities carried out during the fourth year and summary over the whole period

Milestone 3a *Core collection evaluated for seed quality characters and pest resistance*
Fourth year:
Further gaps in the seed analyses of the preliminary core collection (N=180 accessions) were filled in order to conclude the categorisation of the accessions due to their seed quality, viz. 1) high erucic acid-high glucosinolate (++), 2) low erucic acid-high glucosinolate (0+, single low), 3) high erucic acid-low glucosinolate (+0), and 4) low erucic acid-low glucosinolate (00, double low quality, canola). Due to this quality classification and obvious alterations in seed quality a few accessions (e.g., 'Lenora', 'Nugget', 'Bronowski') were identified as off-types not longer representing the original genebank entries. The seed quality data - together with the phenotypic information derived from the field trials in Rauischholzhausen (Spring 2002, Winter 2000/2001) - delivered valuable information to be included in the finalisation of the *B. napus* core collection.
Seed samples (N=43) of swedes (ssp. *napobrassica*), derived from regeneration procedures performed by partner 3 (NGB, Alnarp, Sweden), were analysed for oil and protein content, glucosinolates and fatty acid composition. It was shown that the swedes represent a distinct group among *B. napus* with a high seed glucosinolate content (average: 107.6 µmol/g seed) and a medium-high erucic acid content (average: 35.0 %) in the seed oil. Interestingly, among the swede accessions with traditional seed characteristics (++) the accession 'Doon Major' was identified possessing a superior seed quality with 0.4% erucic acid and 21.5 µmol glucosinolates/g seed (Table 1).

Table 1: Seed quality of 43 swede (*B. napus* ssp. *napobrassica*) genebank accessions

	Oil	**Protein**	*GSL*	**% of total fatty acids**								
	% DM	**% DM**	**(µmol /g)**	**Palmitic**	**Stearic**	**Oleic**	**Linoleic**	**Linolenic**	**Eicosenoic**	**Erucic**	**Nervonic**	**Rest**
Min	31.4	25.4	21.5	2.6	0.9	12.0	10.0	5.3	1.7	0.4	0.2	1.8
Mean	**37.3**	**30.8**	**107.6**	**3.5**	**1.3**	**23.8**	**13.6**	**8.9**	**10.0**	**35.0**	**0.9**	**3.0**
Max	43.8	35.6	147.3	4.5	1.8	57.6	21.4	11.6	13.8	48.2	1.2	4.2
SD	3.25	2.95	20.48	0.42	0.24	7.33	2.19	1.37	2.21	7.71	0.18	0.53
Variance	10.59	8.72	419.38	0.17	0.06	53.71	4.82	1.89	4.90	59.43	0.03	0.28
CV%	8.72	9.58	19.03	12.06	18.29	30.77	16.08	15.44	22.15	22.05	20.63	17.57
SE	0.50	0.45	3.12	0.06	0.04	1.12	0.33	0.21	0.34	1.18	0.03	0.08

Summary whole period:

With the aim of creating a *B. napus* core collection representing a broad variability of all available accessions a number of 338 summer type *B. napus* accessions, including oilseed rape types, fodder and green manure types as well as „exotic“ types, incl. vegetables (ssp. *pabularia*), Hakuran, Couve Nabica, was sown in spring 2000 in the field (Rauischholzhausen near Marburg/Lahn, Germany). Nearly one third of the material displayed a biennial growth habit and stayed vegetative like forage types. For seed quality analyses in each plot individual plants were isolated with bags to obtain seeds for fatty acid analysis by gas liquid chromatography (GLC), while the open-pollinated seed material was collected for oil, protein and glucosinolate analysis by near-infrared reflectance spectroscopy (NIRS). Based on sufficient seed harvest a total of 202 *B. napus* genebank accessions was analysed for both gross seed composition (oil, protein, glucosinolates) and fatty acid pattern of the seed oil (Table 2).

Table 2: Seed composition of *B. napus* genebank material harvested from the spring field trial (Rauischholzhausen, 2000) *

Constituent	N	OP/SF	Min.	Mean	Max.	CV%
Oil (% DM, NIRS)	202	OP	35.1	40.8	48.3	5.7
Protein (% DM, NIRS)	202	OP	23.4	26.7	30.9	6.0
GSL (µmol/g seed, NIRS)	202	OP	7.5	39.5	84.9	59.2
Palmitic acid (%, GLC)	332	SF	2.1	4.4	8.7	25.6
Stearic acid (%, GLC)	332	SF	0.1	2.2	4.5	32.3
Oleic acid (%, GLC)	332	SF	10.1	48.3	74.9	39.0
Linoleic acid (%, GLC)	332	SF	8.9	19.6	32.8	26.8
Linolenic acid (%, GLC)	332	SF	3.4	7.9	17.4	29.2
Eicosenoic acid (%, GLC)	332	SF	0.1	4.4	19.6	118.9
Erucic acid (%, GLC)	332	SF	0.1	12.5	58.1	148.1

* N = number of samples, OP = seeds derived from open pollinated plants (average of the plot), SF = seeds obtained from isolated plants, DM = dry matter basis, NIRS = near-infrared reflectance spectroscopy, GLC = gas liquid chromatography.

In autumn 2000 a number of 857 winter type *B. napus* accession were sown for the same pre-evaluation purpose. In Table 3 the results of extensive NIRS seed quality analyses are summarised, which were obtained for the open-pollinated seed material harvested 2001 from N=827 genebank accessions. For quality analyses on selfed seeds in each plot three to five plants were isolated with bags.

Table 3: Gross composition of *B. napus* seed material derived from the winter field trial (Rauischholzhausen 2000/2001) involving (a) genebank material and (b) standards*

(a) *Genebank material*

Constituent	N	OP/SF	Min.	Mean	Max.	CV%
Oil (% ADM, NIRS)	2,534	SF	30.3	46.3	57.2	9.7
Oil (% ADM, NIRS)	827	OP	33.5	48.1	57.8	7.7
Protein (% ADM, NIRS)	2,534	SF	17.5	24.6	34.7	11.9
Protein (% ADM, NIRS)	827	OP	14.5	22.6	31.9	12.2
GSL (µmol/g seed, NIRS)	2,534	SF	2.0	64.5	125.0	43.8
GSL (µmol/g seed, NIRS)	827	OP	0.8	68.0	123.5	42.3

(b) *Standard varieties*

Constituent	N	OP/SF	Min.	Mean	Max.	CV%
Oil (% ADM, NIRS)	28	SF	41.2	49.0	55.1	7.3
Oil (% ADM, NIRS)	17	OP	48.9	52.4	57.0	5.3
Protein (% ADM, NIRS)	28	SF	17.4	22.5	27.3	12.5
Protein (% ADM, NIRS)	17	OP	16.7	19.1	23.9	8.8
GSL (µmol/g seed, NIRS)	28	SF	7.2	13.6	54.6	62.4
GSL (µmol/g seed, NIRS)	17	OP	4.7	8.4	14.1	34.3

* N = number of samples, OP = seeds derived from open pollinated plants (average of the plot), SF = seeds obtained from isolated plants, DM = dry matter basis, NIRS = near-infrared reflectance spectroscopy.

Regarding oil, protein and glucosinolate content the genebank material displays considerable variation as compared to the standard varieties. In general, the material shows the well-known inverse relationship of oil and protein content with the consequence that the sum of protein and oil is nearly stable. As demonstrated by the standards representing current cultivars, rapeseed breeders have stressed their quality selection on oil content improvement and reduction of glucosinolates (Table 3).

In addition to the phenotypic data (assessed by Partner 12) the extensive analytical results of both field trials (for detail cf. Lühs et al. 2002b) were used to select accessions for a preliminary core collection of 180 specimen (including ssp. *napobrassica*) representing a broad variability within the species *B. napus* (Poulsen et al. 2002). The seed quality of genebank entries belonging to this selection of 180 *B. napus* accessions (Table 4) covered well the variation found before in the pre-evaluation experiments (Tables 1 to 3).

Table 4: Seed quality of 180 *B. napus* genebank accessions of the preliminary core collection

	Oil	**Protein**	*GSL*	**% of total fatty acids**								
	% DM	**% DM**	**(µmol/g)**	**Palmitic**	**Stearic**	**Oleic**	**Linoleic**	**Linolenic**	**Eicosenoic**	**Erucic**	**Nervonic**	**Rest**
N	180	180	180	183	183	183	183	183	183	183	183	183
Min	31.7	16.4	4.2	2.2	0.6	7.2	10.1	4.2	0.5	0.0	0.0	0.0
Mean	**45.6**	**24.7**	**74.4**	**3.6**	**1.4**	**29.2**	**15.7**	**8.7**	**6.5**	**31.1**	**0.7**	**3.2**
Max	57.8	35.6	147.3	7.2	4.4	68.9	30.1	15.5	16.1	57.9	1.5	6.2
SD	6.15	4.26	30.69	0.88	0.53	21.00	4.43	1.53	3.94	22.06	0.44	1.62
Variance	37.78	18.18	941.68	0.78	0.28	440.93	19.59	2.35	15.55	486.45	0.19	2.64
CV%	13.47	17.25	41.26	24.36	38.74	72.00	28.26	17.68	60.40	70.89	62.45	51.13
SE	0.46	0.32	2.29	0.07	0.04	1.55	0.33	0.11	0.29	1.63	0.03	0.12

The field trial for the evaluation of resistance against cabbage stem flea beetle (*Psylliodes chrysocephala*) was carried out in collaboration with partner P12 in the vegetation period 2001/2002 at Goettingen-Weende (northern part of Germany) in a double-replicated block design. Aside the 180 *B. napus* genebank accessions, 20 specimens of different brassicaceous species (*Sinapis alba*, *Raphanus sativus*, *B. rapa*, *B. oleracea*, *B. nigra*, *B. juncea*, *B. carinata*) and current winter rape cultivars (including modern hybrids) were included in the evaluation, while the winter oilseed rape cultivar 'Express' was used as standard.
The evaluation of the feeding damage (percentage of leaf area missing, 20 plants/plot) by adult cabbage stem flea beetle in autumn 2001 was focussed on 128 accessions (111 samples of the preliminary B. napus core collection) that showed plant densities sufficient for this investigation. To assess the number of larvae within plants, the stems and petioles of 10 plants/plot were dissected individually under a microscope. To check the results obtained in the juvenile state, a number of 28 accessions were selected for sampling in February 2002 in order to re-evaluate the number of flea beetle larvae/plant.
In nearly one half of the 28 accessions a positive relationship was found between the number of larvae/plant in autumn 2001 and the number of larvae/plant in spring 2002 (Table 5). For the swede accessions no. 117 'Conqueror Bronze Green' (HRI 3470), no. 121 'Drummonds Purple Top' (HRI 5878) and no. 133 'Scotia' (HRI 3271) as well as the spring oilseed rape no. 176 'Topas' (NGB 2659) the low levels of infestation in the early juvenile stage could be confirmed by the level of infestation in corresponding plots in spring 2002. Whereas the accession nos. 33 ('Collo', CR 285), 43 ('Liragrün', CR718) and 179 ('Matador', NGB 594) showed a high number of ca. 22 larvae per plant in spring 2002 (Table 5).

Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*
Fourth year:
The data regarding the tolerance against cabbage flea beetles and the extensive seed analyses of the N=180 preliminary core collection samples (cf. Table 4) were filled in data sheets to be the linked to Bras-EDB.

Table 5: Assessment of cabbage stem flea beetle (*Psylliodes chrysocephala*) infestation (mean number of larvae per plant) in 28 *B. napus* accessions in autumn 2001 and spring 2002 as compared to the standard winter oilseed rape 'Express'

				November 2001		Februar 2002
No.	**ACCENUMB**	**SUBTAXA**	**ACCNAME**	**No. of larvae/ plant**		**No. of larvae/ plant**
10	BS 28660	*oleifera*	Mansholts Hamb. Raps	0.80		13.2
11	BS 28661	*oleifera*	Markus	2.20		13.4
13	BS 7300	*oleifera*	Oleander	2.80		11.2
15	BS 7306	*oleifera*	Rapol	0.70		13.0
23	BS 28678	*oleifera*	Oro	2.10		5.9
24	BS 16223	*oleifera*	Petranova	4.40		8.5
26	BS 16225	*oleifera*	Spaeths Zollerngold	2.50		5.9
31	CR 164	*oleifera*	Anja	2.30		19.4
32	CR 182	*oleifera*	Binera	1.90		17.4
33	CR 285	*oleifera*	Collo	2.30		22.0
40	CR 241	*oleifera*	Idol	2.00		13.3
43	CR 718	*oleifera*	Liragrün	4.20		21.8
49	CR1026	*oleifera*	Trebicska	2.50		13.8
53	BRA175	*oleifera*	Brauner Schnittkohl	11.00		10.2
78	CR 659/97	*oleifera*	Janpol	5.60		20.8
81	CR 707/99	*oleifera*	Lingot, R-26	4.60		7.1
112	HRI 6627	*napobrassica*	Angus	2.30		5.5
113	HRI 3268	*napobrassica*	Balmoral PT	2.60		7.3
117	HRI 3470	*napobrassica*	Conqueror Bronze Green Top	2.10		4.5
121	HRI 5878	*napobrassica*	Drummonds Purple Top	2.80		3.4
133	HRI 3271	*napobrassica*	Scotia	2.30		3.9
146	CGN06869	*oleifera*	Kromerska		8.40	14.2
158	NGB 593,1	*oleifera*	Norde		12.10	14.8
170	NGB 6791	*napobrassica*	Rotabaggeue		2.70	9.2
171	NGB 2769	*oleifera*	Silona		2.20	9.5
176	NGB 2659	*oleifera*	Topas		0.90	5.1
178	NGB 2336	*oleifera*	Alku		2.70	9.3
179	NGB 594	*oleifera*	Matador		2.30	21.9
38	CR 2186	*oleifera*	Express	**6.31**	**12.37**	**16.7**

Summary whole period:
The evaluation work performed in collaboration with the partners P3 (NGB, Alnarp, Sweden) and P12 (DSV) on the preliminary core collection is divided into resistance screening and seed analyses as summarised in the following table:

Disease / Pest / Seed quality	*B. napus* core accessions	Additional Brassicaceae accessions (incl. pre-evaluation results)	Total
Clubroot disease (*Plasmodiophora brassicae*)	188	-	188
Alternaria brassicae, *Sclerotinia sclerotiorum*, Phoma (*Leptosphaeria maculans*) = additional evaluations	(65)	-	(65)
Cabbage stem flea beetle (*Psylliodes chrysocephala*)	111	17	128
Cabbage stem weevil (*Ceutorhynchus pallidactylus*)	87	8	95
Rape stem weevil (*Ceutorhynchus napi*)	87	8	95
Field slugs (*Deroceras* spp.)	177	19	196
Seed oil content (% dry matter)	180	892	1,072
Seed protein content (% dry matter)			
Glucosinolate content (µmol/g seed)			
Fatty acid composition of triacylglycerols	183	176	359
Total number of evaluations	**1,013 (1,078)**	**1,120**	**2,133 (2,198)**

Executive summary including highlights over the whole period:

In the course of pre-evaluation field trials, which were conducted in collaboration with partners 11 (NPZ) and 3 (NGB, Alnarp, Sweden), a basic differentiation of *B. napus* genebank accessions was achieved with regard to morpho-agronomic characters and seed quality traits. Together with the information on country of origin and breeding pedigree a preliminary core collection of 180 *B. napus* accessions - including oilseed rape, fodder rape, spring and winter types, swedes and vegetable types - was created (Poulsen et al. 2002).
The main task of P11 in collaboration with partner 12 (DSV) was the phenotypic evaluation of the available *B. napus* accessions in the field accompanied by quality analysis of the harvested seed material (Lühs et al. 2002a, 2002b, 2003a). In breeding of oilseed rape and other *B. napus* crops, the percentage of erucic acid content in the seed oil and the glucosinolate content of the meal are very important quality characteristics. The extensive results of seed analyses allowed a differentation and identity check of the material. Based on these seed characteristics the genebank accessions (N=180) could be classified as follows: 1) high erucic acid-high glucosinolate (++), 2) low erucic acid-high glucosinolate (+0, single low), 3) high erucic acid-low glucosinolate (+0), and 4) low erucic acid-low glucosinolate (00, double low quality, canola).
The results from the flea beetle (*Psylliodes chrysocephala*) trial are of great interest for breeding practice. A considerable variation was observed in the genetically diverse *B. napus* core collection for both feeding damage by the adult insects and the larvae.
The extensive phenotypic and analytical results will allow to create a final core collection of 150 accessions representing a large variability within the species *B. napus* (cf. Poulsen et al. 2002). The results of the evaluation experiments have been presented at conferences dealing with genetic resources of Brassica crops and their use in plant breeding (Lühs et al. 2002a, 2002b, 2003a, 2003b).

Publications

Lühs, W., F. Seyis, M. Frauen, H. Busch, L. Frese, E. Willner, W. Friedt, M. Gustafsson and G. Poulsen, 2002a: Development and evaluation of a European *Brassica napus* core collection. In: P.B.E. McVetty, K. Schlosser and C.F. Quiros (Eds.), 13th Crucifer Genetics Workshop, 23-26 March 2002, University of California, Davis, California, USA, Poster abstract, p. 116.

Lühs, W., F. Seyis, M. Frauen, H. Busch, L. Frese, E. Willner, W. Friedt, M. Gustafsson, G. Poulsen, 2002b: Preliminary Field Evaluation of a *Brassica napus* Core Collection. In: L. Maggioni L, G. Thomas and E. Lipman, Comp. (2003) Report on a working Group on Brassica. Extraordinary Meeting, held jointly with the Third Coordinating Meeting of The EU Project GEN RES CT99 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy.

Lühs, W., F. Seyis, M. Frauen, H. Busch, L. Frese, E. Willner, W. Friedt, M. Gustafsson, and G. Poulsen, 2003a: Development and evaluation of a *Brassica napus* core collection. In: H. Knüpffer and J. Ochsmann (eds.), Rudolf Mansfeld and Plant Genetic Resources. Proceedings of a symposium dedicated to the 100th birthday of Rudolf Mansfeld, Gatersleben, Germany, 8-9 October 2001. Schriften zu Genetischen Ressourcen 19, pp. 284-289. ZADI/IBV, Bonn, (http://www.genres.de/infos/rei-bd22.htm).

Lühs W, B. Ulber, F. Seyis, M. Frauen, H. Busch, W. Friedt, M. Gustafsson and G. Poulsen, 2003b: Evaluation of a *Brassica napus* core collection and prospects of its exploitation through rapeseed breeding. 11th Intern. Rapeseed Congr., 6-10 July 2003, Copenhagen, Denmark, Vol. 2, pp. 371-374.

Poulsen G, H. Busch, M. Frauen, L. Frese, M. Gustafsson, F. Seyis, E. Willner, W. Lühs, 2002: Development and Evaluation of a *Brassica napus* L. Core Collection. In: L. Maggioni L, G. Thomas and E. Lipman, Comp. (2003) Report on a working Group on Brassica. Extraordinary Meeting, held jointly with the Third Coordinating Meeting of The EU Project GEN RES CT99 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy.

Contract no: RESGEN CT99 109/112

Project title: "*Brassica collections for Broadening Agricultural Use*" including 'Characterizing and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Participant no. P12: Deutsche Saatveredelung Lippstadt-Bremen GmbH (DSV)

Names of participants: Heinrich Busch, Dr. Carsten Oertel, Dr. Fatih Seyis, Dr. B. Ulber, G. Stemann, Hartmut Bockholt

Reporting period: 1st January to 31st December 2003 and summary over the whole period

Role in the project:
DSV is carrying out extensive evaluation work with respect to pest resistance/tolerance by performing field trials.

Milestone 3a *Part of the core collection evaluated*
Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*

Activities carried out during the fourth year and summary over the whole period

Milestone 3a *Core collection evaluate for resistance for resistance against field slugs and stem weevils*
Fourth year:
The results of the evaluation of tolerance to field slugs (*Deroceras* spp.) were processed. The field trial was carried in winter 2002/2003 at Merklingsen-Soester Boerde (northern part of Germany) in a randomised, triple-replicated block design with plot sizes of 1.5 x 1.3m per accession and the oilseed rape cultivar 'Express' as standard. Due to poor emergence of some of the accessions in autumn 2002, the establishment and within-plot distribution of plants was temporally and spatially inhomogeneous. The occurrence of slugs and carabid beetles (especially *Pterostichus melanarius*) as natural predators were monitored. In the field trial 177 *B. napus* accessions (including ssp. *napobrassica*) out of the preliminary core collection and 19 Brassicaceae specimens the percentage of intact and damaged plants were visually determined. The loss of plants and leaf area missing from true leaves of the crop, which was entirely attributed to slug damage, was recorded six times (18.09./16.09./ 07.10./14.10./24.10.). The average percentage of feeding damage was calculated and compared with the final rating (level 1-9; 1 represented very low and 9 very significant damage) of leaf damage assessed for the entire plot (Table 1).

Table 1: Extreme variation of slug-feeding damage observed among *B. napus* genebank accessions in comparison to winter oilseed rape cv. 'Express' (slug susceptible) and *Sinapis alba* cv 'Maxi' (slug resistant)

	ACCENUMB	SPECIES	SUBTAXA	ACCNAME	Level * leaf damage	Average feeding damage
182	White mustard	*Sinapis alba*		Maxi	1.7	17.3
131	HRI 5671	*B. napus*	*biennis*	Ragged Jack	1.0	9.7
98	CR 658/86	*B. napus*	*oleifera*	Janetzkis Schlesischer	2.7	29.7
91	CR 167/92	*B. napus*	*oleifera*	Aphid Resistant Rape	2.7	31.0
56	CR 2272	*B. napus*	*oleifera*	Cubs Root	2.3	32.6
43	CR 718	*B. napus*	*oleifera*	Liragrün	6.0	44.2
80	CR 561/96	*B. napus*	*oleifera*	Liglory	5.3	50.8
84	CR 853/2000	*B. napus*	*oleifera*	POH 285, Bolko	6.3	55.9
156	NGB 13603	*B. napus*	*oleifera*	Helios	5.0	59.7
38	CR 2186	*B. napus*	*oleifera*	Express	4.0	60.8

***** level 1,0 represents a very low and level 9,0 a very significant slug damage

Summary whole period:
The crop species *Brassica napus* comprises winter and spring types of oilseed rape varieties, fodder and green manure forms (ssp. *napus*), swedes (rutabaga, swede turnips, ssp. *napobrassica*) as well as „exotic" types used as vegetables, such as Hakuran, Couve Nabica types and Leaf rape (Siberian kale, Hanover

salad, ssp. *napus* var. *pabularia*). For a basic differentiation of all available *B. napus* genebank accessions information about the growth habit (seasonality, vernalisation requirement, winter hardiness), type of use, seed quality and agronomic characters was collected. Following this gross grouping of the *B. napus* material (excluding ssp. *napobrassica*), 338 summer type *B. napus* accessions and in the vegetation period 2000/2001 a total of 857 *B. napus* winter type accessions were grown at the Field Research Station in Rauischholzhausen (near Marburg/Hesse, Germany).
In addition of the seed quality data (cf. Partner 11; Lühs et al. 2002a, 2002b, 2003a) the extensive phenotypic results of both field trials were used to build up a preliminary *B. napus* core collection of 180 genebank accessions (Poulsen et al. 2002). In the pest evaluation experiments 20 additional specimens were included belonging to different brassicaceous species (*Sinapis alba*, *Raphanus sativus*, *B. rapa*, *B. oleracea*, *B. nigra*, *B. juncea*, *B. carinata*) and currently grown winter rape cultivars (including modern hybrids); the winter oilseed rape cultivar 'Express' was used as standard.
The field trial for the evaluation of resistance against stem weevils (*Ceutorhynchus* spp.) was carried out in the vegetation period 2001/2002 at Goettingen-Weende (northern part of Germany) in a double-replicated block design. Because of poor emergence of some of the accessions and/or plant losses due to winter frost (specially in the cases of the spring type *B. napus* and swedes), the evaluations of the infestation by cabbage stem weevil (*C. pallidactylus*) and rape stem weevil (*C. napi*) were focussed on 87 gene bank accessions of the preliminary *B. napus* core collection (plus 8 specimens of the brassicaceous species).The stems of 10 plants/plot were dissected in order to count the eggs and larvae of both stem weevils.
Regarding the infestation by *C. pallidactylus* 55 out of the 95 accessions showed a similar or even lower larval incidence than the standard plots sown with 'Express' (3.9 infested plants per 10 plants sampled)The *B. napus* accessions no. 40 ('Idol'), no. 55 ('Chuosenshu') and no. 192 ('Wotan') did not show any infestation by cabbage stem weevils (Table 2). In contrast, in 13 accessions the incidence of weevil attack was markedly higher than in the standard (7–9 infested plants per 10 plants). In 63 out of the 95 accessions the mean number of larvae/plant was smaller than the number of larvae in the standard plots (1.52 larvae/plant). In 18 accessions the number of larvae ranged between 0 and 0.5 larvae/plant. The *B. napus* accession no. 93 (CR 283, 'Clubrot resistant'), no. 33 ('Collo') and no. 153 (CGN 06893, 'Tantal') showed a considerably higher number of larvae (max. 10.8 larvae/plant) than all of the other accessions.

Table 2: Extreme variation / Magnitude of larval damage (*C. pallidactylus*) observed among *B. napus* genebank accessions in comparison to the winter oilseed rape cultivars 'Express' (susceptible) and 'Wotan' (resistant)

	ACCENUMB	SPECIES	SUBTAXA	ACCNAME	No.of infes stems/ 10 samp plants	No. of larv plant
192	Winter rapeseed	*B. napus*	*oleifera*	Wotan	0	0.00
40	CR 241	*B. napus*	*oleifera*	Idol	0	0.00
55	CR 2198	*B. napus*	*oleifera*	Chuosenshu	0	0.00
49	CR1026	*B. napus*	*oleifera*	Trebicska	1	0.10
120	HRI 3367	*B. napus*	*napobrassica*	Devon Champion	1	0.10
38	CR 2186	*B. napus*	*oleifera*	Express	3.9	1.52
93	CR 283	*B. napus*	*oleifera*	Clubrot resistant	9	4.50
33	CR 285	*B. napus*	*oleifera*	Collo	7	4.60
153	CGN06893	*B. napus*	*oleifera*	Tantal	9	10.80

Among the same 95 accessions tested for infestation by rape stem weevil (*C. napi*) 24 accessions did not show any infestation by this pest. Additionally, in plant samples from 14 accessions only 0.1 larva/plant was found. The incidence of rape stem weevil infestation in 36 accessions was inferior to the standard 'Express', which had 3.2 infested plants per 10 plants sampled.

Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*

Fourth year:
The data regarding resistance traits was filled in data sheets allowing the link to Bras-EDB.

Summary whole period:

The evaluation work performed in collaboration with the partners P3 (NGB, Alnarp, Sweden) and P11 (NPZ) on the preliminary core collection is divided into resistance screening and seed analyses as summarised in the following table:

Disease / Pest / Seed quality	***B. napus* co accessions**	**Additional Brassicaceae accessions (in pre-eva-luation results)**	**Total**
Clubroot disease (*Plasmodiophora brassicae*)	188	-	188
Alternaria brassicae, *Sclerotinia sclerotioru* Phoma (*Leptosphaeria maculans*) = additior evaluations	(65)	-	(65)
Cabbage stem flea beetle (*Psylliod chrysocephala*)	111	17	128
Cabbage stem weevil (*Ceutorhynch pallidactylus*)	87	8	95
Rape stem weevil (*Ceutorhynchus napi*)	87	8	95
Field slugs (*Deroceras* spp.)	177	19	196
Seed oil content (% dry matter)	180	892	1,072
Seed protein content (% dry matter)			
Glucosinolate content (µmol/g seed)			
Fatty acid composition of triacylglycerols	183	176	359
Total number of evaluations	**1,013 (1,078)**	**1,120**	**2,133 (2,198)**

The extensive phenotypic and quality data is being used to select accessions representing the variability within the species *B. napus* and to establish a reliable European core collection of 150 accessions (Poulsen *et al*. 2002), which can be further used for other evaluations and molecular genetic characterisation (Seyis et al. 2003a, 2003b, Hasan et al. 2003).

Executive summary including highlights over the whole period:

In the course of pre-evaluation field trials, which were conducted in collaboration with partners 11 (NPZ) and 3 (NGB, Alnarp, Sweden), a basic differentiation of *B. napus* genebank accessions was achieved with regard to morpho-agronomic characters and seed quality traits. Together with the information on country of origin and breeding pedigree a preliminary *B. napus* core collection of 180 accessions was created representing a broad variability of the accessions in the European *Brassica* database. The samples of the preliminary *B. napus* core collection - including oilseed rape, fodder rape, spring and winter types, swedes and vegetable types - were evaluated under natural field conditions in order to access the resistance against these pests, which are difficult to control in rapeseed production.
Depending on the biology of the respective pests, autumn-sown *B. napus* is attacked twofold: In the seedling and juvenile stage by field slugs (*Deroceras* spp.) and in early spring by larvae of stem weevils (*Ceutorhynchus napi*, *C. pallidactylus*) mining the stems of the plants. Due to the heterogeneity of the core collection as such, the results of the pest evaluation experiments provide some preliminary indications towards the susceptibility of the selected accessions of *B. napus* in the field. However, the results from the field slug trial are promising. One *B. napus* accession could be identified showing a slug resistance even better than White mustard (*Sinapis alba*), which is well known being resistant against field slug feeding attack.

Because of low plant densities and inhomogeneous distributions of the plants in the plots, particularly after overwintering, the level of stem weevil infestation of many genotypes could not be evaluated properly in spring 2002. Various relations that might exist between the level of pest infestation and plant density and other, determined morpho-agronomic traits (growth stage, plant length, number of leaves) need to be analysed for individual accessions in more detail. The results of the stem weevil (*Ceutorhynchus* spp.) trial showed that variability exists among the accessions of the core collection (Lühs et al. 2003b). The cabbage stem weevil (*Ceutorhynchus pallidactylus*) evaluation experiments involving *B. napus* genebank material will be continued by Dr. B. Ulber (University of Göttingen, Germany), funded by the “Gemeinschaft zur Förderung der privaten deutschen Pflanzenzüchtung” (GFP, Bonn, Germany) and the German rapeseed breeders.

Publications

Hasan M., W. Lühs, F. Seyis, W. Friedt and R. Snowdon, 2003: Surveying genetic diversity in the *Brassica napus* gene pool using SSR markers. 11th Intern. Rapeseed Congr., 6-10 July 2003, Copenhagen, Denmark, Vol. 2, pp. 392-394.

Lühs, W., F. Seyis, M. Frauen, H. Busch, L. Frese, E. Willner, W. Friedt, M. Gustafsson, and G. Poulsen, 2002a: Development and evaluation of a European *Brassica napus* core collection. In: P.B.E. McVetty, K. Schlosser and C.F. Quiros (Eds.), 13th Crucifer Genetics Workshop, 23-26 March 2002, University of California, Davis, California, USA, Poster abstract, p. 116.

Lühs, W., F. Seyis, M. Frauen, H. Busch, L. Frese, E. Willner, W. Friedt, M. Gustafsson, G. Poulsen, 2002b: Preliminary Field Evaluation of a *Brassica napus* Core Collection. In: L. Maggioni, G. Thomas and E. Lipman, Comp. (2003) Report on a working Group on Brassica. Extraordinary Meeting, held jointly with the Third Coordinating Meeting of The EU Project GEN RES CT99 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy.

Lühs, W., F. Seyis, M. Frauen, H. Busch, L. Frese, E. Willner, W. Friedt, M. Gustafsson and G. Poulsen, 2003a: Development and evaluation of a *Brassica napus* core collection. In: H. Knüpffer and J. Ochsmann (eds.), Rudolf Mansfeld and Plant Genetic Resources. Proceedings of a symposium dedicated to the 100th birthday of Rudolf Mansfeld, Gatersleben, Germany, 8-9 October 2001. Schriften zu Genetischen Ressourcen 19, pp. 284-289. ZADI/IBV, Bonn, (http://www.genres.de/infos/rei-bd22.htm).

Lühs W, B. Ulber, F. Seyis, M. Frauen, H. Busch, W. Friedt, M. Gustafsson and G. Poulsen, 2003b: Evaluation of a *Brassica napus* core collection and prospects of its exploitation through rapeseed breeding. 11th Intern. Rapeseed Congr., 6-10 July 2003, Copenhagen, Denmark, Vol. 2, pp. 371-374.

Poulsen G, H. Busch, M. Frauen, L. Frese, M. Gustafsson, F. Seyis, E. Willner, W. Lühs, 2002: Development and Evaluation of a *Brassica napus* L. Core Collection. In: L. Maggioni, G. Thomas and E. Lipman, Comp. (2003) Report on a working Group on Brassica. Extraordinary Meeting, held jointly with the Third Coordinating Meeting of The EU Project GEN RES CT99 109-112, 8-9 February 2002, Vila Real, Portugal. IPGRI, Rome, Italy.

Seyis, F., R. Snowdon, W. Friedt, W. Lühs, 2003a: Molecular genetic diversity in resynthesised and conventional spring rapeseed. 11th Intern. Rapeseed Congr., 6-10 July 2003, Copenhagen, Denmark, Vol. 2, pp. 382-384.

Seyis, F., R.J. Snowdon, W. Lühs and W. Friedt, 2003b: Molecular characterization of novel resynthesized rapeseed (*Brassica napus*) lines and analysis of their genetic diversity in comparison with spring rapeseed cultivars. Plant Breeding 122, 473-478.

Contract no: RESGEN CT99 109/112

Project title: "*Brassica collections for Broadening Agricultural Use"* including 'Characterizing and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Participant no. P 13: Polytechnic University of Valencia
Biotechnology Department, 46022 Valencia, Spain.

Names of participants: Fernando Nuez Viñals
María José Díez Niclós
Pascual Fernández de Córdova

Reporting period: 1st January to 31st December 2003 and summary over the whole period

Role in the project: Updating data and donation to the central database
Regeneration and characterisation of *Brassica oleracea*

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*
Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Milestone 2a *Part of the core collection characterised.*
Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*
Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*
Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Activities carried out during the fourth year and summary over the whole period

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*

Fourth year:
Partner 13 was not involved in this Milestone for the fourth year
Summary whole period:
The passport database of the UPV was updated durig the first year of the project and a revised version was sent to the Subcoordinator.

Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Fourth year:
Partner 13 was not involved in this Milestone for the fourth year
Summary whole period:
Partner 13 participated in the First Meeting held in Wageningen, where decisions were taken in relation with methods for developing the core collection for *B. oleracea*.
Accessions of UPV to be included in the core collection were selected, following the indications of the Subcoordinator of *Brassica olearea* group, and this information was sent to the Subcoordinator.
The following accessions were selected:

- 2 kale´s (*B. oleracea acephala*): C-B-13 and A-B-14
- 5 cabbages of different types: A-B-1, B-B-1, C-B-61, MU-B-6, V-B-8
- 3 broccoli´s, different types: C-B-105, C-B-14, C-B-40
- 1 cauliflower: V-B-11
- 15 *B. oleracea* landraces of which the cultivar group is not known: A-B-9, AN-B-2, AN-B-12, AN-B-13, AN-B-14, AN-B-15, C-B-1, C-B-3, C-B-4, C-B-7, C-B-8, C-B-18, C-B-20, C-B-22, V-B-46.

Samples of these accessions were sent in October 2000 to the Subcoordinator.
During the characterisation of these accessions the crop types were checked or identified, when not known. The results were sent to P1 for updating the Bras-EDB.

Milestone 2a *Part of the core collection characterised.*
Fourth year:
Fifteen accessions of B. oleracea have been characterised this year.

Accessions included in the characterisation assay conducted in the Politechnic University of Valencia (Spain) in 2003.

Accesion	Scientific name
C-B-41	*B. oleracea var. sabauda*
C-B-46	*B. oleracea var. sabauda*
C-B-50	*B. oleracea var. alba*
C-B-54	*B. oleracea var. sabauda*
C-B-57	*B. oleracea var. botrytis*
CA-B-5	*B. oleracea var. alba*
CA-B-10	*B. oleracea var. alba*
CA-B-12	*B. oleracea var. alba*
CM-B-4	*B. oleracea var. alba*
E-B-2	*B. oleracea var. alba*
E-B-3	*B. oleracea var. alba*
E-B-5	*B. oleracea var. alba*
V-B-20	*B. oleracea var. alba*
V-B-25	*B. oleracea var. alba*
V-B-36	*B. oleracea var. alba*

Additional site data:
Country of characterisation and regeneration: Spain
Site: Research Institute: Polytechnic University, Camino de Vera, 14 46022 VALENCIA
Name of person in charge: Eva Solbes
Number of plants/accessions: 30
Sowing date: 1st to 15th January 2003
Transplant date: 24th of January
Harvest and characterisation date: April-May 2003
Harvest of seeds date: June 2003

Characterisation data are shown in Table 1.

Summary whole period:
The UPV participated in the First Meeting held in Wageningen, where the list of descriptors for *Brassica oleracea* was revised and a minimum of them were selected.
Fifteen accessions of *B. oleracea* have been characterised every year of the project (2001, 2002 and 2003). Characterization data were sent each year in the corresponding report.
All results were sent in Excel files in the requested formats to P1 to be linked to the Bras-EDB.

Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Fourth year:
The same fifteen accessions characterised this year have also been regenerated
During this year a trial has been conducted to determine the percentage of germination of the collection. Fifty seeds of 248 accessions have been tested. The results obtained are the following:

Number of accessions	% Germination
51	0 - 20 %
25	21 - 40 %
15	41 – 60 %
19	61 - 80 %
138	81 – 100 %

Summary whole period:
Every year the accessions characterised were also regenerated.

The germination percentage of the collection has been tested.

Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*

Fourth year:
Safety duplication of all the *Brassica* collection held in the UPV have been sent to the "Centro de Recursos Fitogenéticos" (Alcalá de Henares, Madrid). This Center is the Coordinator for genetic resources in Spain.

Summary whole period:
The complete collection of UPV is duplicated in the Centro de Recursos Fitogenéticos (Alcalá de Henares, Madrid)

Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Fourth year:
Partner 13 has sent the report to the Subcoordinator and will send the cost statement in due time

Summary whole period:
Partner 13 has sent the reports and cost statements every year of the project.

Executive summary including highlights over the whole period:

Updating and donation of data to Bras-EDB was completed in 2000.
Samples of our collection which take part in the core collection were sent to CGN in 2000 and sent by the subcoordinator of Brassica Group to the EVA partners.
Fifteen accessions of cabbage have been characterised every year (45 in total). Twenty seven descriptors have been recorded, more that the minimum descriptor list agreed and all data have been sent in the annual reports. The same accessions have been regenerated.
Assays for testing the viability of seeds of the collection have been carried out and priorities for regeneration have been identified. A duplicate of the collection has been sent to the Centro de Recursos Fitogenéticos (Alcalá de Henares, Madrid, Spain).

Table 1. Characterisation data of the 15 accession characterised in UPV (Partner 13) in 2003.

Accesion	Seedling leaf colour (4.1.2) *	Plant growth habit (4.2.2)	Plant height (cm) (4.2.3)	Plant diameter (cm) (4.2.4)	Leaf length (cm) (4.2.12)	Leaf blade width (cm) (4.2.13)	Leaf blade width/leaf length ratio (4.2.14)	Leaf blade shape in outline, including lobes (4.2.16)
C-B-41	4	2	24	51,6	25	35	1,4	1
C-B-46	4	2	32	60	29	33	1,13	1
C-B-50	4	2	29	72	42	20	0,42	4
C-B-54	4	2	30,6	57,3	28,6	33,3	1,16	1
C-B-57	4	2	28	60,6	24	32,3	1,34	1
CA-B-5	4	2	27	35,3	35	23	0,65	1
CA-B-10	4	2	40	82	37	32	0,86	1
CA-B-12	4	2	46,3	84,6	30	37	1,23	1
CM-B-4	4	2	43,6	81,3	38	34,3	0,9	1
E-B-2	4	2	40	69	33	41	1,24	1
E-B-3	4	2	33	77	37	42	1,13	1
E-B-5	4	2	47,3	78	30	33,3	1,11	1
V-B-20	4	2	38,6	67	23,5	27,16	1,15	1
V-B-25	4	2	23	74,3	33,3	33	0,1	1
V-B-36	4	2	27	36	35	32	0,9	1

Accesion	Leaf division (margin) (4.2.17)	Leaf shape apex (4.2.19)	Leaf colour (4.2.24)	Petiole length (cm) (4.2.28)	Petiole width (cm) (4.2.29)	Petiole length/width ratio (4.2.30)
C-B-41	2	8	3	7,2	2,5	2,88
C-B-46	2	8	3	7	2,5	2.8
C-B-50	2	6	3	0,5	3	0,16
C-B-54	2	6	3	6,73	1,7	3,95
C-B-57	2	8	3	4	1,96	2,04
CA-B-5	2	8	3	5,2	1,9	2,7
CA-B-10	2	8	2	0,3	3	0,1
CA-B-12	2	8	3	9,3	2,7	3,4
CM-B-4	2	8	3	6,4	3	2,13
E-B-2	2	8	2	7,3	7,25	1,01
E-B-3	2	8	3	11	4,5	2,44
E-B-5	2	8	3	7,8	2,4	3,25
V-B-20	2	6	3	9,3	2,6	3,57
V-B-25	2	8	3	0,5	4,2	0,11
V-B-36	2	8	3	9,3	2,5	3,72

Accesion	Petiole thickness (mm) (4.2.31)	Petiole section (4.2.32)	Petiole and/or midvein colour (4.2.33)	Heading habit (4.2.34)	Head shape in longitudinal section (4.2.35)	Weight of harvested organ (g)	Head length (cm) (4.2.41)
C-B-41	1,2	3	1	7	7	1010	18
C-B-46	2,5	3	2	7	2	823	19
C-B-50	1,1	3	1	7	7	475	15
C-B-54	1,03	7	2	7	4	924	29
C-B-57	1,4	5	2	7	5	865	17
CA-B-5	1,2	3	1	7	5	275	13
CA-B-10	1,6	5	2	7	5	1200	20
CA-B-12	2,6	3	1	7	2	970	18
CM-B-4	2,2	5	2	7	2	1755	27,5
E-B-2	2,3	3	1	7	2	700	16
E-B-3	2,3	3	1	7	2	1345	29
E-B-5	1,4	3	1	7	7	1600	17,5
V-B-20	1,76	3	1	7	2	650	16,2
V-B-25	1,6	3	2	7	5	795	15
V-B-36	1,5	3	2	7	2	400	15

Accesion	Head diameter (cm) (4.2.42)	Stem length in head measured (cm) (4.2.44)	Stem diameter at head base (cm) (4.2.45)	Stem length in head estimate (4.2.47)	Primary colour inside cut (4.2.48)	Primary colour of outer head leaves (4.2.38)	Head forming leaf overlap at terminal section (4.2.36)
C-B-41	18	6,5	3	3	2	3	5
C-B-46	14	9,6	4	5	2	2	5
C-B-50	15	6	3,5	3	1	4	1
C-B-54	15,5	12	3,8	4	2	2	5
C-B-57	18	4,9	2,8	5	2	2	5
CA-B-5	13,5	10,5	3	7	1	2	4
CA-B-10	20	8,5	4	5	2	2	4
CA-B-12	13	7,2	4,2	5	1	1	5
CM-B-4	20	11,6	5,4	5	1	1	5
E-B-2	12	5,5	4,5	5	2	1	3
E-B-3	22	17	4,5	7	2	2	3
E-B-5	21	11,5	3	7	1	3	5
V-B-20	11	7	3,7	3	1	2	4
V-B-25	15	5,5	3,5	3	2	2	5
V-B-36	9,5	9	3,5	7	2	2	5

Accesion	Head solidity (4.2.40)	Stem length under head (4.2.57)	Flowering head shape in flowering section (4.2.75)	Flowering head solidity (4.2.77)	Flowering head colour surface (4.2.78)	Harvest time or season (4.5.12)	Time from planting to harvest (4.5.13)	Global uniformity (4.5.14)
C-B-41	5	5	-	-	-	-	-	1
C-B-46	7	5	-	-	-	-	-	1
C-B-50	5	5	3	5	2	1	2	1
C-B-54	5	5	-	-	-	-	-	1
C-B-57	7	5	-	-	-	-	-	1
CA-B-5	5	7	-	-	-	-	-	1
CA-B-10	5	7	-	-	-	-	-	1
CA-B-12	7	5	-	-	-	-	-	1
CM-B-4	5	5	-	-	-	-	-	1
E-B-2	5	7	-	-	-	-	-	1
E-B-3	5	5	-	-	-	-	-	1
E-B-5	7	5	-	-	-	-	-	1
V-B-20	5	5	-	-	-	-	-	1
V-B-25	5	5	-	-	-	-	-	1
V-B-36	5	5	-	-	-	-	-	1

*Numbers in brackets are corresponding with the ones of the “Descriptors for Brassica and Raphanus” 1990.

Contract no: RESGEN CT99 109/112

Project title: "*Brassica collections for Broadening Agricultural Use*" including 'Characterizing and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Participant no. P14 Plantum NL, formerly: Nederlandse Vereniging voor Zaaizaad en Plantgoed (NVZP), Gouda, The Netherlands

Names of participants:

Nickerson Zwaan	K. van 't Hoenderdal
SVS Holland	I. Weber
Syngenta(formerly Novartis Seeds)	R. Linders
Bejo Seeds	J. de Geus
Enza Zaden	H. v.d. Sloot
Takii Europe	S. Lachmann
Rijk Zwaan	A. v.d. Nieuwenhuizen

Reporting period: 1st January to 31st December 2003 and summary over the whole period
Reported by P1: Centre for Genetic Resources, The Netherlands (CGN)

Role in the project: Evaluation of the core collection of *B. oleracea* for resistance to *Xanthomonas campestris* (blackrot).
Evaluation of the core collection of *B. oleracea* for resistance to *Mycosphaerella brassicicola*.

Milestone 3a *Part of the core collection evaluated*
Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*
Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Activities carried out during the fourth year and summary over the whole period

Milestone 3a *Part of the core collection evaluated*
Fourth year:
The offspring of plants (a total of about 80 families) that had shown the best resistance to *Xanthomonas* in 2001 have been evaluated for *Xanthomonas* resistance. The majority of the offspring showed a level of resistance.
Plants resistant to *Mycosphaerella* in accessions with a majority of susceptible plants have been selfed. The evaluation of *Mycosphaerella* resistance in this offspring was not successful because there was not enough infection due to the hot dry summer.

Summary whole period:
Evaluation for resistance to Xanthomonas campestris (blackrot)
396 accessions have been evaluated for resistance to *Xanthomonas campestris*, according to the protocols. In some cultivargroups, especially "*alboglabra"*, cauliflower, broccoli and marrowstem and fodder kale, many accessions with resistant plants were found (table 1). However, the number of resistant plants within most of these accessions was very low. The offspring of these selfed plants showed a level of resistance, which confirms the resistance found in the selected plants.

Evaluation for resistance to Mycosphaerella brassicicola
396 accessions have been evaluated in the field for resistance to *Mycosphaerella* according to the protocols. Only a few accessions had 100% resistant plants in the field. Especially in red cabbage, accessions with many resistant plants have been found.
65 accessions were evaluated again in 2002 by two companies as they germinated insufficiently or were sown in the wrong period. The results of this test have been added to the results of 2001. Of 17 accessions no results were obtained, as either germination was too low or harvest time was too early for *Mycosphaerella* to develop. Although sowing date was later than in 2001,all the Chinese kale-accessions started to flower so early that infection did not take place.
The evaluation of *Mycosphaerella* resistance in the offspring of resistant selfed plants was not successful

Table 1: Overview of the results of the assays on *Xanthomonas campestris pv campestris* and *Mycosphaerella brassicicola* (2001 and 2002-results combined) per cultivar group

Company	*Brassica oleracea* …	Vernacular name	Number of accessions		
			tested	with resistant plants	
				Xan	Myco
BEJO	Gemmifera	Brussels sprouts	40	4	---
	Gongylodes	Kohlrabi	20	1	---
	Capitata alba	White cabbage	55	10	---
Takii	Gemmifera	Brussels sprouts	40	---	1
	Gongylodes	Kohlrabi	20	---	1
	Capitata alba	White cabbage	55	---	5
Nickerson Zwaan	Capitata rubra	Red cabbage	15	11	15
	Tronchuda/ Capitata alba	Tronchuda/Pointed headed cabbage	19	10	13
	Botrytis italica	Broccoli	35	16	27
Rijk Zwaan	Botrytis botrytis	Cauliflower	63	55	14
SVS	Acephala sabellica	Borecole	18	0	1
	Capitata sabauda	Savoy cabbage	24	0	9
Syngenta	Acephala	Marrowstem and Fodder kale	59	21	28
ENZA	Alboglabra	Chinese kale	10	10	no result
	---	Rest group	37	22	14

NB: the number of accessions found with resistant plants is independent of the number of resistant plants found within an accession.

Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*

Fourth year:

The results, presented in 3 resistance classes and disease index, together with the descriptions of the two evaluations, including those of the repeat in 2002 have been sent to P01 to be linked to the Bras-EDB.

Summary whole period:

The results, presented in 3 resistance classes and disease index, together with the descriptions of the two evaluations, including those of the repeat in 2002 have been to P01 to be linked to the Bras-EDB.

Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*

Fourth year:

During the final meeting gaps in the collections were identified and recommendations made for appropriate collecting activities, see *B. oleracea*-subgroup report

Summary whole period:

During the final meeting gaps in the collections were identified and recommendations made for appropriate collecting activities, see *B. oleracea*-subgroup report

Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Fourth year:

The fourth and final progress report and cost statement of the fourth year were finalised and submitted to subco-ordinator on time.

Summary whole period:

All individual progress reports and cost statements were finalised and submitted to subco-ordinator on time.

Executive summary including highlights over the whole period:

Xanthomonas campestris pv campestris

396 accessions have been evaluated for resistance to, according to the protocols. In some cultivargroups, especially, cauliflower, broccoli. Chinese-, marrowstem- and fodder kales, many accessions with resistant plants were found (table 1). However, the number of resistant plants within most of these accessions was very low. Only in 5 accessions the percentage resistant plants was more than 50%: These were: HRI 9846 (kale) and ITAIDG 201563 and 203313, CGN11982, HRI 4250 (all cauliflower) The evaluation of offspring of selfed resistant plants showed a level of resistance to *Xanthomonas*.

Mycosphaerella brassicicola

396 accessions have been evaluated in the field for resistance to *Mycosphaerella* according to the protocols. 65 accessions were evaluated again in 2002 by two companies and. the results of this test have been added to the results of 2001.

Only a few accessions had 100% resistant plants in the field. Especially in red cabbage, but also in broccoli, accessions with many resistant plants have been found. BRA 804, BRA 775, CGN11038, CGN7094 and HRI 6852, all red cabbage, had 100% resistant plants..

Presentations

Nieuwenhuizen van den, A. The use of wild species in *B. oleracea*-breeding. Open day at final project meeting. Giessen, Germany, 11 December 2003

Contract no: RESGEN CT99 109/112

Project title: "*Brassica collections for Broadening Agricultural Use*" including 'Characterizing and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Participant no. P15: Instituto de Agricultura Sostenible (IAS) –CSIC

Names of participants: A. De Haro, J.M. Fernández, R Font, M. del Río, B. Guta, A. Merino, G. Fernández

Reporting period: 1st January to 31st December 2003 and summary over the whole period

Role in the project: Co-ordination of the *B. carinata* subgroup. Regeneration and characterisation of *B. carinata* collection. Establishment of the core collection of *B. carinata* in collaboration with JIC. Evaluation of the core collection of *B. carinata* for characters of agronomic importance including seed storage components. Development of NIRS calibrations for seed quality analysis in *B. carinata*.

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*
Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*
Milestone 2a *Part of the core collection characterised.*
Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Milestone 3a *Part of the core collection evaluated*
Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*
Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*
Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*
Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Activities carried out during the fourth year and summary over the whole period

Milestone 1a *Updated Bras-EDB with passport data and linked info on characterisation and evaluation data resulting from the project made available via Internet. The information will be also available on diskette.*

Fourth year

Excel files with different worksheets filled with the available passport, characterisation and evaluation data have been sent to be attached to the Bras-EDB website.

Summary whole period

In relation to the accessions obtained in the 1980s from Prof. Knowles (Dept. of Agronomy, University of California-Davis) that have been included in the germplasm collection studied in this project, we have tried to complete the previously available information by contacting with the Office Staff of the Genetic Resources Conservation Program of this University. The only information, therefore, available at this moment, is the original code numbers provided by Prof. Knowles together with the accessions.
All the available information on passport data from the B. carinata accessions has been submitted to the Bras-EDB.

Milestone 1b *Core collections of the four Brassica species tagged in the Bras-EDB.*

Fourth year and summary whole period

Data from all the accessions grown at JIC (Norwich) and IAS (Córdoba) during three seasons (years 2000 to 2003) have been combined and analysed to established the *Brassica carinata* core collection.

Eighty accessions have been chosen for the core collection, 73 of them based on analysis of the seven minimum descriptors previously defined (see Milestone 2a of partner P16) using data from JIC trials,

and 7 accessions selected for its variability in the main seed storage characters (protein, acid detergent fiber, oil, glucosinolates and fatty acid composition) using data from IAS trials.

Milestone 2a *Part of the core collection characterised.*
Fourth year:
The third set of 100 accessions for possible inclusion in the *B. carinata* core collection have been grown in field plots at Cordoba in two en two randomised blocks of 5 plants from December 2002 to July 2003. All the plants have been grown in self-pollinating conditions (nylon mesh cages). As in previous years, important differences among accessions have been detected and recorded. A wide range of morphological and agronomic characters have been assessed during the growth cycle of the plants, duplicating those collected at Norwich during year 2002 according with methodologies developed jointly by both groups. After harvesting, agronomic and seed storage traits have been obtained. The analysis of the main seed quality components (oil content, protein content, acid detergent fibre content, fatty acid composition and glucosinolate content) have been performed for each accession, using selfed seeds obtained both at Norwich and Cordoba.

Summary whole period:
A total of 222 accessions of *Brassica carinata* have been characterised throughout the four years of the project by performing field plots at two localities, Norwich (UK) and Córdoba (Spain).

In October of each year seed from the selected accessions were germinated in Petri dishes, grown in small pots and, in November, transplanted to field plots in two randomised blocks of 5 plants. All the plants have been grown in self-pollinating conditions (nylon mesh cages), and the adequate growing conditions for this species allowed a good development of the crop, with a high production of biomass, pods and seeds (some entries reached more than 2 meters high). Important differences among the accessions in characters as time to flowering, time to ripening and seed yield have been detected and recorded. A wide range of morphological and agronomic characters were assessed during the growth cycle of the plants: anthocyanins, margins and glaucousness of leaves, time to flowering, flower colour, stem diameter, plant height, level of branching, time to ripening, pod colour, homogeneity of the accession etc. These measured traits duplicate those collected at Norwich during the previous year and follow the methodologies developed jointly by both groups. After harvesting, other morphological, agronomic and seed traits have been evaluated including: dimensions of siliques, angles of pedicel to rachis, and silique to rachis, seed colour, number of seeds in 50 siliques, 1000-seed weight.

Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Fourth year:
Selfed seeds from all the accessions grown from December 2002 to July 2003 have been obtained.
Thirty accessions from the third set of accessions have been regenerated during 2003 using field plots isolated by using nylon mesh cages thus allowing self-pollination among *circa* 50 plants of each accession.

Summary whole period:
Thirty accessions from the *B. carinata* collection have been regenerated each year at IAS (Córdoba – Spain) by using field plots isolated under nylon mesh cages, thus allowing self-pollination among *circa* 50 plants of each accession.

Milestone 3a *Part of the core collection evaluated*
Fourth year:
Selfed seeds from all the third set of accessions grown both at Norwich and Cordoba have been evaluated for seed storage components by scanning 3 g of intact seed using a Near Infrared Reflectance Spectroscopy monochromator to record reflectance spectra from 400 to 2500 nm. The application to these spectra of the calibration equations obtained in years 2001 and 2002 allowed us to evaluate all the accessions grown in both environments (Norwich and Córdoba) for oil, protein and glucosinolate contents, and for fatty acid composition of the oil (Table 1 and 2, 3rd year).
Differences among and within the accessions have been detected and recorded.

Summary whole period:
Seed storage component analysis of *B. carinata* collection: In order to optimise the analysis of the seed storage components of the accessions grown at Norwich and Córdoba, and to enable the rapid analysis of large numbers of seed quality characters, reference standards methods have been

developed on samples of our *B. carinata* collection obtained from a sub-set of the initial core collection. These have been analysed using the following methods: Soxhlet and Nuclear Magnetic Resonance for oil content, gas chromatography of methyl esters for fatty acid composition, Kjeldahl for protein content, Van Soest for acid detergent fiber content, and liquid chromatography of desulphoglucosinolates for glucosinolates content. These reference standards have been used to develop the calibration equations that allow us to analyze each seed storage component by Near Infrared Reflectance Spectroscopy (See Annexe 1).

Selfed seeds from all the accessions grown both at Norwich and Cordoba throughout the years of the project have been evaluated for seed storage components by scanning about 3 g of intact seed using a monochromator to record reflectance spectra from 400 to 2500 nm and applying the calibration equations previously obtained (Tables 1 and 2).
Differences among and within the accessions have been detected and recorded.

Evaluation of the *B. carinata* core collection for agronomic and seed quality characters:
The core collection has been assessed for agronomic characters by growing the 80 accessions in self-pollination conditions at Córdoba.
Selfed seeds from accessions of the core grown both at Norwich and Cordoba have been evaluated for seed storage components by scanning 3 g of intact seed using a Near Infrared Reflectance Spectroscopy monochromator to record reflectance spectra from 400 to 2500 nm. The application to these spectra of the calibration equations obtained in years 2001 and 2002 allowed us to evaluate all the accessions grown in both environments (Norwich and Córdoba) for oil, protein and glucosinolate contents, and for fatty acid composition of the oil.

Table 1. Evaluation results for the seed storage components of *Brassica carinata* at the IAS (Córdoba, Spain) from 2001 to 2003.

1st year

	protein (% dm)	oil (% dm)	gsl (mmol/g dm)	adf (% dm)	C 18:1 (% oil)	C 18:2 (% oil)	C 18:3 (% oil)	C 22:1 (% oil)	1000 seed wt (g)	seed yield/plant (g)
Mean	22,7	44,7	108,8	13,8	9,8	15,8	12,9	42,9	4,0	83,9
Sd	3,3	3,8	18,6	2,2	2,7	1,9	1,6	3,4	0,9	61,4
Min	16,7	25,6	56,5	7,7	4,0	10,0	6,6	23,2	2,0	4,0
Max	37,8	54,6	221,1	19,1	18,9	21,6	17,7	53,1	6,8	480,0

2nd year

	protein (% dm)	oil (% dm)	gsl (mmol/g dm)	adf (% dm)	C 18:1 (% oil)	C 18:2 (% oil)	C 18:3 (% oil)	C 22:1 (% oil)	1000 seed wt (g)	seed yield/plant (g)
Mean	22,7	45,0	107,5	12,9	7,9	15,9	12,6	44,6	3,9	105,1
Sd	3,0	3,3	18,6	1,2	3,2	2,0	1,3	3,1	0,9	74,7
Min	16,6	27,8	58,0	6,0	2,0	9,1	8,4	31,8	1,9	2,0
Max	37,7	53,7	191,7	16,1	19,1	25,8	16,1	59,5	12,1	570,0

3rd year

	protein (% dm)	oil (% dm)	gsl (mmol/g dm)	adf (% dm)	C 18:1 (% oil)	C 18:2 (% oil)	C 18:3 (% oil)	C 22:1 (% oil)	1000 seed wt (g)	seed yield/plant (g)
Mean	24,7	45,3	111,2	12,0	11,7	19,1	9,9	44,7	4,3	47,4
Sd	3,2	4,3	25,7	2,4	4,5	2,9	2,4	6,9	1,2	38,5
Min	18,3	31,4	40,7	4,7	2,1	7,5	3,6	9,2	1,7	2,0
Max	37,7	56,5	191,8	20,4	35,9	29,3	19,3	57,8	7,8	300,0

gsl: total glucosinolate content; **adf:** acid detergent fiber; **C18:1:** oleic acid; **C18:2:** linoleic acid; **C18:3:** linolenic acid; **C22:1:** erucic acid; **dm:** dry matter; **wt:** weight.

Table 2. Evaluation results for the seed storage components of *Brassica carinata* at the JIC (Norwich, UK) from 2001 to 2003.

1st year

	protein (% dm)	oil (% dm)	gsl (mmol/g dm)	adf (% dm)	C 18:1 (% oil)	C 18:2 (% oil)	C 18:3 (% oil)	C 22:1 (% oil)
mean	25,7	33,3	105,2	9,6	8,9	17,4	13,2	38,4
Sd	2,8	4,1	19,1	1,7	1,4	1,4	1,6	2,6
Min	15,2	20,5	38,9	5,2	3,2	12,8	7,0	25,1
Max	36,2	50,4	167,0	13,8	16,1	23,1	18,1	45,6

2nd year

	protein (% dm)	oil (% dm)	gsl (mmol/g dm)	adf (% dm)	C 18:1 (% oil)	C 18:2 (% oil)	C 18:3 (% oil)	C 22:1 (% oil)
Mean	23,0	43,1	86,7	10,8	11,6	17,9	13,0	32,0
Sd	2,8	2,8	16,9	0,9	3,7	2,0	1,5	5,4
Min	16,6	30,1	50,2	6,9	2,0	13,1	8,0	15,1
Max	34,3	49,7	166,2	14,4	22,1	26,8	18,1	47,0

3rd year

	protein (% dm)	oil (% dm)	gsl (mmol/g dm)	adf (% dm)	C 18:1 (% oil)	C 18:2 (% oil)	C 18:3 (% oil)	C 22:1 (% oil)
Mean	28,8	40,3	116,2	9,0	10,2	23,4	13,6	37,7
Sd	4,2	3,6	21,4	1,3	3,8	3,6	2,3	8,2
Min	17,6	27,4	63,0	6,2	2,5	15,2	8,0	0,0
Max	44,1	52,3	205,9	12,0	27,4	39,6	21,6	64,7

gsl: total glucosinolate content; **adf:** acid detergent fiber; **C18:1:** oleic acid; **C18:2:** linoleic acid; **C18:3:** linolenic acid; **C22:1:** erucic acid; **dm:** dry matter

Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*

Fourth year and summary whole period

Excel files with different worksheets filled with the available evaluation data have been sent to be attached to the Bras-EDB website.

Milestone 4a *Bras-EDB updated allowing individual **PGR** partners to set further priorities for regeneration; Safety duplication of the core collections and part of the other material will be completed.*

Fourth year:

no task

Summary whole period:

Arrangements have been made for safety duplication in the near future.

Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*

Summary whole period:

See carinata subgroup report.

Milestone 5 *Final report comprising overall results from the project, submitted with the cost statements to the European Commission.*

Fourth year:

Annual and final report was prepared and submitted.

Summary whole period:

The first year meeting was organised by the subcoordinator of the *B. carinata* group and held in Córdoba, Spain, from 10 to 13 of January 2001.

The participants of the meeting are listed in Appendix 1 of the Annual Report 2001.
The Agenda and Time schedule of the meeting are presented in Table 7 of the Annual Report 2001.
All technical and financial annual reports and the final report were submitted on time.

Executive summary including highlights over the whole period:

- Substantial progress on the characterisation, regeneration and evaluation of *Brassica carinata* under European conditions has been made.
- A core collection of 80 accessions has been defined on this species based on seven minimum descriptors (morphological characters) and seed quality characters.
- Calibration equations for the analysis of seed quality characters by Near Infrared Reflectance Spectroscopy has been developed in this species, and applied to the rapid, simultaneous and non destructive analysis of 9 seed storage components in the accessions grown at two environments: Norwich UK) and Córdoba (Spain).
- Genotypes showing characteristics of potential interest in relation with morphological, agronomical or seed quality features have been selected for future research programmes.

Annexe 1.

Development of Near Infrared Reflectance Spectroscopy to analysis of seed storage components in *Brassica carinata*

About 3 g of intact seeds of each plant (N= 1000) belonging to the first year of plot trials of the project, were scanned in an NIR spectrophotometer (NIRSystems model 6500, Foss-NIRSystems, Inc., Silver Spring, MD, USA) in reflectance mode, equipped with a transport module, acquiring their spectra at 2 nm intervals over a wavelength range from 400 to 2500 nm (VIS + NIR regions). A selection of samples ($100<N_1<200$), was carried out on the basis of their spectral features (Mahalanobis distance) in order to select a representative group of samples (N_1) of the whole population. These samples were then analysed for the following seed storage components (SSC): Soxhlet and Nuclear Magnetic Resonance for oil content, gas chromatography of methyl esters for fatty acid composition, Kjeldahl for protein content, Van Soest for acid detergent fiber content, and liquid chromatography of desulphoglucosinolates for glucosinolates content.. The selected set of samples (N_1) was then separated into a calibration and validation groups (i.e., 2/3 for calibration and the rest for validation).

Using the GLOBAL v. 1.50 program (WINISI II, Infrasoft International, LLC, Port Matilda, PA, USA), different calibration equations for the SSC studied (Table 3), were developed on the calibration set (n_1= $2/3N_1$). Calibration equations were computed using the raw optical data (log 1/R, where R is reflectance), or first or second derivatives of the log 1/R data, with several combinations of segment (smoothing) and derivative (gap) sizes. Wavelengths from 400 to 2500 nm every 8 nm were used to perform the different calibration equations. Modified partial least squares (MPLS) was the method employed to correlate spectral information and the composition for the different SSC in the samples. The external validation was conducted with equations developed in the calibration process. These equations were validated on an external group of samples (n_2= $1/3N_1$) not included in the calibration set. The prediction ability of the different equations obtained was determined on the basis of the coefficient of determination (r^2) and standard error of performance (SEP) (Fig. 1 and 2).

Those selected equations having the highest prediction abilities (one for each seed storage component), were then used to predict the composition of the N samples of the first year (2001). Any sample belonging to this year that increased the chemical and/or physical variability of the population N_1, was analysed for the SSC of interest and was added to this set of samples, and new calibration equations over the new set were developed. The determination of the SSC of the plants corresponding to the year 2002, were obtained from the equations developed in 2001. As previously occurred, those samples of the year 2002 that increased the existing variability were added to the previous group. The third year (2003) was conducted following the same methodology exposed for year 2002.

This methodology has allowed the development of robust predictive NIRS equations for different seed storage components in *Brassica carinata*, as these were obtained over a large number of accessions of different origins and grown over different years.

Summary of NIRS analyses performed on *B. carinata* at IAS Córdoba.

- Approximately, the intact seed of 3000 individual plants of *B. carinata* were analysed by NIRS from 2001 to 2003 in each of 2 different environments at Córdoba, Spain and Norwich, U.K. (3000 x 2 envir.= 6000 plants).
- NIR equations were developed for 9 seed storage components (oil, protein, adf, glucosinolates, oleic acid, linoleic acid, linolenic acid, erucic acid and 1000 seed weight), thus generating 54.000 data involving the different seed storage components.
- Each NIR analysis (spectral register) took about 2 min., what makes a total of 6000 plants times 2 min.= 12000 min (200 h).

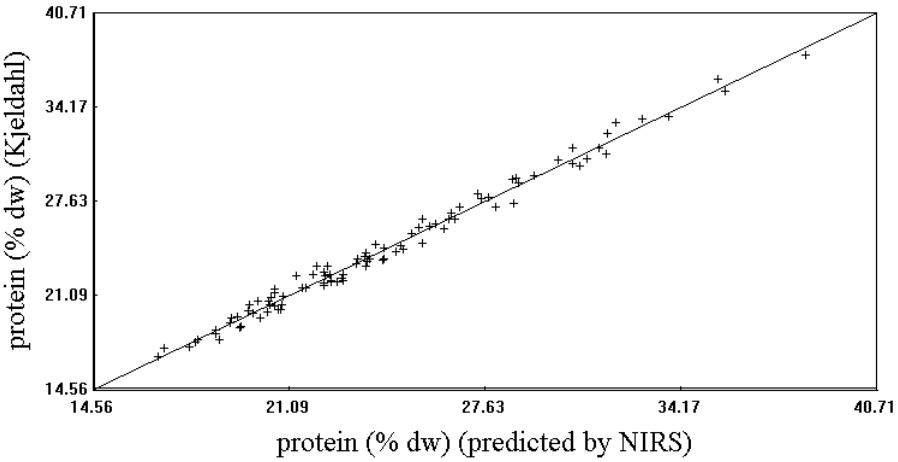

Fig. 1. Validation scatter plot for protein (laboratory vs. predicted values by NIRS).

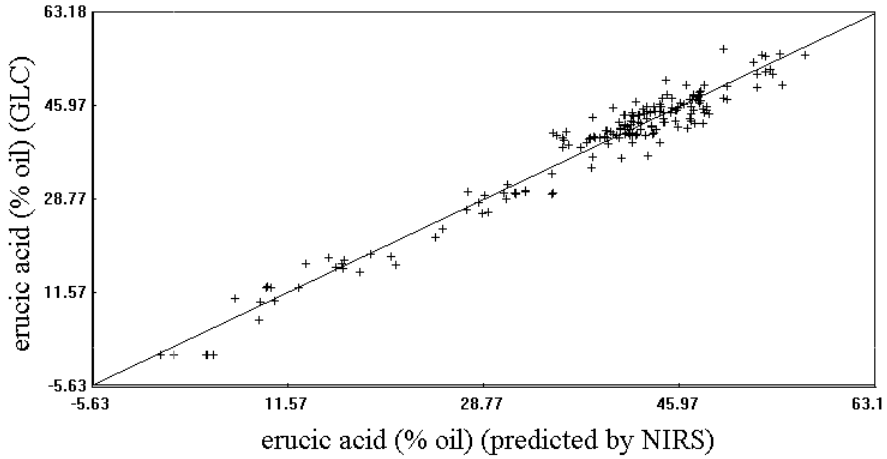

Fig. 2. Validation scatter plot for erucic acid (laboratory vs. predicted values by NIRS).

Table 3. Statistics for the different NIR equations developed for the seed storage components studied.

Seed Storage Component	n	range	mean	sd	SEP	r^2
protein (% dw)	100	16.80-37.80	24.21	4.66	0.51	0.99
oil (% dw)	100	25.6-54.6	43.13	5.4	1.35	0.94
acid detergent fiber (% dw)	100	5.33-16.31	11.00	2.18	0.83	0.81
glucosinolates (µmol g^{-1} dw)	150	56.53-221.10	117.62	31.65	8.5	0.93
C18:1 (% oil dw)	180	4.53-65.75	14.38	10.51	3.77	0.90
C18:2 (% oil dw)	180	7.15-33.46	17.17	4.67	2.04	0.81
C18:3 (% oil dw)	180	3.11-21.18	12.28	2.99	1.17	0.85
C22:1 (% oil dw)	180	0-56-35	38.26	12.25	2.81	0.95
1000 seed weight (g ww)	150	1.09-6.94	2.78	0.93	0.45	0.80

n= number of samples used in the NIR analysis; sd= standard deviation; SEP= standard error of performance; r^2= coefficient of determination.

Contract no: RESGEN CT99-109/112

Project title: *"Brassica* Collections for Broadening Agricultural Use" including "Characterising and utilising genetic variation in *Brassica carinata* for its exploitation as an oilseed crop"

Participant no (partner 16): John Innes Centre

Name(s) of participant(s): C.L.Morgan, C. N. Chinoy & A.E.Arthur

Reporting period: 1st January to 31st December, 2003 and summary over period

Role in the project: Evaluate European accessions of *B. carinata* by the characterisation of plant, raceme and seed traits and the investigation of intra-specific relationships using DNA fingerprinting techniques. Co-ordinate the establishment of the core collection of *B. carinata* in collaboration with IAS, Cordoba.

Tasks during the fourth year and summary:

Milestone 1b *Initial core collection established.*
Milestone 2a *Define minimum descriptors for B. carinata*
Milestone 2b *Part of the core collection regenerated and this material will be available for use.*
Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*
Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*
Milestone 5 *Submit annual report*

Milestone 1b *Initial core collection established.*

Fourth year:

Data from all the accessions grown at JIC, Norwich (222 lines) have been combined and analysed. Plant morphological and raceme data have been used to define a core collection of 80 accessions. This collection is primarily based on analysis of the minimum descriptors chosen as described in milestone 2a using data from the JIC field trials. An initial core collection of 73 accessions has been selected initially through calculating a similarity matrix and consequent dendrogram using the minimal descriptors. Because the accessions show considerable heterogeneity it was decided to include only the most uniform accessions as assessed through the determination of individual coefficients of variation (CV%). This method of determining heterogeneity will be confirmed and enhanced through the use of the molecular data that has been completed with five microsatellite markers. Initially, accessions chosen for the core collection have been selected by eliminating individuals from groups with similarities greater than 95%. Subsequent selection has been carried out at progressively lower levels of similarities. There are no marked groupings within the collection and there appears to be a continuum of characteristics throughout, compounded by the heterogeneity of the accessions. This core has been tested against the full range of data and shows similar means, maximum and minimum values but greater variances. Where gaps appeared in the coverage of individual characters additional lines have been included to fill gaps. Seven new accessions have been included based on outliers showing variation for seed storage products as determined at IAS, Cordoba. Data for selected characters for the core accessions are given are given in Table 1.

Summary whole period:

A total of 222 accessions of *Brassica carinata* have been characterised during this period. Ten plants of each accession were grown in randomised blocks at both JIC (Norwich, UK) and IAS (Cordoba, Spain). These have been assessed *in situ* for variation in plant morphology and development and in the laboratory for raceme morphology (JIC and IAS). Accessions were also characterised for seed storage products at IAS using material harvested from both sites. Additional field assessments were made at JIC on their resistance to flea beetle (*Psylliodes chrysocephala*). Also at JIC each plant from all the accessions were assessed for molecular variation using five microsatellite markers.

Data obtained at JIC for these descriptors were used to describe a core collection of 73 accessions. These accessions were selected following analysis by similarity matrix through which 'near neighbours' were eliminated. Care was taken to include outliers to the distribution of individual traits. Seven

additional accessions were added to this collection based on variation in seed storage components measured at IAS to give a total core of 80 accessions.

Milestone 2a *Define minimum descriptors for B. carinata*

Fourth year:

Plant morphology, raceme and seed data has been combined for all accessions grown at JIC, Norwich and used to define the most appropriate minimum descriptors. A total of 26 characters were measured from which seven have been selected. These are plant anthocyanin pigmentation (score), date of first flower (after 1st May), flower colour (score), natural height (cm), pod depth (mm), seed size (mg) and number of primary branches on the main stem. These have been selected using the following criteria: stability of the trait across environment (estimated from four control lines grown in each year), high genetic component (Φ_g) determining variation, large range of values for the trait among accessions, ease of measurement (scoring) and minimising heterogeneity of the accessions. Confirmation and modification of these data will be carried out by including data from IAS, Cordoba and through the molecular data.

Summary whole period:

Descriptors for this species were not available at the outset and were therefore selected during the course of the work using the collected data to identify those characters most suitable. The criteria used for this selection were high stability, large genetic component, independence of expression, ease of measurement and large variation among accessions. The seven descriptors were chosen from the characters measured were date of first flower, anthocyanin pigmentation, flower colour, plant height, number of primary branches on main stem and seed size.

Milestone 2b *Part of the core collection regenerated and this material will be available for use.*

Fourth year and summary whole period

Regeneration of the accessions has been done throughout this project and an average of 30 accession per partner per year have been regenerated giving a total of 180 accessions, including those selected as core material.

Milestone 3b *Results of the evaluations available in a format allowing links to the Bras-EDB*

Fourth year:

Tables of the evaluation data obtained for all the measured characters for all accessions assessed have been presented in the annual report and submitted to be linked to the Bras-EDB (Tables 1 and 2 of annual report Partner 15).

Summary whole period:

Standardized formats received from CO for evaluation data have been filled out with the passport and evaluation data generated throughout the project. These data have been submitted separately for JIC and IAS data to be linked to the Bras-EDB. Additionally, we have also submitted tables of the evaluation data obtained for all the measured characters for all accessions assessed. These data include the calculated coefficients of variation (CV%) as an estimate of within accessions variation and details of the molecular characterisation. This data has been submitted separately for JIC and IAS data

Milestone 4b *Gaps in the collections are identified and recommendations for appropriate collecting activities made.*

Summary whole period:

B. carinata comes from a very restricted geographical area and it is not possible to estimate gaps in the collection. However, it is known that there are other collections which have not been characterised and we suggest that these are the first step in extending this work before collecting new material.

Milestone 5 *Submit annual report*

The fourth year and final progress report submitted

Summary

Progress has been made in the analysis of the data collected throughout the three years of the project. A core collection has been defined initially based on field results from JIC, Norwich. This will be adjusted as further analysis is carried out on all the available data from IAS, Cordoba, seed storage products and microsatellite markers.

Table 1. Summary of selected character measurements for the core collection selected using JIC data.

	leaf colour[a]	date of firs	flower colour[c]	stem diameter	natural height (cr	primary branches	pod strength[d]	pod depth (mı	pod length (m	pod angle (°)	plant laxness[e]	pod shape[f]	seed weight (	seeds per pod	primary b number[g]	cv%
CGN3930	3.9	48.2	3.0	16.8	146.8	13.8	3.0	7.0	40.7	44.0	0.97	2.36	5.56	13.0	12.5	13.8
CGN3931	2.0	65.8	1.0	27.2	210.0	11.5	4.5	6.7	47.2	34.2	1.00	2.03	6.15	15.6	18.7	6.8
CGN3933	3.9	44.2	1.2	18.5	105.2	13.6	3.3	7.5	45.0	31.1	0.99	2.37	5.26	17.8	8.2	20.8
CGN3934	2.2	35.1	3.0	17.0	115.5	11.5	2.0	5.4	47.5	49.1	0.92	1.84	5.61	14.3	11.1	14.4
CGN3936	3.0	39.0	3.0	15.0	107.2	10.0	2.3	7.5	50.2	11.2	0.98	2.17	5.88	13.7	11.3	12.9
CGN3937	1.5	29.5	3.0	11.1	82.2	13.4	1.8	6.3	39.8	49.1	0.93	2.04	6.61	14.0	6.7	16.5
CGN3938	3.1	38.9	3.0	14.0	84.7	12.0	2.2	5.9	43.5	28.3	0.96	1.91	5.51	13.6	7.6	12.6
CGN3939	2.9	35.8	3.0	15.3	103.4	12.3	2.0	5.4	42.8	43.2	0.95	1.77	5.03	15.5	9.1	9.5
CGN3945	2.2	32.6	3.0	12.7	100.6	11.2	1.4	5.0	40.3	40.0	0.91	1.79	5.07	11.9	10.0	14.6
CGN3946	2.4	33.8	3.0	16.1	102.2	14.7	1.3	4.8	40.0	49.5	0.87	1.74	4.60	15.1	8.1	10.6
CGN3952	2.0	29.2	2.0	12.1	74.7	10.7	1.0	4.5	43.3	48.7	0.95	1.68	4.89	11.4	7.3	12.4
CGN3953	2.8	33.8	2.1	14.2	84.7	10.3	3.1	7.0	39.4	29.7	0.95	2.27	5.20	16.2	8.8	15.5
CGN3958	2.0	21.9	3.0	14.5	86.8	12.5	1.1	4.6	40.3	45.0	0.93	1.72	4.21	19.2	7.5	5.4
CGN3961	1.6	34.9	1.7	14.0	108.6	8.8	3.1	6.3	45.8	27.2	0.82	2.03	4.67	14.1	15.5	27.6
CGN3968	2.8	37.9	3.0	16.1	97.2	15.4	1.3	4.3	37.7	55.2	0.91	1.70	3.96	12.8	7.1	13.6
CGN3969	1.6	23.5	3.0	12.9	79.1	10.8	1.1	4.7	38.6	43.8	0.95	1.85	4.26	15.3	7.9	17.5
CGN3975	2.8	34.8	3.0	14.2	87.6	11.5	3.0	6.9	47.3	55.5	0.89	2.22	5.49	14.7	8.6	11.4
CGN3976	3.0	35.1	0.6	11.8	126.0	10.3	5.8	8.5	48.1	33.4	0.99	2.53	5.41	12.6	12.4	12.4
CGN3977	3.0	33.7	3.0	12.5	91.1	14.5	1.7	5.7	43.4	53.5	0.94	1.87	3.62	15.6	6.7	7.5
CGN3978	2.0	29.9	3.0	14.8	104.3	12.1	2.4	5.7	40.0	44.6	0.91	1.96	5.02	15.6	9.7	14.0
CGN3990	2.8	34.0	3.0	12.9	106.7	13.5	2.2	5.8	43.6	56.8	0.98	1.79	4.46	17.5	8.3	13.5
CGN3991	2.6	32.0	3.0	13.2	108.9	9.9	2.0	5.7	45.4	15.6	0.85	1.87	4.10	13.8	13.0	9.7
CGN3993	3.2	36.1	3.0	15.0	105.6	15.0	1.8	6.3	41.1	61.6	0.94	2.11	5.43	16.4	7.6	12.3
CGN4001	2.6	34.0	3.0	13.7	91.4	13.9	1.8	5.3	42.9	51.2	0.90	1.85	4.61	12.3	7.4	12.1
CGN4002	2.6	39.0	1.8	12.7	111.7	13.4	1.9	6.0	41.1	56.3	0.95	1.97	4.13	19.0	9.3	21.8
CGN4003	3.0	30.4	3.0	11.3	92.4	11.3	2.4	6.0	42.2	56.5	0.93	2.05	3.87	19.1	9.0	8.1
CGN4005	2.8	39.0	3.0	14.6	137.6	15.3	2.0	7.2	43.0	52.5	0.95	2.26	4.53	16.5	9.9	23.7
CGN4009	2.5	32.6	3.0	12.2	118.9	12.2	1.3	5.6	51.9	43.5	0.90	1.83	4.05	17.4	11.0	12.0
CGN4013	2.7	28.6	3.0	12.2	100.0	13.4	0.6	4.6	49.1	56.5	0.87	1.56	4.06	16.3	8.8	10.6
CGN4015	3.5	38.4	3.0	16.5	104.1	16.1	1.1	4.2	37.6	54.9	0.94	1.64	3.93	11.8	6.9	9.9
CGN4016	2.9	22.1	3.0	10.1	71.4	9.5	0.9	4.8	43.3	48.7	0.87	1.86	3.47	15.6	8.9	12.3
CGN4020	2.6	27.1	3.0	10.4	93.1	10.3	1.4	5.4	44.5	50.3	0.93	1.81	3.97	16.0	9.9	11.6
CGN4024	3.0	34.6	3.0	13.3	108.1	13.9	2.3	6.8	41.0	63.0	0.93	2.05	4.75	17.3	8.7	14.0
CGN4025	5.0	33.9	1.3	12.7	109.6	11.7	2.0	5.7	46.5	29.0	0.95	2.00	4.76	15.0	10.7	19.8
CGN4030	3.0	46.8	3.0	19.9	108.8	11.7	1.1	5.0	46.0	53.0	0.90	1.91	3.67	13.3	10.7	13.1
CGN4031	3.9	35.4	3.0	18.4	103.6	9.5	1.9	4.4	46.0	71.3	0.86	1.60	4.41	12.0	12.9	10.0
CGN4033	3.3	36.8	1.0	14.3	85.6	12.1	2.9	5.7	42.7	28.5	0.92	1.83	4.84	13.5	8.0	21.1

CGN4264	2.0	66.6	1.5	34.2	183.4	15.4	3.1	6.3	39.8	75.0	0.80	2.02	5.00	13.8	15.1	11.8
N4-8313	3.5	42.6	0.5	18.2	117.1	10.4	2.7	5.9	42.1	42.8	0.88	1.79	6.41	12.2	13.1	17.8
N4-8407	3.0	32.4	3.0	14.4	93.7	12.9	1.5	5.7	42.4	35.7	0.97	1.84	5.00	17.7	7.6	5.2
N4-8425	2.5	29.5	3.0	13.5	87.2	11.4	2.1	6.5	43.5	46.2	0.96	1.81	6.70	13.2	8.2	14.9
N4-8447	2.6	43.8	3.0	19.4	143.7	11.4	1.0	4.8	44.1	49.4	0.97	1.71	5.19	15.9	13.4	10.0
N4-8481	2.4	34.4	3.0	14.5	112.0	13.7	1.8	5.6	38.1	34.0	0.84	2.20	5.62	11.8	9.8	12.3
N4-8499	2.7	34.8	3.0	16.8	133.2	12.5	2.0	5.7	43.4	32.1	0.95	1.87	6.98	13.4	11.3	11.5
N4-8547	2.0	36.4	3.0	11.1	107.8	12.6	2.2	6.5	41.4	51.5	0.94	1.97	7.49	12.1	9.2	16.4
N4-8564	3.6	39.0	3.0	16.3	121.8	13.8	1.7	6.3	45.7	44.7	0.96	2.04	5.97	12.7	9.3	8.4
N4-8169	3.3	39.4	3.0	16.3	117.4	11.9	3.1	8.3	40.9	20.0	0.98	2.45	5.83	13.1	9.9	14.1
N4-8209	3.0	27.4	3.0	13.0	85.8	10.7	2.0	6.2	42.9	27.8	0.98	1.77	6.43	11.4	8.4	9.1
N4-8135	3.0	32.8	3.0	11.7	98.1	10.6	2.7	6.9	44.8	48.0	0.88	2.10	7.79	10.3	10.6	6.2
N4-8226	2.9	35.5	3.0	11.3	104.9	8.2	2.0	5.6	42.0	24.7	0.94	1.83	5.83	11.0	14.0	8.2
N4-8216	3.4	39.0	3.0	15.3	113.4	13.4	2.2	5.8	45.2	53.8	0.95	1.88	5.21	14.7	9.0	8.6
N4-8232	1.8	33.4	3.0	14.1	99.0	12.0	2.6	6.5	43.3	11.4	0.92	2.10	5.69	14.6	9.2	13.1
N4-8257	3.0	39.9	3.0	15.8	125.5	13.4	2.0	5.8	44.0	48.1	0.94	1.86	6.53	14.2	10.1	9.9
N4-8281	1.8	43.0	3.0	15.8	129.6	13.1	2.1	6.1	39.3	49.8	0.92	1.82	7.17	12.0	11.5	16.9
IAS 01-1	2.4	34.5	3.0	11.0	105.6	9.5	2.1	8.5	37.9	48.1	0.97	1.86	6.19	16.2	11.7	15.3
IAS 01-2	1.8	28.9	3.0	10.3	93.0	11.2	2.6	7.4	45.3	55.2	0.96	2.33	5.08	15.3	8.7	13.2
IAS 01-9	1.8	34.2	3.0	11.5	117.2	15.6	1.9	4.4	44.0	58.8	0.94	1.62	3.31	27.7	8.1	18.2
IAS 01-10	2.6	31.8	1.6	13.8	109.9	9.5	4.2	6.8	41.4	63.0	0.88	1.83	6.26	19.8	13.8	19.7
IAS 01-11	1.0	31.3	1.0	10.8	82.8	9.9	3.2	6.2	41.1	57.0	0.95	2.17	4.30	15.1	8.9	8.6
IAS 01-19	1.2	26.8	1.1	10.3	69.2	13.1	3.2	6.4	46.7	40.7	0.91	1.75	5.12	16.9	5.9	15.4
IAS 01-28	2.0	23.4	3.0	11.0	72.0	10.0	1.5	5.5	43.9	40.3	0.94	1.56	5.34	13.3	7.8	5.7
IAS 01-29	1.1	24.4	0.8	9.8	80.6	10.6	3.1	7.1	42.1	47.3	0.93	2.46	4.55	15.3	8.5	19.5
IAS 01-34	3.0	27.6	3.0	13.1	90.2	8.5	2.5	7.3	41.8	57.4	0.93	1.92	5.31	17.0	11.6	5.0
IAS 01-36	3.5	25.8	3.0	11.3	83.0	12.0	2.8	6.5	38.4	61.2	0.91	2.08	4.59	19.8	7.7	8.1
IAS 01-37	2.9	42.2	1.4	12.2	100.9	12.4	2.8	6.9	45.1	56.7	0.96	2.00	5.64	20.7	9.3	21.5
IAS 01-44	2.0	26.4	3.0	12.2	84.2	10.9	2.0	5.1	48.8	50.6	0.94	1.62	5.11	15.2	8.3	12.3
IAS 01-51	2.5	26.8	3.0	11.8	85.3	12.0	1.0	5.3	44.6	50.3	0.89	1.67	5.13	14.3	8.3	13.5
IAS 01-53	2.6	30.7	1.8	11.5	106.3	11.8	1.5	6.5	41.7	49.7	0.94	2.12	4.92	18.5	9.8	18.1
IAS 01-54	3.5	25.3	3.0	10.7	93.8	12.6	0.6	5.4	43.2	51.1	0.89	1.77	3.49	17.0	8.5	9.5
IAS 01-57	3.0	40.8	3.0	11.6	109.0	18.8	1.4	4.6	48.0	48.6	0.94	1.75	3.43	17.4	6.4	9.7
IAS 01-59	2.0	23.9	3.0	10.0	99.3	8.8	1.2	6.4	41.6	48.8	0.80	2.27	4.78	17.3	14.4	6.8
IAS 01-60	2.8	25.9	3.0	12.0	111.2	10.0	0.7	6.2	49.2	49.6	0.93	1.98	4.43	15.3	12.1	8.1
CGN6985	2.9	40.0	3.0	15.5	115.2	11.7	2.3	6.1	43.3	11.2	0.96	1.86	6.25	13.4	10.3	13.8

[a] 1 = absent, 5 = purple; [b] days after 1 May; [c] 1 = white, 2 = cream, 3 = yellow; [d] 0 = weak, 6 = very strong; [e] natural height/maximum height; [f] pod depth/pod width; [g] no of primary branches per main stem