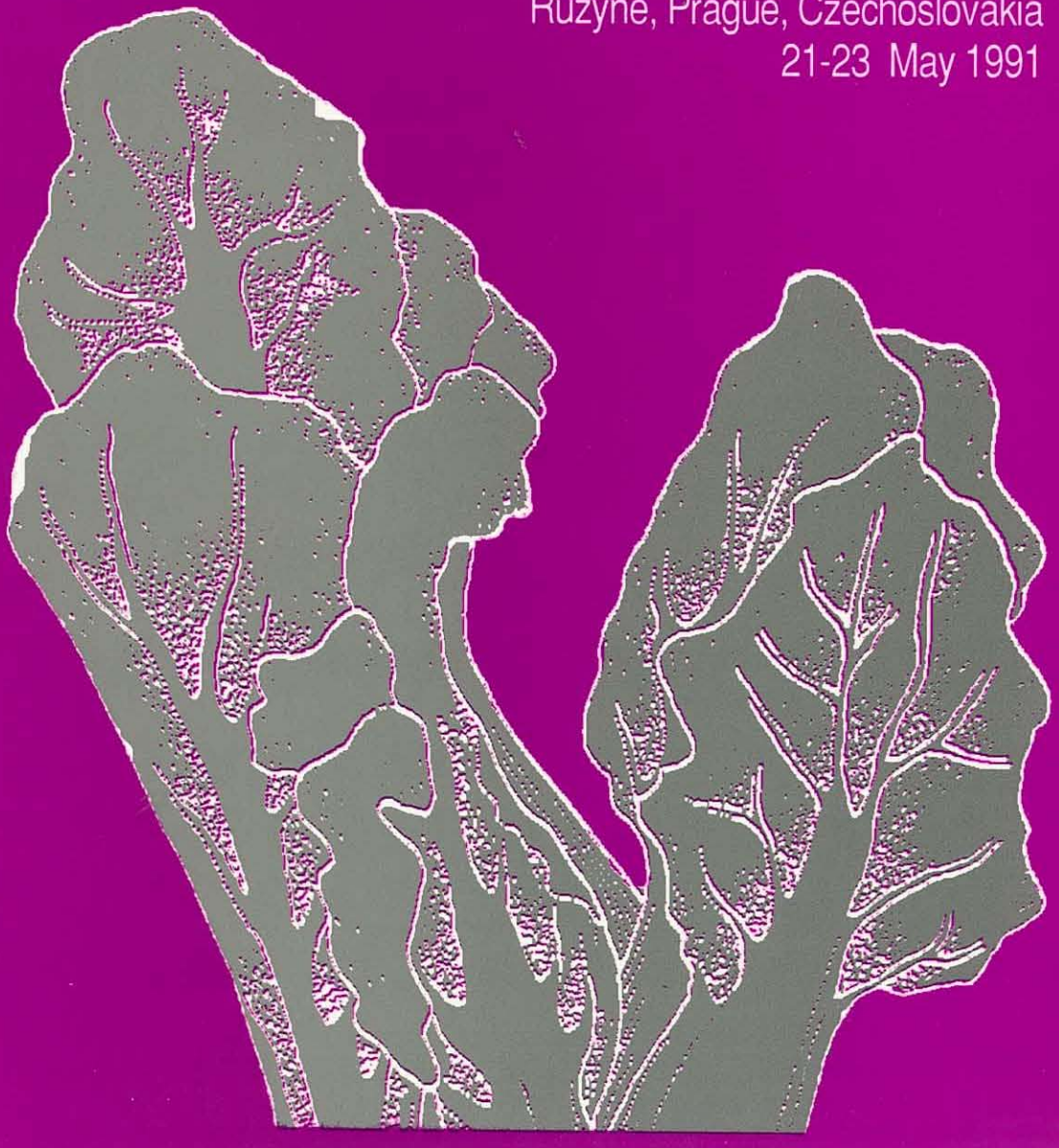
EUROPEAN COOPERATIVE PROGRAMME FOR
CROP GENETIC RESOURCES NETWORKS

IBPGR

REPORT OF A WORKING GROUP ON *BRASSICA*

(first meeting) held at the
Research Institute of Vegetable Growing and Breeding,
Olomouc, and the Research Institute of Plant Production,
Ruzyne, Prague, Czechoslovakia
21-23 May 1991



INTERNATIONAL
BOARD FOR
PLANT
GENETIC
RESOURCES

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ECP/GR/IBPGR
ROME 1993

The International Board for Plant Genetic Resources (IBPGR) is an autonomous international scientific organization under the aegis of the Consultative Group on International Agricultural Research (CGIAR). IBPGR was established by the CGIAR in 1974 and is administered by the Food and Agriculture Organization of the United Nations. IBPGR's mandate is to advance the conservation and use of plant genetic resources for the benefit of present and future generations. Financial support for the core programme of IBPGR was provided in 1992 by the Governments of Australia, Austria, Belgium, Canada, the People's Republic of China, Denmark, France, Germany, India, Italy, Japan, the Republic of Korea, the Netherlands, Norway, Spain, Sweden, Switzerland, the UK, the USA and the World Bank

Citation
IBPGR, 1993. Report of the First Meeting of the ECP/GR *Brassica* Working Group. European Cooperative Programme for Crop Genetic Resources Networks. International Board for Plant Genetic Resources, Rome

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INTRODUCTION

The Technical Consultative Committee of ECP/GR, meeting in Szeged in October 1989, unanimously called for the formation of a *Brassica* Working Group during Phase IV of the ECP/GR Programme (1990-1992). As a result of this initiative, the first meeting of the ECP/GR *Brassica* Working Group was held in Czechoslovakia on 21-23 May 1991, at the kind invitation of Dr. L. Dotlacil, ECP/GR Coordinator for Czechoslovakia and the Directors of the Research Institute for Vegetable Growing and Breeding, Olomouc, and the Research Institute of Plant Production, Ruzyne, Prague.

In view of the strong genetic resources interest in vegetable, oilseed and forage *Brassica* species throughout Czechoslovakia, the meeting was held both at the Research Institute for Vegetable Growing and Breeding, Olomouc, and at the Research Institute of Plant Production, Ruzyne, Prague.

Dr. Chmela (Director, Research Institute for Vegetable Growing and Breeding, Olomouc) and Dr. Dotlacil welcomed participants to Czechoslovakia and to the workshop. Dr. Hodgkin (Research Officer, Genetic Diversity, IBPGR, Rome) provided a general overview of the objectives of Phase IV of the ECP/GR programme and of the background and opportunities for the development of a *Brassica* crop network. He noted that European *Brassica* workers had a considerable tradition of collaborative work and that, within the European Community, collaborative projects had already been undertaken. The initial steps to develop a European database of cultivated *Brassica* accessions had also been taken by IHAR, Poland and a wild *Brassica* spp. database had been developed by Prof. Gomez-Campo (Spain) and Prof. Gustafsson (Sweden). There was, therefore, a good basis for the development of practical proposals for collaborative work to strengthen the conservation and use of *Brassica* genetic resources.

The participants present at the meeting are listed in Appendix I of this report.

Dr. J. McFerson from USDA, Geneva, U.S.A., had been invited to the meeting in order to strengthen collaboration between North America and Europe and to participate in discussions on classification of *Brassica* crops, but was unable to attend. The Group welcomed the participation in the meeting of Dr. A. Omran, IDRC Oilseeds Network Coordinator.

Prof. C. Gomez-Campo was elected Chairman of the first sessions of the meeting and Dr. K. Hammer and Prof. M. Gustafsson took the chair during later sessions. At the end of the meeting Prof. Gustafsson was elected Chairman of the Working Group for the period until the next working group meeting.

For convenience and to avoid unnecessary repetition, the report does not follow exactly the agenda (Appendix II). During the meeting, participants had the opportunity to visit research labs and facilities at the Research Institute for Vegetable Growing and Breeding, Olomouc and the Research Institute of Plant Production, Ruzyne, Prague.

Although it is now generally accepted that the correct specific designation for *Brassica campestris* is *Brassica rapa,* individual reports in the appendices frequently refer to both species. For this report the usages of the individual participants have been maintained.

REPORT

Review of Activities supported by the European Community

Dr. D. Astley reviewed past activities supported by the European Community. EC project 0890 in 1981/83 initiated the coordinated collection of valuable *Brassica* germplasm in EC countries. The final report of the project (van der Meer *et al.*, 1984) recognized the need to extend the collection programme, to regenerate poor quality material and to characterize/evaluate all collections. Scientists expressed concern that the variation to be found in traditional crops would be lost very rapidly. This was of particular concern in the previously uncollected areas in the newer member states where the influx of commercial cultivars was expected to cause serious genetic erosion.

The total number of accessions collected under project 0890 was approximately 3500 (Table 1). Most of the accessions were located either in gene banks or in institutions under conditions of low humidity and low temperatures (-10 to -20°C) and were distributed in accordance with IBPGR recommendations. The base collection consists of the bulk of each seed sample. Its maintainer is responsible for storing it, multiplying it, and distributing it to any breeders or researchers who request it. Duplicate collections are stored intact in high quality gene banks; they are not intended for use (even for germination testing), and are an insurance against the loss of the base collection. If the base collection consists of *ca.* 100 g seed, then the duplicate should be 5-20 g, depending on its germination.

Table 1. Numbers and location of seed accessions collected under project 0890

Programme	Country	Number of samples	Location of base collection	Duplicate
CP 1	Britain	121	IHR	CGN
CP 2	Netherlands	*ca.* 700	CGN	IHR
CP 3	Netherlands	*ca.* 400	CGN	CGN/IHR
CP 4	Britain	256	IHR	CGN
CP 5	Britain	471	IHR	CGN
CP 6	Ireland	62	IHR	CGN
CP 7	Denmark	120	CGN	IHR
CP 8	Germany	*ca.* 200	FAL	
CP 9	Belgium	45	RVP	FAL
CP 10	France	*ca.* 500	INRA, Rennes	IHR/CGN
CP 11	Germany	*ca.* 50	FAL	
CP 13	Italy	362	IHR	Bari
CP 15	Italy	211	Bari	IHR/CGN

Despite the achievements of project 0890, there was only limited systematic collection of cruciferous crops in southern Europe. Inevitably, some of the material to be collected and a proportion of the collections from 0890 needed to be regenerated before becoming available to users. Minimal characterization was required to go along with full passport data, thus defining the variation available to plant breeders.

A further proposal to support collection of additional landraces and the regeneration, characterization and evaluation of previously collected accessions was submitted to the EC in 1988. This proposal involved Institutes and Genebanks from West Germany, France, Greece, Ireland, Italy, Netherlands, Portugal, Spain and the United Kingdom. Reviewing the proposal, the ECP/GR *Brassica* Crop Working Group considered that the priority actions identified by the group that developed this proposal were still appropriate and it was hoped that they would feature as aspects of future research proposals submitted to the EC.

Collection and Maintenance of Wild *Brassica* Germplasm

IBPGR-sponsored collecting missions for wild (n=9) *Brassica* species were carried out from 1982-1986 and in 1988. C. Gomez-Campo and M. Gustafsson reported on these and on the current status of wild *Brassica* spp. germplasm collections. The areas covered by the collecting missions were as follows:

1982	Attica, Peloponissos, Greece
1983	Euboea, Crete, Greece
1984	S. Italy, Sicily
1985	N.W. Italy (Alpi Apuani and Riviera), S. France (Cote d'Azur), N.E. Spain (Gerona) and N.W. France (Le Havre region)
1986	Cyprus, Tunisia, Corsica and Sardinia
1988	N. Spain, N.W. France and United Kingdom

The populations from which collections were made were usually fairly small, essentially perennial, occurring on steep maritime cliffs. Information on population size, habitats, seed dispersal mechanisms and threat to populations (mainly from grazing or tourist development) was obtained. In all, over 230 samples were collected of the following species:

B. cretica Lam.
B. hilarionis Post.
B. incana Ten.
B. insularis Moris.
B. macrocarpa Guss.
B. montana Pourret
B. oleracea L.
B. rupestris Rafin
B. villosa Biv.

As a result of these collecting activities, *B. hilarionis* has been made available for research, probably for the first time.

A detailed descriptor list for wild *Brassica* spp. has been developed as part of the collecting activities and both characterization and multiplication programmes are in progress. Duplicate samples were left in a genebank in the country of origin and the collection is duplicated at Sendai (Japan). A database has been developed which contains information on wild *Brassica* spp. accessions and includes passport, multiplication and characterization data. Material which has already been multiplied is available as listed in "A Germplasm Collection of Crucifers" ed. C. Gomez-Campo, INIA-UPM, Madrid, Spain.

Work is continuing on multiplication of the accessions under the leadership of C. Gomez-Campo and on characterization of the material and the population genetics of the species collected under M. Gustafsson. It is intended to extend characterization and evaluation to include measurement of glucosinolate content and other biochemical traits.

The Current Status of Collections

Participants reported on the current size of their collections and different *Brassica* species, varieties and crops which were present in them. Subsequently, additional data was provided by a number of members of the group. Most of this information has already been published in IBPGR Directory of Crop Germplasm Resources 4. Vegetables ed. E. Bettencourt and J. Konopka. IBPGR, Rome, 1990. or in A Germplasm Collection of Crucifers ed. C. Gomez-Campo, INIA-UPM, Madrid, 1990. Additional data provided by participants is presented in Appendices III - VIII.

Development of a Database of Cultivated *Brassica* Genetic Resources

Dr. Bartkowiak Broda described the initiative taken by the Plant Breeding and Acclimatization Institute, Poznan, Poland, to create a European database for cultivated *Brassica* genetic resources. In 1988, IHAR offered to begin work on developing a united database and IBPGR contacted 18 European genetic resources and research centres inviting them to forward passport data of their holdings to IHAR in computerized form. IHAR received listings of accessions from Hungary (59 accessions), Italy (335 accessions) and Spain (180 accessions). It received passport data on disk from Germany (1031 accessions), Nordic Gene bank (311 accessions) and Horticultural Research International, Wellesbourne, U.K. (3648 accessions). IHAR also provided information on 351 accessions in its own collection. There was considerable diversity in the way in which the data was made available and the information provided, and IHAR considered that there were major difficulties in preparing a uniform database. IHAR considered that, in view of the difficulties that had been found in collecting and collating the data, it would be more appropriate for the work to be transferred to another genetics resources centre.

The work of IHAR in starting to develop a database of cultivated *Brassica* genetic resources was welcomed and their achievements were considered of considerable importance for *Brassica* workers. The group recognized the central importance of such a database in the development of its activities.

I. Boukema described the work of the Centre for Genetic Resources, Netherlands (CGN), on *Brassica* germplasm and the development of International Crop Databases. She reported that CGN had accepted the base collection responsibility for *Brassica* oleracea, together with HRI Wellesbourne. In the interpretation of the CGN, this responsibility meant that it has to prevent genetic erosion and make existing germplasm accessible. For both tasks, a central crop database was an essential management tool. This was clearly shown by the "World *Beta* Network", managed at the CGN in close cooperation with Germany. In this network, the International Data Base for Beta (IDBB) allowed precise identification of gaps in the pooled Beta collections in the world, thus making it possible to set priorities for collection activities. Besides linking various genebanks holding collections in joint activities, it also allowed the identification of duplication between collections, thus making it possible to set priorities for regeneration activities. The group agreed with this view.

On behalf of CGN, I. Boukema reported that CGN was also prepared to take over the responsibility for the database, and expand its scope to other cruciferous crops. If this was acceptable, knowledge of other members of the ECP/GR *Brassica* working group on processing and using information on the non-*oleracea* species would be needed. Collecting and managing the information could be done by the CGN in the same working sessions as the *B.oleracea* data. All data would be permanently available on paper, magnetic media or via Email.

The group welcomed this offer by CGN, which was also considered desirable by IHAR. The following conclusions were agreed:

1. There is an urgent need for a unified database to contain information on *Brassica* germplasm holdings of ECP/GR members.

2. The offer of CGN, Netherlands to provide a central database facility for cultivated *Brassica* germplasm was welcomed.

3. In the first instance, the central database should be supplied with, and contain, passport data on accessions.

4. It was noted that wild accessions required different passport data from cultivated material. The extensive passport data recorded for the wild *Brassica* spp. database developed by Prof. Gomez-Campo, Spain, was noted. The wild *Brassica* spp. database would continue to be maintained at Madrid, but when facilities allowed, the information in it could also be added to the cultivated *Brassica* spp. database. The extensive passport information would form a "comment" in the central database.

5. Countries supplying the data should provide it in a computerized form. CGN will circulate a proposed format and discuss problems with individual participants. In general, the descriptors of IBPGR should be followed.

Review of Collecting

Recent collecting activities in Europe were described by the participants as follows:

1. **Cultivated *Brassica* crops**

Czechoslovakia. A programme of collecting vegetable landraces in Slovakia and S. Bohemia was in progress in areas of traditional vegetable production (see also Appendix III).

France. Although there had already been considerable genetic erosion and extensive collecting of landraces, a significant amount of variation of kale was still available and could be collected (see also Appendix IV).

Germany. The last German landraces were collected some years ago using popular magazines and the gardening press to request seed samples from individuals who continue to grow traditional types.

Greece. The Greek Government's initiative in introducing legislation to protect landrace cultivation was a positive development, although funds had yet to be released for this activity. Landrace collection was continuing as part of the general vegetable collection programme (see also Appendix V).

Italy. The collaborative collecting programme by Bari and Gatersleben had resulted in the collection of 400 landraces from five regions. Following a survey of production patterns in Italy, a further collecting programme had been devised by staff at Bari (see also Appendix VI).

Netherlands. Collecting activities were currently targetted on *Beta* in Turkey and S. USSR. Some *Brassica* spp. accessions were collected during these expeditions.

Nordic countries. There was still a need to collect landraces from middle Finland, Sweden and Norway, which are still used and may have unique characteristics for growth at high latitudes.

Poland. The emphasis of Polish collecting activities was on the most original and typical old cultivars of *B. napus* and *B. rapa.*

Portugal. A broad spectrum collecting programme was in progress through Portuguese and UK collaboration. This needed to continue for four to five years with special emphasis on N.W., S. and central areas. *B. napus* and *B. rapa* ecotypes which were extremely difficult to distinguish morphologically were described by E. Rosa and useful characteristics such as drought and frost tolerance and adaptability to acid soils had been identified in collected material. Resistance to some races of *Plasmodiiphora brassicae* (club root) had also been found.

Spain. A large amount of collecting was required, particularly in Galicia and Valencia. Collaborative collecting involving UK and Spanish groups is in progress.

Yugoslavia. Collection of cabbage and collard landraces was in progress. It was estimated that more than half the landraces present in 1958 had disappeared. An important development was the involvement of Island cultivators on the Dalmatian coast in landrace multiplication *in situ* which provided good quantities of seed produced in conditions of effective isolation.

2. Wild *Brassicas*

The studies by C. Gomez-Campo and M. Gustafsson had shown that there were three main areas of diversity of n=9 *Brassica* spp. In the areas of Spain, France and South U.K. every known population had been covered and South and North Italy had also been fairly well collected, although the island of Pantelleria had yet to be visited. In the third area (Greece and the Aegean), collecting had been carried out in Attica, Peleponnisos and Crete, but collecting was still needed in the Aegean Islands.

3. Future Collecting Activities

In discussions, it was noted that collaboration between ECP/GR countries was already common and should be further encouraged. There was general agreement that the overall focus of the group should continue to be the ECP/GR area with the addition of North Africa. The following collecting priorities were agreed:

1. Wild, n=9 *Brassica* spp. for the Aegean Islands.

2. Wild and cultivated species from the Dalmatian coast and islands and, when contacts had been established, within Albania.

3. Continuation of the joint collecting activities of Gatersleben and Bari in Italy for *Brassica oleracea* and *B. rapa* landraces.

4. Spain and Portuguese landrace material involving continued collaboration between Spanish, Portuguese and UK workers.

5. Central European material where it still exists should be collected using the press advertising techniques developed by Gatersleben.

6. Landraces of *B. oleracea* still present in central Finland, Sweden and Norway should be collected by collaboration with the Nordic Gene Bank.

7. A documented survey of *Brassica* spp. genetic resources which might be collected in N. Africa should be undertaken. This is likely to involved collaboration between K. Hammer, P. Perrino, C. Gomez-Campo and M. Gustafsson.

Safety Duplication

The group reviewed current safety duplication practices of the different genebanks represented. The extent of duplication of existing accessions ranged from 80% for wild n=9 *Brassica* spp. which were duplicated in Sendai, Japan, to non-existant.

Dr. Astley reviewed the major objectives of safety duplication and the responsibilities of the genebank in which duplicates were deposited It was agreed that safety duplication was desirable using, where appropriate, IBPGR designated base collections (Appendix IX). Duplicates of the base collections should be placed in cold storage and be accompanied by relevant documentation but it was not expected that any monitoring of viability would take place in the recipient genebank. The actions taken in respect of the wild n=9 *Brassica* spp. were particularly commended.

Regeneration

K. Hammer introduced this topic by stating that the regeneration of accessions was a neglected field in genebanks. In most cases, cold storage facilities for maintaining seed viability over a long period have been available from the beginning and therefore there was no need for urgent regeneration. Now, in many genebanks, a declining viability of the longer stored seeds could be observed and there was insufficient time to develop fully tested regeneration procedures. This was particularly true for cross-pollinating crops such as *Brassica,* which was also often bienniel. Problems included isolation requirements, population size, use of pollinators and overwintering of plants. It was likely that *in vitro* techniques should also be available for security methods.

It was noted by C. Gomez-Campo that recent studies in Madrid and Reading had found that samples of 12 Cruciferae species stored for 25 years had shown little or no loss in viability. The storage procedures had been of a high standard, but in general Cruciferae seed could remain viable for long periods if good quality seed was well stored.

Regeneration of *Brassica* spp. was recognized as presenting particular difficulties in view of their outcrossing nature and the difficulty (particularly in landraces) of handling large numbers of plants and accessions. Even the major genebanks were unable to use population sizes in excess of 100 plants or to regenerate more than 60 accessions per year. The possibility of collaborating with private breeders (1-3 accessions to each company) to regenerate accessions was reported by I. Boukema as a useful way of extending available facilities and involving the plant breeding industry in the work of conservation.

It is unlikely that it will be possible to retain all rare alleles in accessions with existing constraints and it was considered more important to ensure timely

regeneration of existing accessions so as to ensure the widest range of material was maintained.

Regeneration should be considered as an integral part of the work of genebanks maintaining *Brassicas* and collecting activities should take account of the potential demand that new accessions will take place on regeneration facilities in the future. This suggests that, especially for wild species, the use of *in situ* conservation and population monitoring should be seriously evaluated.

For the existing *ex situ* collections effective regeneration will require the widest possible participation on a coordinated basis of all those involved in conserving *Brassica* spp., especially given the labour and facility constraints of existing genebanks.

Fuller collaboration can only be developed following the establishment of a unified database. However, where individual genebanks are experiencing real difficulties with one or two endangered accessions, they should contact the Chairman of the *Brassica* Working Group who will contact genebanks who might assist in regeneration.

The need for research was recognized and will be discussed below.

Taxonomy of *Brassica* species and crops

Naming of cultivated and wild *Brassica* spp. has caused considerable problems in the past and continues to hinder communication between workers. M. Gustafsson described procedures followed for naming species. Nomenclature for wild as well as for cultivated plants is regulated by the International Code of Botanical Nomenclature (ICBN). There are some basic concepts which must be fulfilled for legitimate names and epithets, that is in accordance with the rules. These basic concepts are: (1) Priority - for a species the correct name is the earliest available legitimate epithet in the same rank combined with the correct name of the genus. Priority for higher plants goes back to Linneaus Species Plantarum 1753. In special cases conservation of widely used names can be accepted (see below). (2) Description of a new taxon must be accompanied by a Latin diagnosis in order to be validly published. (3) Typification - designation of a type specimen to which the name of the taxon is permanently attached. (4) Effective and valid publication - is effected only by distribution of printed matter to the general public or at least to botanical institutions with libraries accessible to botanists generally. (5) Citation of the author's name - for instance, in the name *Brassica oleracea* L. the L. indicates that this species was described by Linneaus in Species Plantarum.

In the description of *Brassica oleracea* in the Species Plantarum (1753), Linneaus included several different elements. The *nomen specifierum* was taken over from Hortus Cliffortianus 338 and does, no doubt, apply to wild plants. The formal selection of a lectotype in the Sloane herbarium, made by Oost, Brandenburg and Jarvis in 1989, conserves this usage. The correct name for wild, maritime populations

growing along the Atlantic coasts of Spain, France and UK is consequently *B. oleracea* ssp. *oleracea* and the cultivated crop plants must be given another epithet at the subspecific level.

K. Hammer stated that the botanical names of cultivated plants were governed by the International Code of Botanical Nomenclature (ICBN). The ICBN tried to ensure that a taxon in a given circumscription, position and rank had only one valid name. Operative principles were publication, typification and priority. Recently a new rule was included into the ICBN to ensure more stability for economically important plants. Now it was possible to conserve widely used species names against older (priority!) uncommon names; e.g. *Triticum aestivum* L. em Fiori et Paoletti (1896) is conserved against *Triticum hybernum* L. em Mérat (1821). The ICBN provides stability also at the infraspecific level. As cultivated plants show a high variation, further infraspecific ranks have been proposed, the most useful of which may be convar. (e.g. *Brassica oleracea* L., convar, *caulorapa* (DC. Alef.), which equals more or less the informal category cultivar-group. The International Code of Nomenclature of Cultivated Plants (ICNCP) provides a system which is based on the taxonomic category cultivar (cv.). There are two major possibilities to present the name of a cultivar in botanical context: formal vs. informal ways. For example: formal classification: *Brassica rapa* L. em. Metzg. subsp. *chinensis* (L.) Hanelt var. communis (Tsen et Lee) Hanelt cv. Hikoshima Spring or 'Hikoshima Spring'. Informal classification: *Brassica rapa* L. em. Metzg. cv.-group Pak-Choi (or cv.-group Chinese cabbage) cv. Hikoshima Spring or 'Hikoshima Spring'.

D. Astley reported on recent work undertaken by himself, E. Oost and J. MacFerson to further the development of a satisfactory set of cultivar groups for *Brassica* spp. He noted that earlier lists of cultivar groups for *B. rapa* had been put forward by Toxopeus, Yamagishi and Oost (1987) and revised by Toxopeus et. al. (1988). Cultivar groups were a pragmatic means of classifying crop species (such as *B. rapa* L.) that are highly polymorphic and include an increasing number of cvs from crosses between infraspecific taxa. The objective was to classify and name the variation of crop forms - including new forms - in a way that is scientifically sound, clear and unambiguous, meaningful (to crop scientists, breeders, seed companies, growers, consumers), and practical (ICNCP, 1980).

A draft discussion paper was being prepared by MacFerson, Oost and Astley which would provide a basis for discussion by *Brassica* workers with a view to developing a generally agreed list of cultivar groups covering all the *Brassica* crops and crop types. The working group considered that the cultivar group approach might well be useful in a complex and highly polymorphic genus such as *Brassica* with its many crop types. It looked forward to the circulation of a discussion paper which would provide a basis for a more detailed consideration of the subject.

Brassica Descriptors

T. Hodgkin introduced the discussion on *Brassica* descriptors and summarized the history of the recently published IBPGR Descriptors for *Brassica* and *Raphanus*.

It was noted that the descriptor list took little account of the list of descriptors developed by C. Gomez-Campo and M. Gustafsson for wild n=9 *Brassica* spp. and had been developed essentially for crop *Brassicas*. Participants described the procedures followed by their own genebanks which usually involved recording a small number of descriptors felt to be of particular importance in the crops on which they worked. It was noted that in *Allium* and *Vicia* it had been possible to develop a list of a few descriptors of particular value in characterizing the material and providing users with the most important information. The group felt that the same approach should be developed with *Brassicas* spp. It was recognized that any limited list of descriptors would have to be specific for the major crop groups in *Brassicas* spp. It was agreed that:

1. Participants would inform CGN of their current practices with respect to characterizing and evaluating material.

2. Participants would examine the IBPGR descriptor list and those developed by M. Gustafsson for wild spp. and VIR for cabbage and inform the Chairman and CGN of their preferences for a minimum list.

3. J. Baert would take responsibility for forage *Brassicas*.

4. I. Bartkowiak and Y. Hervé would collaborate on developing a list for oilseed *Brassicas*.

5. Once the group had made progress on developing lists of minimum descriptors, the Chairman would approach IBPGR to explore the possibility of carrying out a more extensive survey (e.g. of plant breeders) to identify those descriptors throught to be of greatest use.

Research Priorities

Brassica spp. were recognized as having particular value for investigating certain key areas of importance for genetic conservation. As largely outbreeding crops with a well-described self-incompabibility system, they could play an important part in studies of the distribution of genetic variation in outbreeding crops and their wild relatives and in investigating regeneration methodology. It was noted that studies on the former were already in progress in France (Appendix X) and Sweden. Research on the latter was to be initiated at Gatersleben through funding obtained as an IBPGR special project.

In addition to the proposals made to the European Commission in 1988 referred to above, the following areas of research were identified by the group as being of high priority and requiring collaboration between participants.

1. An ecogeographic survey of *Brassica* genetic resources in N. Africa, together with an evaluation of collecting needs (C. Gomez-Campo, M. Gustafsson, K. Hammer, P. Perrino).

2. A comparison of the effect on genetic diversity of current regeneration procedures using one or two identical accessions in a range of different genebanks (D. Astley will prepare a first draft proposal).

3. Collaboration with the Vegetable Gene Bank, Olomouc, Czechoslovakia on screening for resistance to clubroot (*Plasmodiophora brassicae*) in order to improve and standardize test results obtained within ECP/GR (staff at Olomouc will prepare a first draft proposal).

International Relations and Future Activities of the ECP/GR *Brassica* Working Group

The working group welcomed A. Omran representing the IDRC Oilseeds Network, who outlined the work of the network (Appendix XI). It was considered very important that the ECP/GR *Brassica* Working Group develop and maintain close relations with other groups collaborating in work relevant to conservation of *Brassicas*. In addition to the *Brassica* Sub
Network of the IDRC Oilseeds Network, the possibility of collaborating with the Indian oilseed network and the Crucifer Genetics Germplasm Cooperative in North America was noted.

It was agreed that:

1. The group would ask IBPGR to provide Dr. Barthowiak Broda with support to enable her to attend a meeting of the *Brassica* Sub Network to be held in August at the International Rapeseed Conference.

2. Contact should be maintained with the Crucifer Genetic Germplasm Cooperative through D. Astley.

3. The group would ask IBPGR to contact (through its Regional Coordinators) groups in China, India and Africa who might wish to collaborate with the ECP/GR *Brassica* Working Group on an *ad hoc* basis.

The importance of holding regular working group meetings was stressed and IBPGR was urged to provide support or to obtain support for a further meeting, preferably within two years. The group expressed its gratitude to the Research Institute of Plant Production, Prague and Research Institute of Vegetable Growing

and Breeding, Olomouc, Czechoslovakia for their generosity in hosting the meeting and their efficiency in organizing it.

References

van der Meer, Q.P., Toxopeus, H., Crisp, P., Roelofsen, H. and Astley, D., 1984. The Collection of landraces of Cruciferous Crops in EC countries. Final Report of EC Research Programme 0890, Wageningen, Netherlands, pp. 210.

Toxopeus, H., Oost, E.H., Yamagishi, H. and Prescott-Allan, R., 1988. Cultivar group classification of *Brassica rapa* L.: Update, 1988. Cruciferae Newsletter, 13, 9-11.

Toxopeus, H., Yamagishi, H. and Oost, E.H., 1987. A cultivar group classification of *Brassica rapa* L.: Update, 1987. Cruciferae Newsletter 12, 5-6.

ICNCP (International Commission for the Nomenclature of Cultivated Plants of the IUBS) 1980. Regnum Vegetabile, 104, 1-32.

APPENDIX I

List of Participants

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APPENDIX II

Agenda

1. Welcome address on behalf of RIVGB, Olomouc - P. Havránek
2. Welcome address by ECP/GR Coordinator of CSFR - L. Dotlacil
3. Introduction to ECP/GR *Brassica* Crop Group Meeting - T. Hodgkin, IBPGR
4. Review of ongoing activities:
   - i. Previous activities within EEC and their current status - D. Astley
   - ii. The development of a European database for cultivated *Brassicas* - I. Bartkowiak Broda
   - iii. *Brassica* germplasm activities of VIR, USSR - T. I. Bodjalkina
   - iv. Collecting activities for wild *Brassicas* in the Mediterranean and the development of a wild *Brassica* spp. database - M. Gustafsson
   - v. Maintenance and multiplication of wild *Brassica* spp. - C. Gomez-Campo
   - vi. *Brassica* in the IDRC Oilcrops Network for Eastern/Southern Africa and South/SouthEast Asia - A. Omran
5. Formulation of a workplan
   - i. Development of international *Brassica* databases
   - ii. Collecting - current status and recommendations for urgent action.
   - iii. Safety duplication - current status and procedures for enhancing safety duplication
   - iv. Regeneration - problems, appropriate procedures and proposals for improvements
   - v. Characterization and evaluation descriptors
   - vi. Taxonomy of the genus *Brassica;* Current status for wild and cultivated species; Development of a suitable system.
   - vii. Opportunities for research collaboration

viii. Relationship of ECP/GR *Brassica* crop group to other international organizations and the development of an international network.

ix. Future organization of ECP/GR *Brassica* crop group.

APPENDIX III

Collection of *Brassica* ssp. in Czechoslovakia

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General

The National Czechoslovak Programme is coordinated by RICP Prague; the Czechoslovak Board on Genetic Resources of Cultivated Plants was established as the advisory and coordinating body. The introduction of plant genetic resources (GR), the information system of GR (EVIGEZ) and the long-term storage of seed-propagated crop collections are ensured by RICP Prague as a service for the GR community. Collections are studied at 29 cooperating crop institutes, stations and universities.

The annual introduction of GR amounts to 3-5.000 samples (more than 1/2 being introduced by RIPP Prague); the export of GR is comparable. Distributed samples are after preliminary evaluation included in collection, where base evaluations are performed (scale 1-9 according to agreed descriptor lists). More exact or special evaluation is done on selected materials with the aim of supplying breeders with donors of important characters and providing them with information. There were more than 43,000 accessions in Czechoslovak collections; most of them are cereals (23,000), vegetables (6,500), legumes (5,600) and fruit trees (2,800). The resources of Czechoslovak origin constitute 7,2%.

The Czechoslovak information system of GR consists of documentation of import/export, documentation of collections (passport data, evaluation data) and monitoring of gene banks. At present, passport data on 68% of accessions and evaluation data on 7% of accessions have been collected; to complete the passport database is the most urgent task for the immediate future.

Brassica collections

There are several Institutions in Czechoslovakia engaged in the maintenance and the study of *Brassicaceae* genetic resources. Let me introduce the different workplaces to you and set out a brief survey of their activities.

The collection of *Brassicaceae* maintained in the Research and Plant Breeding Institute of Vegetables in Olomouc includes the following species: *Brassica oleracea* vars. *acephala*, capitata, *gemmifera*, *gongylodes* and *italica*; *B. alboglabra*, *B. campestris* subvar. *pekinesis*, *B. chinensis*, *japonica*, *narinosa*, *rapa*, *carinata*, *juncea*, *nigra*; *B. napus* var. *napobrassica*. This collection in which some 230 accessions had been gathered from 1950 to 1987 represents first of all cultivars from Western Europe, USA and

Japan. Only a small part of the collection was acquired from VIR Leningrad-USSR, Gatersleben and Quedlinbourg, Germany and Skierniewice, Poland. These accessions were regenerated in 1988 for a long term storage and no description data are available. Some landraces of *B. capitata* f. *alba* and *rubra* and of *B. napus* var. *napobrassica* were collected by expeditions undertaken by workers of the Institute in Slovakia and Southern Bohemia from 1988 to 1990.

New introductions into the collection are also gained from the Departments of Experimental Breeding and Phytopathology when their researchers hand over some materials which they use for their experimental and breeding activities. These introductions are treated according to procedures recommended by IBPGR for gene banks, i.e. passportization, germination tests, drying, packing, storage. Among the materials obtained in this way and stored in the Genetic Resources Department, there are, for instance, populations of rapid cycling plants, male sterile lines, open pollinated cultivars and hybrids. Further extension of the collection will depend on users' demands and will be limited by financial and personal capacities.

Documentation of passport and storage data is done using dBase 3+ and a slide collection is maintained for a limited number of accessions.

Another collection of *Brassicaceae* vegetables of more than 400 accessions is kept in the Research and Breeding Station in Kvetoslavov in Southern Slovakia. It consists of registered cultivars *Brassica oleracea* var. *capitata, botrytis* and *gongylodes* - cabbage, cauliflower and kohlrabi - of Czechoslovak and foreign origin. Biological, economic and morphological characteristics of different varieties and their suitablity for the climatic conditions of Southern Slovakia are tested in field trials. Documentation is done on the basis of evaluation of these trials and of description of individual characteristics. The collection's purpose is to help in breeding programmes of *Brassicas*, first of all at the station itself.

A large collection of oilseed *Brassica* crops is maintained and studied in the Research Institute of Oilseed Crops in Opava. It includes about 600 accessions of formerly and recently registered cultivars of oilseed rape - *Brassica napus* (winter and spring forms), turnip rape - *B. rapa* f. *biennis* f. *praecox*, white mustard - *Sinapis alba*, black mustard - *B. nigra*, brown mustard - *B. juncea*. There are also various breeding materials in the collection.

The basic yield components and the most important economic and morphological characteristics are evaluated in field experiments. The main documentation consists of the alphabetical catalogue and the list of introductions. Passport data are documented in the Czechoslovak information system of genetic resources, EVIGEZ, in the Genebank at the Research Institute of Crop Production in Prague - Ruzyne. Long term storage is done in freezers.

The importance of this collection is in its utilization as initial material for breeding and research studies and for sample exchanges.

A new collection of *Brassica* fodder crops is being established in the Research Institute of Fodder Plants in Troubsko near Brno. The collection includes registered cultivars of *B. napus* (winter and spring forms), turnip rape - *B. rapa* and marrow-stem kale - *B. acephala,* of predominantly foreign origin. Basic documentation according to variety catalogues is at its beginning. Economic and morphological characteristics will be evaluated in field trials. This collection will be used in breeding stations for fodder crops breeding.

In the Research Institute of Crop Production in Prague - Ruzyne a collection of special breeding materials of *Brassicaceae* is under preparation. It comprises self incompatible and male sterile lines of *B. oleracea* var. *botrytis* and *gongylodes* and self incompatible *B. napus* lines. This collection will be used for hybrid breeding programmes in cauliflower, kohlrabi and winter oilseed rape.

Collections of *Brassica* sp. in Czechoslovakia and their documentation

Species	Institute	Number of accessions: in collection	with passport data
B.napus L.var *napus*	Research Inst.		
(winter)	of Oilseed Crops,	407	407
(spring)	Opava	91	91
B.napus L.f. *biennis*		30	30
f. *praecox*		22	22
B.nigra L.		8	8
B.juncea L.		37	37
B.napus L.var.*napobrassica*		2	2
B.oleracea L.	Research Inst. of		
var.*alboglabra*	Vegetable Growing	1	
var.*acephala* DC.	and Breeding	11	5
var.*botrytis* L.	RIVGB, Olomouc	89	89
var.*capitata* L.		122	122
var.*gemmifera* DC.		3	3
var.*gongylodes* L.		12	12
var.*sabauda* L.		6	6
B.campestris		2	
B.carinata		1	
B.juncea L.		7	
B.chinensis L.		14	14
B.pekinensis Rupr.		51	48
B.napus L.			
var.*napobrassica* L.		9	8
B.rapa L.		2	1
B.oleracea L.	Research and Breeding		
var.*capitata* L.	Station, Kvetoslavov	246	
var.*botrytis* L.		188	

APPENDIX IV

Genetic Resources of *Brassica* in France

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1. Preservation of genetic resources

Cruciferous crops are important components of agriculture and horticulture in France, but, as a consequence of agricultural evolution and progress in plant breeding, the genetic status of the crops has been moving rapidly. Except for some traditional fodder (kale) or vegetable (cabbage) crops, landraces have almost disappeared from professional farming. Table 1 gives the current cropping areas of *Brassicas* in France.

Table 1. Cruciferous crops in France (in hectares)

Vegetable crucifers (principally cauliflower)	70,000
Fodder crucifers (principally kale)	250,000
Oleaginous crucifers (exclusively rape)	700,000

Collection of landraces was intensively done, mainly between 1982 and 1988. The major part of this operation was partly funded by the European community (E.C. research programme 0890 "Collection of land races of cruciferous crops in E.C. countries"). Collecting operations were completed by INRA (National Institute for Agricultural Research) and ENSAR (National High School for Agronomy, Rennes). Emphasis was laid on collecting land races in the most endangered areas. Commercial populations, open to genetic evolution, were also gathered. All samples collected were deep-freezed and conserved at -20°C.

No regeneration has so far been undertaken and description was limited to part of kale and cabbage samples for resistance to club root.

Collections are held in:

- Rennes Plant Breeding Station (Le Rheu)
  (all cruciferous crops except winter cauliflower)

- Plougoulm Vegetable Breeding Laboratory
  (winter cauliflower)

There is no central genebank in France but total current holdings are given in Table 2.

Table 2. Collection of cruciferous crops in France

	landraces	commercial varieties	Total
Vegetable crops			
B. oleracea capita (cabbage)	38	59	97
B. oleracea botrytis (cauliflower)	294	80	374
B. oleracea gemmifera (brussel sprouts)	6	7	13
B. rapa (turnip)		36	36
R. sativus (radish)		56	56
Total	**338**	**238**	**576**
Fodder crops			
B. oleracea acephala (kale)	342	18	360
B. napus rapifera (fodder rape)	33	9	42
B. napus rapifera (swede, fodder turnips)	81	19	100
Total	**456**	**46**	**502**
Oleaginous crops			
B. napus and *B. rapa* (oilseed rape)		9	9
TOTAL	794	293	1087

2. Evaluation of genetic resources for resistance to club-root

This evaluation has been done by the breeding laboratory of the Rennes plant breeding station for resistance to club-root. The major aim is breeding cauliflower resistant to this disease and the work was first undertaken in cultivated crops close to this crop (*Brassica* oleracea var. botrytis).

2.1 Genetic material evaluated

- kale 370 land-races
- cabbage 16 land-races
- brussel sprouts 3 land-races
- cauliflower 19 land-races

. tests were made at the seedling state (4 to 6 leaves) in a greenhouse.
. at least 2 different inoculums were used.
. 2 x 20 plants were tested by population and by inoculum using artificial inoculation.
. pathological index (IP) was estimated following plant by plant evaluation.

The results are shown in Table 3.

Table 3. Pathological index (IP)
(Occurrence and importance of disease
for different *B. oleracea* crops)

CROP	AVERAGE	VARIATION
cauliflower	95	84-100
Brussels sprout	92	20-98
cabbage	87	76-97
kale	66	1-100

The results show that cauliflower is by far the most susceptible to club-root but that a good level of resistance is present in some old landraces of kale.

APPENDIX V

Brassica genetic resources work in Greece

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The Greek Gene Bank is a relatively new gene bank, established in 1981 with significant support from IBPGR and UNDP. It is located in Thessaloniki and is a department of the Agricultural Research Centre of Northern Greece.

Germplasm collection

1. Landraces: Until 1985, when IBPGR's support ended, the Greek Gene Bank followed the collection priorities set up by IBPGR, on the basis of global importance of the crops and the estimated degree of threat of their germplasm. The crop priority was as follows:

1) Cereals (landraces and wild relatives)
2) Forage crops and legumes
3) *Beta vulgaris* and *Beta maritima*
4) *Gossypium*
5) *Nicotiana tabaccum*
6) *Vitis vinifera* clones

Early collections had the character of urgent rescue missions. Large areas were explored and collected over short time periods. In all, 126 *Brassica oleracea* landraces were collected, principally in Northern Greece and Thrace as a secondary activity during collecting expeditions targeted on *Nicotiana tabaccum* germplasm in 1982-83 and on forage germplasm in 1983. These activities paralleled wild *Brassica* spp. collecting missions in 1982 by Gomez-Campo and Gustafsson in Crete and Peloponissos.

2. Wild relatives: *Brassica cretica* germplasm was collected by Gomez-Campo and Gustafsson in 1981 and 1982 in Peloponnisos and Crete. In all, 43 wild populations were identified and sampled in calcareous precipices, where they were inaccessible to freely grazing goats.

Conservation

The germplasm is conserved in the active storage fridge of the Greek Gene Bank at temperatures ranging from 0 to 5° and with air humidity control to 30%. The moisture content of the seeds at these conditions is estimated to be 6%.

Follow up work

In the absence of isolation facilities, the material has not yet been regenerated and evaluated in Greece. However, the germplasm collected by Profs. Gomez-Campo and Gustafsson has been multiplied, characterized and evaluated in Spain and Sweden for certain important characters.

Documentation

Passport data are maintained in computerized form in the Greek Gene Bank. The computer employed on this is an Apple-II Europlus of 644 kb capacity, without hard disk and with 15O kb diskettes.

Assessment of the degree of genetic erosion

1. Landraces: Only small part of the country has been collected and explored. Most of the cultivated *Brassica oleracea* complex collected comes from home-garden populations grown for subsistence and not for the market. These populations are disappearing along with the old farmers, since the new generation does not cultivate home vegetable gardens, or tend not to produce seed, relying instead on the modern varieties or hybrids offered by the market. The Greek Gene Bank therefore intends in the coming years to organize urgent collecting expeditions to rescue as much of this germplasm as possible.

2. Wild relatives: Grave threats to this germplasm exists for island or sea-side areas that are facing pressure on the natural environment by tourist development. Urgent collecting missions must be planned for these areas.

General Germplasm Protection Measures

Germplasm protective legislation has been introduced in Greece by Presidential Decree Nr. 80/1990. It provides for protection of landraces by subsidizing traditional cultivation of endangered crops, and also for wild relatives by protecting areas of high diversity. However, many administrative measures have to be taken to implement this protection in future, and many scientific and educational organizations (Universities, Institutes, Nature Protection Bodies etc.) have to be involved in these protection schemes to enable their efficient application. Existing protected areas (National Parks, Reserves, etc.) are to be used in the first stage, along with their administrative and scientific superstructure, to provide protection to germplasm at the lowest possible cost. At a later stage, new protected areas could be established when and where necessary.

Future planning

Regeneration of the germplasm is among future priorities, as soon as we obtain isolation facilities. Urgent collecting expeditions, mostly directed to the rescue of landraces throughout Greece are envisaged in the coming years, in the framework of future multicrop collecting expeditions. Support of these activities by EC or other genetic resources organizations would speed up the rescue process and will be pursued through the submission of relevant proposals. *In situ* protection of wild populations by fencing off the goats to enable the wild populations to multiply and retain their variation is also envisaged, probably in already existing Natural Reserves. Although subsidized landrace cultivating is also a potential target it is probably the most difficult to achieve.

APPENDIX VI

Conservation and utilization of *Brassica* germplasm in Italy

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1. Collections

1.1 Landraces

As reported in a meeting early in 1988, the Germplasm Institute had already collected 335 landraces from different regions of southern Italy (Fig. 1).

Since 1988, other samples were collected in Puglia, Campania, Basilicata, Umbria, Calabria, Toscana, Veneto, Friuli Venezia Giulia and Trentino regions. At the moment, the collection of *Brassica* maintained at Bari is made up of 360 landraces (Table 1).

1.2 Wild Species

From 1984 to 1986 the Germplasm Institute in collaboration with IBPGR collected more than 100 populations of different wild species of *Brassica oleracea* groups, namely: *B. incana, B. villosa, B. rupestris, B. drepanensis, B. macrocarpa, B. tenuis, B. montana, B. insularis.* Most of them were collected in Italy and only *B. montana* in France and Spain and *B. insularis* in Sardinia and Corsica. The collection maintained at Bari is intended for long term storage.

2. Facilities

2.1 Storage rooms

As reported in 1988, in a proposal to the EC through the *Brassica* Working Committee, the National Research Council of Italy has provided a new complex of 48 small isolation rooms, which have been installed in Metaponto (PZ), one of the Germplasm Institute's field trial sites.

2.2 Isolation rooms

Later this year, a second complex of isolation rooms will very likely be built in Valenzano, another field trial site close to Bari. Thanks to these facilities, multiplication and regeneration of a portion of the *Brassica* collection was started.

3. Taxonomy, systematics and geographical distribution of cultivated types of *Brassica* in Italy.

In 1988, in order to make a better planning for collecting *Brassica* germplasm in Italy, a survey on the existence of different types of *Brassica* in Italy was made and the results are reported in Tables 2 and 3.

4. Recommendations for urgent action

4.1 Collection

The proposal for future action is to collect in those regions where *Brassica* crops are also extensively cultivated but never intensively collected, namely, Lazio, Abruzzi, Marche, Veneto, Basilicata, Toscana and Piemonte. In the rest of the regions, where cultivation of *Brassica* crops is less common and where genetic erosion may be less severe, a second priority for collection is assigned. Special attention may be given to Lazio and Abruzzi regions for collecting *B. campestris*.

4.2 Multiplication and regeneration

Further multiplication and regeneration of samples already collected are urgently needed for distribution, utilization and evaluation activities.

Table 1 - Species of *Brassica* and number of samples stored in Bari

Species	Botanical Group	Regions										Other Countries	Total
		PU	CA	BA	CL	MA	UM	TO	VE	FR	TR[1]		
B. campestris[2]	*ruvo*	87	25	-	10	-	-	-	-	-	-	-	122
B.campestris	-	-	6	-	-	-	-	-	-	-	-	-	6
B.rapa	*rapa*	2	4	6	14	2	-	2	-	1	1	-	26
B.oleracea	*italica*	7	23	1	4	-	-	1	-	-	-	-	36
B.oleracea	*botrytis*	-	6	-	4	-	-	-	-	-	-	-	10
B.oleracea	*sabauda*	2	5	1	1	-	-	-	-	1	-	-	10
B.oleracea	*capitata*	-	-	-	2	-	-	-	-	-	-	-	2
B.oleracea	*acephala*	-	-	4	1	-	-	-	-	-	-	-	5
B.oleracea	-	7	3	-	-	1	1	1	-	1	-	-	14
B.nigra	-	-	-	-	-	-	-	-	1	-	-	-	1
B.napus	-	-	-	-	-	-	-	-	-	1	-	-	1
NC[4]		-	-	-	-	-	-	-	-	-	-	127	127
TOTAL		105	72	12	36	3	1	4	1	4	1	127	360

1 PU Puglia, CA Campania, BA Basilicata, CL Calabria, UM Umbria, TO Toscana, VE Veneto, FR Friuli VeneziaGiulia, TR Trentino.
2 subsp. *campestris*
3 Subsp. unknown
4 NC not yet classified from different countries: Italy, Ethiopia, Algeria, Egypt, Libya, Morocco.

Table 2 - Area and yield of *Brassica* crops in Italy (1)

Regions	Hectares	(1000q)	Observation
Campania	12,300	2,400	collected
Apulia	8,300	1,600	collected
Lazio	7,700	1,100	
Abruzzi	4,800	720	
Sicily	4,200	750	collected (partly)
Marche	3,400	600	
Calabria	2,900	410	collected (partly)
Veneto	2,700	820	
Basilicata	2,200	300	collected (partly)
Toscana	1,850	300	
Piemonte	1,800	500	
Liguria	900	280	
Lombardia	800	220	
Sardinia	600	90	
Emilia Romagna	550	160	
Molise	380	60	
Umbria	340	60	
Friuli V.G.	180	40	
Trentino	180	50	
TOTAL	56,000	9,500	

(1) Mean data of last three years (ISTAT) data.

Table 3 - Area (hectares per region cultivated with *Brassica* ssp. in Italy)

Regions	Broccoli (*B.oleracea*) Broccoli	Headed cabbage (*B.oleracea* var. *italica*) Cavolo cappuccio	Savoy cabbage (*B.oleracea* var.*sabauda*) Cavolo verza	Brussel sprouts (*B.oleracea* var. *gemmifera*) Cavoli di Bruxell	Cauliflowers (*B.oleracea* var. *botrytis*) Cavolfiore	Turnip (*B.rapa* var.*rapa*) Rapa	Other *Brassica* ssp. Altre Brassiche	Total
Basilicata	614	546	502	-	309	140	117	2,228
Calabria	434	664	302	-	877	343	459	3,079
Sicily	72	146	116	-	3,066	-	801	4,201
Sardinia	5	205	99	-	343	7	8	667
Toscana	-	240	346	22	1,135	130	124	3,569
Lazio	2,509	1,056	875	23	2,072	1,370	94	7,999
Marche	-	199	278	-	3,004	156	-	3,836
Abruzzi	197	345	348	15	3,344	364	57	4,670
Molise	77	107	70	-	15	50	-	249
TOTAL	3,908	3,508	2,946	60	14,165	2,560	1,660	30,498

APPENDIX VII

Current status of the CGN cruciferae collection

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CGN has accepted a base collection responsibility for *B. oleracea.*

Regeneration:

The main part of the CGN Cruciferae collection consists of material collected in the EC programme 0890 (CP2 and CP3). Most of this material has been regenerated, and is stored at -20°C. In the meantime new material has entered the collection, but has not yet been regenerated completely. An overview of the CGN collection is given in Table 1. The *Brassica* material to be included in the CGN collection is given in Table 2. Dutch breeding firms assisted in the regeneration work.

A major initiative is an attempt to reduce redundancy in the *B. oleracea* collection. To reduce redundancy in our collection all selections with the same cultivar name were planted side by side in the field for characterization and multiplication. With the help of the expertise of crop specialists from breeding firms, the Dutch cultivar registration service and the inspection service for vegetable and flower seeds, the selections were grouped. These groups were formed on presumed genetic relationships based on historical background and morphological resemblance.

During multiplication, 20 or more plants per accession belonging to the same group are grown together in isolation rooms for mass pollination with blow flies. The total number of plants for one group is at least 80-100. Seeds harvested from these plants form the new CGN number. All passport and characterization data from the original selections are combined to fit the new CGN number. These data are, as well as the original seeds, also retained for further investigation.

It can be seen from the table below and from appendix 3 that most groups have been formed in the cabbages and in the Brussels sprouts.

Table 1. Number of accessions (CGNnrs) per cultivar group

Scnr	Cultivar group	CGNnrs
0701	*Brassica oleracea* wild	0
0702	*Brassica oleracea* group Borecole	29
0703	*Brassica oleracea* group Curly Kale	0
0704	*Brassica oleracea* group Marrowstem Kale	2
0705	*Brassica oleracea* group Thousandhead Kale	0
0706	*Brassica oleracea* group Perennial Kale	0
0707	*Brassica oleracea* other or unspecified kales	1
0708	*Brassica oleracea* group Chinese Kale	0
0711	*Brassica oleracea* group White Cabbage	94
0712	*Brassica oleracea* group Pointed Head Cabbage	20
0713	*Brassica oleracea* group Red Cabbage	21
0714	*Brassica oleracea* group Savoy Cabbage	40
0717	*Brassica oleracea* group Brussels Sprouts	32
0718	*Brassica oleracea* group Kohlrabi	7
0719	*Brassica oleracea* group Caulflower	60
0720	*Brassica oleracea* group Broccoli	0
0723	*Brassica oleracea* other or unspecified group	1
0724	*Brassica* wild species: 2N=18	1
0725	*Brassica napus* wild	0
0726	*Brassica napus* group Fodderrape	13
0727	*Brassica napus* group Swede	6
0728	*Brassica napus* group Winter (oilseed) Rape	29
0729	*Brassica napus* group Spring (oilseed) Rape	5
0730	*Brassica napus* other or unspecified group	4
0733	*Brassica rapa* wild	1
0734	*Brassica rapa* group Fodder Turnip	165
0735	*Brassica rapa* group Vegetable Turnip	37
0736	*Brassica rapa* group Spring Turnip (oilseed) Rape	10
0737	*Brassica rapa* group Winter Turnip (oilseed) Rape	11
0738	*Brassica rapa* group Pe Tsai (chinese cabbage)	37
0739	*Brassica rapa* group Pak Choi	10
0740	*Brassica rapa* group Mizuna	2
0741	*Brassica rapa* group Komatsuna	1
0742	*Brassica rapa* group Yellow Sarson	2

0743	*Brassica rapa* group Broccoletto	7
0747	*Brassica rapa* group Turnip Greens	0
0748	*Brassica rapa* other or unspecified group	9
0751	*Brassica juncea* wild	0
0752	*Brassica juncea* group Oilseed	13
0753	*Brassica juncea* group Vegetable	0
0754	*Brassica juncea* other or unspecified group	0
0757	*Brassica carinata*	108
0760	*Brassica nigra* wild	0
0761	*Brassica nigra* group Black Mustard	24
0764	*Brassica* unspecified species	6
0766	*Brassica* other wild species	0
0770	*Sinapis alba* wild	3
0771	*Sinapis alba* group White Mustard	41
0772	*Sinapis* other wild species	0
0775	*Raphanus sativus* wild	0
0776	*Raphanus sativus* group Radish	24
0777	*Raphanus sativus* group Giant Radish	70
0778	*Raphanus sativus* group Fodder Radish (oilseed)	43
0779	*Raphanus sativus* group Mougri (caudatus)	2
0780	*Raphanus sativus* other or unspecified group	28
0781	*Raphanus* other wild species	0
0784	*Camelina sativa*	1
0785	*Conringia orientalis*	0
0786	*Eruca sativa*	4
0787	*Thlaspi arvense*	0
0796	*Xbrassicoraphanus* group Radicole	5
0797	*Xbrassicoraphanus* group Raparadish	6
0798	Other *cruciferae* (excluding ornamentals)	1
0799	*Cruciferae* unspecified	2

Table 2. *Brassica* accessions to be included in the CGN collection

Already generated:

Species	Cultivar Group		Number of accessions	Number before grouping
B. oleracea	wild	separate	2	
B. oleracea	borecole	separate	1	
B. oleracea	borecole	group	3	6
B. oleracea	other kales	separate	3	
B. oleracea	chinese kale	separate	19	
B. oleracea	white cabbage	separate	11	
B. oleracea	white cabbage	group	2	5
B. oleracea	pointed head cabbage	group	3	9
B. oleracea	red cabbage	separate	2	
B. oleracea	savoy cabbage	separate	1	
B. oleracea	savoy cabbage	group	1	4
B. oleracea	brussels sprouts	separate	10	
B. oleracea	brussels sprouts	group	7	80
B. oleracea	cauliflower	separate	31	
B. oleracea	kohlrabi	separate	1	
B. napus		separate	1	
	Total		98	

To be regenerated:

Species	Cultivar Group		Number of accessions	Number before grouping
B. oleracea	borecole	separate	8	
B. oleracea	marrow stem kale	separate	5	
B. oleracea	other kales	separate	5	
B. oleracea	white cabbage	separate	15	
B. oleracea	pointed head cabbage	group	1	3
B. oleracea	red cabbage	group	2	4
B. oleracea	brussels sprouts	separate	3	
B. oleracea	cauliflower	separate	14	
B. oleracea	winter cauliflower	separate	43	can be decreased by grouping
B. rapa	broccoletto (tsaishim)		11	
	Total		107	

Number of CGN groups (already accessed) per cultivargroup and the original number of selections included in these groups

CULTIVARGROUP	NUMBER OF GROUPS	ORIGINAL NUMBER OF SELECTIONS
White cabbage	18	88
Red cabbage	5	34
Savoy cabbage	8	25
Brussels sprouts	8	24
Total	**39**	**171**

Characterization:

Most of the *B. oleracea* accessions have been characterized, but the characterization data for the groups, as explained in Appendix 3, have still to be combined to fit the new CGN accessions.

Safety duplication:

So far, the accessions have not yet been sent for safety duplication, but will be in the very near future.

APPENDIX VIII

The history of the establishment and the results of studies of the VIR world cabbage collection

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The formation of the specific and varietal diversity of the VIR world cabbage collection began in the time of N.I. Vavilov's expeditions to Mediterranean countries and his travels to the USA, Canada and Western Europe.

The collection was extended by collection of local varieties in the CIS (about 450 samples). Since then, enlargement has continued due to the resources (about 600 samples) obtained by VIR foreign collecting expeditions in Japan, China and India. From these countries a very large diversity of valuable specimens of Asian species of white cabbage and cauliflower was introduced.

In recent years, over 1400 varieties and hybrids of recent origin were brought from the Netherlands, England, France, Germany, Denmark, Norway, Sweden, Chechoslovakia, Poland, Hungary, Bulgaria and other countries. More than 350 samples were also received from the USA and Canada. Since attention was paid to involving wild cabbage species in breeding, exploring expeditions were conducted in southern Crimea.

Today, the collection amounts to 3700 cabbage specimens from 72 countries of all the continents of the world.

The botanical composition of the collection is as folows:

Mediterranean-European	*Brassica capitata* (L.) - 1645 specimens
	Brassica botrytis (L/) Mill. - 830 spcimens
	Brassica sabauda (L/) Lizg. - 175 specimens
	Brassica oleracea L. - 210 specimens
	Brassica oleracea subsp. *gemmifera* (DC.) Lizg. - 215 specimens
East Asian	*Brassica chinensis* (Jusl.) L.
	Brassica pekinensis (Lour.) Rupr. - 425 specimens
African	*Brassica carinata* A. Braun - 30 specimens

As seen from the above data, a large amount of initial material suitable for different breeding objectives is concentrated in the VIR collection. Complex studies of this material are being carried out in VIR experimental stations in different geographical zones.

The complex studies comprise evaluation for economically valuable characters, such as: earliness, yielding ability, commodity qualities, biochemical composition, resistance to diseases and abiological factors of environment and to a number of other characters. Great attention is paid to the development and utilization of rapid methods for the evaluation of the collection. The most valuable sources are handed over to the breeding institutions of the country and, on this basis, a number of regionally widely adapted varieties have been produced.

As the result of these studies, schemes for character variability and scales for describing specific and varietal diversity in the cabbage were elaborated. An international descriptor list was also developed. Questions concerning the dynamics of growth and morphogenesis in cabbage, together with the anatomical structure of vegetative organs, were investigated.

Based on the extensive data which resulted from the studies of the world cabbage collection a sound approach contributing to the elaboration of specific and intraspecific classification of the plant and was developed and presented in the eleventh volume of Cultivated Flora "Cabbage", published in 1984. This work was conducted under the leadership of Tatyana Vasilyevna Lizgunova, who was in charge of the investigations on the VIR cabbage collection from 1925 to 1984. In the monograph the classification of cultivated species, their origin and distribution are presented. Data on genetics, embryology, cytology, biochemistry and anatomy of the crop are presented and methods of breeding are proposed.

***Brassica* accessions in the N.I. Vavilov All Union Scientific Research Institute of Plant Industry collection**

Species	Subspecies or type	Number of accessions
B. oleracea L.	*oleracea*	60
	selenisia (L.) Lizg.	37
	gemmifera (DC.)	34
	gongylodes (L.) Mill.	93
	gongylodes (L.) Mill (*asiatica* Lizg.)	12
	sabauda (L.) Lizg. (*palmifolia* (DC.) Lizg.)	4
	sabauda (L.) Lizg.	108
	capitata costata (DC.) Lizg.	18
	capitata (*orientalis* (Lizg.) Lizg.)	103
	capitata (white group)	686
	capitata (red group)	92
	italica (Plenck.) Lizg.	51
	botrytis	371
	alboglabra Bailey	7
	wild	5
B. rapa L.	*rapa*	290
	indoafganica Sinsk.	5
	japonica Sinsk.	1
	mesopotamica	2
	oleifera Metzg. *f. biennis* *f. annua*	 52 266
	white yellow seeds	56
	pekinensis (Lour.) Rupr	137
	chinensis Jusl.	34
B. juncea	*japonica* Sieb.	12
	(L.) Czern, *japonica* Sieb., lettuce forms	26
B. napus L.	*oleifera* Metzg. *f. biennis* *f. annua*	 355 336
	rapifera Metzg.	241
B. carinata	A. Braun	30
Raphanobrassica		2

APPENDIX IX

Base collections of crucifer crops which have accepted responsibility for long-term conservation

Species and crop	global	regional	Institute
Brassica carinata	.		FAL, Braunschweig, FRG
	.		PGRC/E, Addis Ababa, Ethiopia
B. oleracea	.		CAAS, Beijing, China
	.		IHR, Wellesbourne, UK
	.		CGN, Wageningen, Netherlands
Raphanus	.		CAAS, Beijing, China
	.		IHR, Wellesbourne, UK
		Asian	NBPGR, New Delhi, India
Wild species	.		Universidad Politécnica Madrid, Spain
	.		Tohoku University, Sendai, Japan
Oilseeds and green manures:			
B. rapa	.		PGR, Ottawa, Canada
B. juncea		Asian	NBPGR, New Delhi, India
B. napus *Sinapis alba*	.		FAL, Braunschweig, FRG
Vegetables and fodders:			
B. rapa *B. juncea, B. napus*	.		IHR, Wellesbourne, UK
B. napus	.		FAL, Braunschweig, FRG
All Cruciferae crops		East Asian	NIAR, Tsukuba, Japan

APPENDIX XI

Brassica in the IDRC Oilcrops Network for eastern/southern Africa and south/southeast Asia

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The Network

The Network Project and its constituent projects have an increasing role in enabling large numbers of small farm families to obtain their daily requirements of oils and fats. The project seeks to continue to link together researchers working in a number of IDRC-supported oilcrop improvement projects. These projects are proving increasingly effective in raising edible oil production in several countries of Eastern and Southern Asia and Africa which have severe deficiencies in edible oil.

The Network is coordinated by an IDRC Network Advisor, based in Ethiopia at present. The Advisor organizes and facilitates all the Network and Sub-Networks workshops, committees and other meetings, edits and arranges publication of the workshop proceedings, Oilcrops newsletter, reviews, bibliographies and other publications. He visits and provides advice, assistance and encouragement to scientists in national programmes and especially the IDRC-assisted projects included in the Network, and also provides assistance to the Ethiopian national oilcrops programme which is supported by IDRC.

In Phase I (1981-84), initial steps were taken to link IDRC-supported national oilcrop research programmes in Eastern and Southern Africa and the Indian region. Phases II (1984-87) and III (1987-90) continued to strengthen and expand the Network to include additional countries such as China and the Philippines. The one-year continuation phase of the project (1991-92) will allow a thorough evaluation of previous phases of the project to be undertaken by the Network Steering Committee, so that future activities can be carefully planned.

Four Sub-Networks were created for "*Brassicas*", "Sunflower", "Sesame", and "other oilcrops". These Sub-Networks enabled scientists specializing in the various crops to interact more closely and economically in Sub-Network workshops, rather than in the larger Network meetings, and to organize successful collaborative research programmes.

An effective oilcrops information system was developed to enable scientists to obtain the necessary specialized information on oilcrops, and an annual newsletter is published since 1984.

Collaboration

By encouraging collaborative research between scientists in stronger research programmes (including Canada) with those in weaker programmes, and arranging peer review of research results and programmes in regular workshops and in other ways, the Network helps to raise scientific standards in the member countries. The collaborative research projects which are being developed within the Network will have the effect of speeding the solution of urgent common research problems, and strengthening the capacity of the weaker programmes to carry out research.

In order to make the most efficient use of limited resources, the Network advisor is seeking to collaborate in any way possible with other Networks or Institutions involved in oilcrop research and development. In particular, collaboration is sought with IBPGR, the various FAO Networks and activities in oilcrops, as well as with CGIRC and ICRISAT. In order to make the needs for oilcrop research more widely known, and to enhance the resources available to the network and its members, the Advisor and all concerned informs other appropriate donors of the needs of the Network and its members, and invites their representatives to attend workshops and meetings.

Germplasm

After a slow start due to bureaucratic problems and national reluctance to share germplasm, a useful germplasm exchange programme has been developed through the Network coordination office. At the request of the members, the Network Advisor coordinates the collection of germplasm both from member countries and from other sources, makes up nurseries and distributes them in a timely fashion to those members who request them, and who supply germplasm, Table 1. If sufficient seed is available, the Advisor may provide it to others on an exchange basis. The Advisor also encourages and assists members to exchange germplasm bilaterally, either as part of collaborative research programmes, or in other ways.

Training

The training needs of the Network members are many and varied, ranging from short course training for technicians and scientists at various levels to graduate training. These needs are supplied from many sources. IDRC's Fellowships and Awards Division assists the network to arrange appropriate short-course training within member countries, according to resources available.

Brassica sub-network

The *Brassica* Subnetwork was first suggested during the 3rd Oilcrops Network Workshop held in Ethiopia in 1986 with 39 participants from 11 countries. Papers on *Brassica* were presented from Ethiopia, Egypt, Pakistan, Nepal, India and China and guest speakers from Canada and Sweden (IDRC MR153e). The 1st *Brassica* Subnetwork workshop was then held in Sweden in 1987 with 14 members, and guest speakers from 10 countries (IDRC MR168e).

Nine members proceeded from Sweden to Poland to participate in the 7th Rapeseed Congress. A review on "Aphid Screening" was recommended and published.

The 2nd *Brassica* Subnetwork workshop was held in India in 1989 with 32 participants from 12 countries (IDRC MR252e). Reviews on Alternaria, white rust, drought resistance and a coulored bulletin on insects and diseases were recommended, and are already in print.

The 3rd *Brassica* Subnetwork workshop was held in China with the Symposium on China International Rapeseed Sciences in 1990. To keep the links, we are taking advantage of the 8th Rapeseed Congress in Canada, July 1991, and will hold the 4th *Brassica* Subnetwork Workshop.

It appears that the *Brassica* Sub-Network has made the most progress, and is well on the way towards a self-sustaining status, though limited continued support from EDRC will probably be needed for some time. It was clear at the China Symposium and Sub-Network meetings that the strong research programmes in China and India, linked closely with the Canadian programme, and with other programmes in countries such as Sweden, are fully capable of providing leadership and research backup for the other Sub-Network member countries, and for the Sub-Network as a whole. Scientists from these programmes have already provided valuable consultancy and training services to other Sub-Network member programmes on request, and these activities are expected to increase in future.

The *Brassica* Sub-Network member countries have contibuted 64 germplasm lines/varieties which had already been dispatched to the member countries, Table 1. This Sub-Netowrk is also arranging collaboration with many other scientists around the world who are interested in *Brassica* research problems, on an equal partnership basis. It should also be able to attract support from other donors when necessary.

References

1. Ker, A. and Omran, A. 1990. Oilcrops Network Phase IV. IDRC.

2. Omran, A. (editor). 1987a. Oil Crops: Niger and Rapeseed/Mustard. Proceedings of the Third Oil Crops Network Workshop held in Addis Ababa, Ethiopia, 6-10 October 1986. IDRC MR153e.

3. _____. 1987b. Oil Crops: The *Brassica* Subnetwork. Proceedings of the First Meeting of the *Brassica* Subnetwork help in Uppsala, Sweden, 7-9 May 1987. IDRC MR168e.

4. _____. 1990. Oil Crops: Proceedings of the Three Meetings held at Patnagar and Hyderabad, India, 4-17 January 1989.

5. _____. 1991. Oil Crops: Proceedings of the Fourth *Brassica* Subnetwork Workshop held in Shanghai, China, April 1990. (under publication.)

Table 1. *Brassica* germplasm lines/varieties received from and dispatched to Network countries

BHUTAN

1. Mongar local
2. Yunkar Serti (local)
3. Bajo Local
4. Baylegphug Local

ETHIOPIA

1. Yellow Dodolla
1. Sarson, S-4
2. S-67
3. S-71
4. S-115
5. Awassa Population

INDIA

1. Mustard-Kranti
2. Mustard-Krishna
3. Mustard-RH-30
4. Mustard-RK-1467 (Vardan)
5. Mustard-JRV-24 (Rohina)
6. Mustard-RK-14 (Vaibhav)
7. Mustard-Durgamani
8. Mustard-Varuna
9. Mustard-Pusa Bold
10. Mustard-B-85 (Seeta)
11. Mustard-RLM-198
12. Mustard-RLM-619
13. Mustard-RLM-514
14. Mustart-RW-351
15. Toria-13-34 (Ayrani)
16. Toria-PT-30
17. Toria-TS-29
18. Toria-T-9
29. Toria-M-27
20. Toria-PT-303
21. Toria-TL-15
22. Toria-Sangam
23. Toria-Bhawani
24. Yell.Sarson-YSB-9 (Benoy)
25. Yell.Sarson-YSB-24
26. Yell.Sarson-BSH-1
27. Br.Sarson-Pusa
28. Br.Sarson-Kalyani
29. Taramira-T-27
30. Eruca sativa-T-27
31. Eruca sativa-JR-1

KENYA

1. Linnot

MEXICO

1. SEL-W

NEPAL

2. Sarson, S-5
3. Toria, Sarlahi Local
4. Toria, Sindhuli Local
5. Toria, Bhairhawa Local
6. Toria
7. Toria, Chilawon Local
8. Toria, Nijgadh Local
9. Toria, Navalparasil Local
10. Toria, Tarahara Local
11. Toria, Nepal Ganj Local

CHINA

1. Wulumugi (Yellow Rape)
2. Qing You-11
3. Gan You 5
4. 23
5. Bai Cheng (Yellow)
6. Hu You 9
7. Qing You 9
8. Sheng Li Qing Geng

SWEDEN

1. Consul
2. Hanna
3. Emma
4. Tornado
5. Puma-SV-86-27102
6. Sonja-86-37702
7. Topas No. 6050
8. Global No. 4061