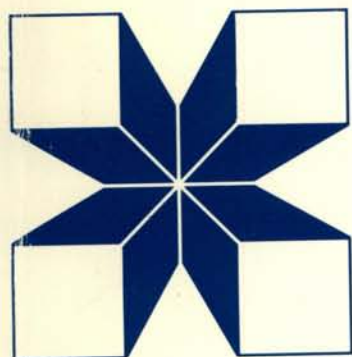


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**OIL CROPS:
PROCEEDINGS OF THE
THREE MEETINGS HELD
AT PANTNAGAR AND
HYDERABAD, INDIA,
4 – 17 JANUARY 1989**

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Esta serie incluye ponencias de reuniones, informes internos y documentos técnicos que pueden posteriormente conformar la base de una publicación formal. El informe recibe distribución limitada entre una audiencia altamente especializada.

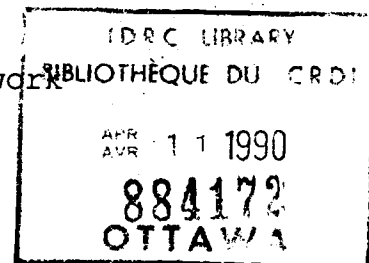
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**OIL CROPS:
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PANTNAGAR AND HYDERABAD, INDIA, 4-17 JANUARY 1989**

1. The Brassica Subnetwork-II
2. The Other Oil Crops Subnetwork-I
3. The Oil Crops Network Steering Committee-I

Edited by

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Organized by

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CONTENTS

Foreword	v
List of Participants	vi
Introduction	xi

Part 1. Brassica Subnetwork-II

Opening Remarks. MAHATIM SINGH	2
Recent Development in Oilseed Brassicas. R.K.DOWNEY	4
The Interinstitutional Collaborative Research Program on White Rust (<i>Albugo candida</i>) Between India (ICAR) and Canada (IDRC) for Rapeseed-Mustard Improvement. P.R.VERMA	9
Stability Parameters for Seed Characters In Different Species of Oleiferous Brassica. H.SINGH, D.SINGH, and V.S. LATHER	14
Oilseed Brassica Research in India. P.R.KUMAR	17
Transfer of Technology and On-farm Trials of Rapeseed and Mustard. BASUDEO SINGH	24
Status of Breeding Research on brassica Oil Crops at Pantnagar, India. G.N.SACHAN	30
Agronomic Investigations on Rapeseed and Mustard at Pantnagar. ARVIND KUMAR and R.P. SINGH	35
Disease Problems in Brassicas and Research Activities at Pantnagar. S.J.KOLTE, R.P.AWASTHI and VISHWANATH	43
Effect of Some Epidemiological Factors on Occurrence and Severity of Alternaria Blight of Rapeseed and Mustard. R.P. AWASTHI and S.J.KOLTE	49
Problems of Insect Pests in Brassicas and Research Work at Pantnagar. G.C.SACHAN	56
Economic Performance, Potential and Constraints in Toria Production. L.R.SINGH	66
Rapeseed In Egypt. BADR A.EL-AHMAR	70
The Role of High-Yielding Varieties and Production Techniques on Oilseed Brassica Performance in the Central, South-Eastern and North-Western Zones of Ethiopia. HIRUY BELAYNEH, GETINET ALEMAW and NIGUSSIE ALEMAYEHU	72
The Achievements and Future of Brassica in Kenya. M.J.MAHASI	79
Rapeseed Adaptation Trials in Cyprus. A.HADJICHRISTODOULOU	83
The Rapeseed (<i>Brassica napus</i> L.) Quality Breeding Progress in Shanghai Academy of Agricultural Sciences (SAAS) for Recent Years. SUN CHAOCAI	92
Statement on the Execution of the Sino-Canadian Rapeseed Breeding Project in 1988. WANG ZAO MU	94
A Preliminary Study on the Combining Ability and Heritability of Main Agronomic Characters in <i>B. juncea</i> . WANG ZAO MU and WANG YAN FEI	98
Report on the Execution of Sino-Canada Research Breeding Project. LIU CHENG QUING and HONG HAI PING	103

A Review of Orobanche Problem in Nepal. M.L.JAYASWAL	106
Oil Crops in Bhutan. TAYAN RAJ GURUNG	119
Brassica Production and Research in Pakistan. REHMAT ULLAH KHAN and MASOOD A.RANA	127
Summary and Wrap-up for Brassica Sub-Network Meeting. HUGH DOGGETT ..	130
Report on a Tour to Oilseed Brassica Growing Areas of India. GETINET ALEMAW	136
Discussions and Recommendations	138

Part 2. Other Oilcrops Subnetwork-I

Safflower Research and Coordination in India. V.RANGA RAO	144
Highlights of the Second International Safflower Conference Hyderabad, India from January 9-13, 1989. V.RANGA RAO	147
Coordinated Research Efforts and Linseed (<i>Linum Usitatissimum</i> L.) Improvement in India. MANGALA RAI	149
Safflower Research in Eighties in Madhya Pradesh (India). A.R.SAWANT	154
Nigerseed in India: Present Status of Cultivation, Research Achievements and Strategies. S.M.SHARMA	159
Constraints and Opportunities for Increasing the Production and Productivity of Niger in India. S.M.SHARMA	166
New Potential Areas of Niger in India. S.M.SHARMA	169
Present Production, Research and Future Strategy for Niger in Maharashtra. A.V.JOSHI	171
Niger in Tribal Bihar. H.B.P.TRIVEDI	176
Cultivation and Varietal Improvement of Linseed in India. R.N.DUBEY .	180
Agronomic Management/Agro-Techniques for Improving Production of Niger and Linseed. G.L.MISHRA	186
The Present Status of Niger and Linseed Pathology Work in India. G.S.SAHARAN	192
Safflower, Niger and Linseed in Nepal. B.MISHRA	203
Country Paper on Other Oilcrops in Bangladesh. M.A.KHALEQUE and DILRUBA BEGUM	208
Country Report on Linseed and Safflower in Pakistan. MASOOD A.RANA, MOHAMMAD SHARI, and ALTAF H.CHAUDHRY	213
Present Status of Safflower in Egypt. BADR A. EL-AHMAR	218
Progress in Linseed On-station and On-farm Research in Ethiopia. HIRUY BELAYNEH, NIGUSSIE ALEMAYEHU and GETINET ALEMAW	220
Investigations on Some Biochemical Characteristics of Nigerseeds (<i>Guizotia abyssinica</i> Cass). GETINET ALEMAW and HIRUY BELAYNEH	229
Processing of Oil Seeds in Ethiopia. DEJENE TEZERA	233
The Status of Linseed, Safflower and Niger Research and Production in Kenya. T.C.RIUNGU	238
Summary and Wrap-up for Other Oilcrops Sub-Network Meeting. HUGH DOGGETT	241
Discussions and Recommendations	248

Part 3. Oilcrops Network Steering Committee-I

The Oilcrops Network for East Africa and South Asia, Achievements and Future. ABBAS OMRAN	256
Recent Developments in The Oil Crops Network and the ORU. HUGH DOGGETT	265
IBPGR's New Concept for the Conservation and Utilization of Germplasm; Global Crop Networks. J.M.M.ENGELS	272
Technology Mission on Oilcrops for Self-Reliance in Vegetable Oils in India. MANGALA RAI	274
Oilseeds Research in India: Network, Its Set Up, Organization, Past Achievements and Current Research Thrusts. V.RANGA RAO	283
Groundnut and the Oilcrops Network. S.N.NIGAM	286
Oilcrops Production in Ethiopia Current Status and Future Prospects. SEME DEBELA	288
The Vegetable Oil/Protein System in Kenya Summary Report-Phase I. C.ZULBERTI and J.LUGOGO	293
Brassica Sub-Network Achievements and Activities, 1987-88. HIRUY BELAYNEH	320
The Present Situation and Main Achievements of Sesame Production in East Africa. MOHAMMED EL-HASSAN AHMED	324
Constituion of the Oil Crops Network (Second Draft). MASOOD A.RANA and ABBAS OMRAN	330

DISEASE PROBLEMS IN BRASSICAS AND RESEARCH ACTIVITIES AT PANTNAGAR

S.J. Kolte, R.P. Awasthi and Vishwanath

Abstract

Research activities on management of seedling blights, Alternaria blight (AB), white rust (WR) and downy mildew (DM) diseases of rapeseed-mustard are highlighted. Tolerance to AB in *Brassica carinata*, *B. napus*, *B. alba* and in some cultures of cultivated *B. juncea*, has been established to be characterized by reduced infection rate suggesting its race-nonspecific nature against different races of most predominant causal fungus, *Alternaria brassicae*. However, resistance to WR in the above crop species appears to be race-specific as some of these (*B. juncea* exotic series) are immune or highly resistant to *Albugo candida* as against the highly susceptible reaction of some others as cultivated *B. juncea* cultures. This suggests the occurrence of races in *A. candida* also.

Until a break-through in breeding high yielding agronomically acceptable disease resistant cultivars is made, the diseased control strategy depends on the integrated use of early maturing and disease escaping or tolerant cultivars and on chemical control. Superiority of Iprodione to Dithiocarbamates in controlling AB is established, whereas the effectiveness of the use of mixture of Metalaxyl + Mancozeb in the control of WR and DM is confirmed.

Pathological research in respect of rapeseed-mustard crops is being carried out at Pantnagar with an overall objective of finding out disease resistant or tolerant cultivars or germplasm among the indigenously available materials or from the exotic *Brassica* species. In addition to this, assessment of yield losses due to diseases under different agricultural situations, variability in pathogens, and uses of cultural and chemical measures, also form part of the research activities for providing some basic information in devising integrated control strategy for management of the diseases of economic importance.

Seedling blights, Alternaria blight (AB), white rust (WR), downy mildew (DM), sclerotinia rot, powdery mildew, bacterial rot and phyllody are the important disease problems in India (1). Part of the information generated through research activities at Pantnagar has been presented in (2). Additional information obtained during the last two years period, i.e., 1986-1988, is given below:

A. Seedling Blights

Toria and mustard crops have been found to be affected by seedling diseases in the range of 1-3% under field conditions. The disease incidence may go beyond 15% when these crops are grown in rotation with sugarcane. Affected seedlings show distinct symptoms of collar rot, wilting, root and stem rots. Isolations from the disease seedlings may yield the growth of *Sclerotium rolfsii*, *Rhizoctonia solani* and *Fusarium oxysporum*. Though resistant to other important diseases, *Brassica alba*, has been found to be susceptible to *S. rolfsii* as compared to *B. campestris*, *B. carinata*, *B. juncea*, *B. napus* and *B. nigra* under natural conditions, Table 1.

Seed treatment with Mancozeb, Thiram, Captafol (each @ 0.2%) has been found to protect the plants against infection from *S. rolfsii* and *F. oxysporum*, whereas seed treatment with Thiophanate methyl (0.2%) or Carbendazim (0.2%) has been observed to be more effective for the control of seedling infection caused by *R. solani*.

Table 1. Natural occurrence of collar rot of rapeseed-mustard caused by *sclerotium rolfsii*

Crop species	Incidence of collar rot (%)*
<i>Brassica alba</i>	10.53
<i>B. campestris</i> var Toria cv. PT 303	2.80
<i>B. campestris</i> var yellow sarson cv. 151	1.30
<i>B. carinata</i>	1.10
<i>B. juncea</i> cv. varuna	1.80
<i>B. napus</i>	0.90
<i>B. nigra</i>	1.90

*Average of two years observations at Pantnagar in field previously grown with soybeans.

B. alternaria Blight

The quantitative loss in yield due to AB has been estimated to be 35-46% (4). Pods harvested from affected plants show shrivelled, shrunken and discolored seeds. Four species of *Alternaria* i.e., *A. brassicae*, *A. brassicicola*, *A. raphani* and *A. alternata* have been found to be associated with the disease under field conditions, though leaf and pod infection due to *A. brassicae* is most common. When two or more species occur together on the same leaf, it may, in practice, be difficult to distinguish them by macroscopic symptoms. Thus, correct identification of the pathogen depends on the isolation and microscopic studies.

1. Variability in *A. brassicae*

- i. Natural occurrence of different strains: The most predominant *Alternaria* species i.e., *A. brassicae* has been found to exist as three distinct isolates; A, C, and D which have been proved, for the first time, to be three distinct strains or races of *A. brassicae* under Indian conditions. It is observed that *A. brassicae* isolate C is more prevalent (65%) than A (47.3%) and D

(42.9%) isolates. *A. raphani* infects more readily *B. alba* and *B. juncea* cv. Exotic to the extent of 65-70%. The prevalence of *A. alternata* is noted only to the extent of 2-17% but when it interacts with *A. brassicae* and *A. raphani* it increases the susceptibility of *Brassica* species to the disease.

- ii. Variability in growth characters: The three isolates of *A. brassicae* show distinct variability with respect to their growth and colony characters on media, size and shape of conidia, sporulation and chlamydospore formation. The best sporulating is isolate C. Asparagine, as a source of nitrogen, does not support the growth of any of the isolates of *A. brassicae* which otherwise supports good growth of *A. raphani* and *A. alternata*. *A. brassicae* isolate A could usually germinate from the middle cell and isolate C from the upper most cell in comparison with the germination of spore by formation of elongation of the spore beak itself in respect of isolate D. Isolate C has been observed to produce secondary conidia as against the absence of such conidia in the case of isolates A and D.

It has been distinctly observed that isolate D shows brownish-grey colony on Sabour's agar (SA) medium which is quite distinct from white cottony growth of isolates A and C. Thus the SA medium can be used to identify the strains of *A. brassicae*. The formation of chlamydospores has been observed in the case of *A. raphani* and *A. brassicae*

isolate A as against the absence of the chlamydospores in the case of isolates C & D.

- iii. Variability in degree of virulence: Based on degree of defoliation effect through artificial infection, *A. brassicae* isolate C is more virulent on indigenously cultivated *B. juncea* and *B. campestris* cultivars, whereas

isolate D is more virulent on *B. napus* cv.2, Table 2. On *B. carinata*, the three isolates of *A. brassicae* produce three kinds of distinct spots thus enabling the use of *B. carinata* as indicatr host for identification of races of *A. brassicae*. Similarly *B. alba*, *B. juncea* cv. exotic, and *B. napus* cv. EA are found to be indicator hosts for identification of *A. raphani*.

Table 2. Degree of Virulence* of *A. brassicae* isolates, *A. raphani* and *A. alternata* on different *Brassica* species

Brassica	<i>A. brassicae</i> isolates			<i>A. raphani</i>	<i>A. alternata</i>
	A	C	D	E	B
<i>B. alba</i>	-	-	-	+	-
<i>B. carinata</i> cv GS	-	+	-	-	-
<i>B. carinata</i> cv RS	+				
<i>B. napus</i> cv EA	-	-	-	+	-
<i>B. napus</i> cv Regent	-	+	-	-	-
<i>B. napus</i> cv 1	+	-	-	-	-
<i>B. napus</i> cv 2	-	-	+	-	-
<i>B. juncea</i> cv Varuna	-	+	-	-	-
<i>B. juncea</i> cv Exotic	+	-	-	+	-
<i>B. campestris</i> cv YST 15	+	+	-	-	-

**indicates highest degree of virulence of respective isolate or species.

-indicates low to moderate virulence.

2. Management

- i. Host Resistance in Commonly Cultivated Brassica species: Several varieties and germplasm lines of cultivated forms of *B. campestris* (Toria or sarson) and *B. juncea* (mustard) have been screened both under naturally and artificially infected conditions. These show differences in the degree of their susceptibility; some being tolerant, but the possibility of the existence of major gene sources of resistance is lacking. The level of resistance/tolerance is not sufficient enough to be used as transferable sources for incorporation of resistance/tolerance in the more

desirable, agronomically acceptable but susceptible cultivars. Some types such as yellow sarson "Type 6" and mustard "PHR 1" have the potential to be used as such,

following selection procedure. It has been observed that young plants of less than 30 days are less susceptible to the disease and the susceptibility increases as the plant age increases.

- ii. Host Resistance in Exotic Brassica Species: Among the exotic *Brassica* species, *B. alba* and *B. napus* cv EA show resistance to the most prevalent *A. brassicae* isolates. But the problem of using their resistance

becomes complicated as these are susceptible to *A. raphani* as discussed above. The possibility of using these species in hybridization program poses a danger of increasing susceptibility of the cross-bred material to *A. raphani*.

Based on the components of resistance, like relatively small size of spots, less defoliation, longer incubation, latent periods and reduced sporulation /lesion, it is consistently observed in the present studies that *B. carinata* is more resistant to *A. brassicae*, *A. raphani* and *A. alternata* as compared to other species, Table 3 and the nature of resistance appears to be non-specific i.e., horizontal type

characterized by reduced infection rate. The apparent infection rate in the case of *B. carinata* has been observed to be 0.154-0.267 as against very high infection rate of 0.763 in the case of *B. juncea* cv. Varuna and *B. campestris* var yellow sarson cv T 151. On the basis of the yield data, *B. carinata* has a potential of yielding to the extent of 24 q/ha as against 7-9 q/ha in the case of *B. juncea* and *B. campestris* cultivars under Alternaria-affected conditions. *B. carinata* has never been found to be affected by WR, DM and PM diseases when cultivars of commonly cultivated *B. juncea* and *B. campestris* show very high degrees of severity of these diseases under similar conditions.

Table 3. Incubation (I) and latent (L) periods in days in respect of *A. brassicae* isolates (A,C,D), *A. raphani* (E) and *A. alternata* (B) on surfaces of leaves of some oleiferous Brassica species.

Crop species	<i>A. brassicae</i> isolates						<i>A. raphani</i>		<i>A. alternata</i>	
	A		C		D		E		B	
	I	L	I	L	I	L	I	L	I	L
<i>B. alba</i>	14	22	12	17	12	18	7	11	15	22
<i>B. carinata</i> cv BS	12	16	11	16	11	16	12	16	13	23
<i>B. napus</i> cv I	14	21	13	16	13	16	9	12	13	20
<i>B. napus</i> cv EA	13	17	13	19	13	17	13	16	13	24
<i>B. napus</i> cv Regent	9	13	13	17	12	15	13	16	14	24
<i>B. juncea</i> cv Varuna	6	9	7	9	6	8	9	13	9	14
<i>B. juncea</i> cv PHR	11	14	14	13	8	10	8	10	9	13
<i>B. campestris</i> cv YST 151	5	7	6	9	7	11	10	13	11	15

Note : Data were obtained through artificial infection keeping the inoculated leaves in moist chambers.

iii. Control Through Disease Escape: Early maturing cultivars, if planted during the last week of September and the first week of October, have been found to be escaping the severe development of AB, WR and DM diseases. Fortunately, in the important crop species, some early varieties have been

identified. These are Toria types: M-27, TS-29, PT-83, Bhavani and RAU-1; mustard types: PR-36, PR-1D, RLM 51; yellow sarson types: YSB-9,

RAUS-3 and PYS-6. It is suggested that the efforts should be made to identify such varieties for cultivation.

iv. Chemical Control: Alternaria blight can be controlled by spraying some fungicides like Mancozeb, Captafol or Ziram @ 0.2%, (Table 4). The results of the field trials conducted over the last three crop seasons (1985-1988) at Pantnagar revealed that Iprodione is superior to Mancozeb, Ziram and Captafol and can result in 86% increase in yield as compared to unsprayed plants. But Iprodione is not effective against WR+ DM. Spray of mixture of Metalaxyl + Mancozeb (Ridomil MZ) @ 0.2% is found to be effective in the control of WR, DM and AB diseases provided the sprays are made to control the staghead phase at 3.9-4.0 stages of the crop growth.

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Table 4. Effect of some fungicides on yield of toria at Pantnagar, 1985-88.

Fungicide	Yield (q/ha)			Yield increase Over check (%)
	85-86	86-87	87-88	
Iprodione @ 0.2	15.73	15.62	23.74	86.78
Mancozeb @ 0.2	13.33	12.30	21.01	57.92
Captafol @ 0.2	12.26	11.92	19.75	50.81
Ziram @ 0.2	13.39	11.00	-	23.88
Metalaxyl + Mancozeb (Ridomil MZ) @ 0.2	13.39	10.99	17.75	42.68
Thiophanate Methyl @ 0.05	9.19	9.85	-	-3.25
Boric acid powder @ 0.53	11.53	12.97	17.15	40.75
Check: No spray	8.39	8.83	12.30	-
CD at 5%	2.44	2.16	3.94	-

*Concentration used in 1986-86 and 1985-87 was 0.2% and in 1987-88 it was 0.5%.

C. White Rust and Downy Mildew

Based on the staghead phase severity, the losses in yield due to WR + DM infection have been estimated to be in the range of 17-37% (2). Both diseases, unlike AB, are more dependent on the favourable weather conditions as described earlier (2). Reduced period of sunlight (2-6 h/day) and rainfall upto 161 mm during the flowering period favour the severe occurrence of the stagheads in the winter rabi crop season (3).

Results of the work done during the past two years period are briefly given below.

1. Variability in *Albugo candida*

There are indications that there are races of *A. candida*. This is evident because of the differences in the pustule size and shape and immune reaction of some exotic *Brassica* species (BEC series) as

against susceptible reactions of commonly cultivated *B. juncea* cultivars like Varuna etc., (Table 5). However, detailed studies on characterization of races through differential host reaction need to be carried out. There are problems and practical difficulties in the development of artificial infection and easy use of the screening techniques.

2. Management

i. Host resistance/tolerance:

Among the cultivated *Brassica* species, *B. juncea* cv "YRT 3" and *B. campestris* cv "PYS 6" have been observed to show resistance/tolerance reaction to WR + DM under field conditions. Some of the *Brassica* species like *B. alba*, *B. carinata*, *B. napus* and *B. juncea* cv Exotic have never been found to be affected with these diseases. The nature of resistance

appears to be race-specific which needs further study for their effective utilization in the breeding program.

ii. Control through disease escape: Use of early maturing cultivars as discussed under AB can be of practical importance to

Table 5. Reaction of some exotic *B. juncea* cultures to *Alternaria* blight (AB) and white rust (WR)*

Culture	AB index on leaf (%)	AB index on pods (%)	WR index on leaf (%)
BEC 107	50-60	17-28	0-10
BEC 109	60-75	22-23	0-0
BEC 111	40-75	9-40	0-0
BEC 112	48-60	25-45	0-10
BEC 115	30-58	12-28	0-0
BEC 127	30-68	16-32	0-0
BEC 138	30-52	9-24	0-0
BEC 152	30-50	9-11	0-0
BEC 142	58-65	9-22	0-0
BEC 164	58-64	9-17	0-0
K 41729	36-58	9-22	0-3
Varuna	60-84	36-40	60-78
Yellow sarson			
T 151	80-90	50-60	20-40

*Data based on average of two crop seasons (1986-87 & 1987-88) at Pantanagar.

minimize the losses caused by WR + DM diseases.

increasing under the changing cropping pattern.

iii. Chemical control: As in the previous years, seed treatment with Apron 35 SD @ 0.2% concentration is found to be effective in checking cotyledonary infection of downy mildew in both Toria and mustard. But seed treatment alone is not effective to control the staghead phase of WR + DM. Hence, spray of mixture of Metalaxyl + Mancozeb is required to control the staghead phase, (Table 4).

D. Other Diseases

Research on disease control measures in respect of bacterial rot, and *Sclerotinia* rot, and phyllody needs to be initiated as their occurrence is seen to be

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