Registration of Eight Ascochyta Blight-Resistant, Early Maturing, Large-Seeded Chickpea Germplasms

Eight kabuli chickpea (*Cicer arietinum* L.) germplasms were developed through hybridization between ascochyta blight-resistant, late maturing, intermediate type (pea-shaped, small, orange seeds) germplasm accessions and early maturing, high-yielding kabuli type (ram-head-shaped, large, beige seeds) lines in the ICRISAT–ICARDA Kabuli Chickpea Project in Syria and released in 1992 (Table 1). Three are resistant to ascochyta blight [caused by *Phoma rabiei* (Pass.) Khune & J.N. Kapoor; syn. *Ascochyta rabiei* (Pass.) Labrousse] and are early maturing: FLIP 90-98C (Reg. no. GP-128, PI 578065), FLIP 91-22C (Reg. no. GP-129, PI 578068), and FLIP 91-46C (Reg. no. GP-130, PI 578070). Four are ascochyta blight-resistant and large-seeded germplasms: FLIP 91-2C (Reg. no. GP-131, PI 578066), FLIP 91-24C (Reg. no. GP-132, PI 578069), FLIP 91-50C (Reg. no. GP-133; PI 578071), and FLIP 91-54C (Reg. no. GP-134, PI 578072). The eighth is an ascochyta blight-resistant, early-maturing and large-seeded germplasm: FLIP 91-18C (Reg. no. GP-135; PI 578067).

The pedigrees are shown in Table 1. Most of the parents were breeding lines (Food Legume Improvement Program = FLIP) and had been developed from crosses made with original resistant sources of intermediate type. The crosses were made in the main season (December–June) in 1987 at Tel Hadya, the principal ICARDA station in Syria. The F_1's were grown in the off season (June–October) in 1987 at Terbol, ICARDA's substation in Lebanon under extended daylight to facilitate their maturity. The F_2 populations of these crosses were grown in the ascochyta blight nursery in the 1987–1988 main season. The nursery was inoculated with diseased debris from blight-affected chickpea and sprayed with a spore suspension of six races of *A. rabiei* from Syria (1). The disease was developed in epiphytotic form following the technique described by Singh et al. (2). Blight-resistant plants from each cross were bulk harvested in June 1988. The F_3 populations were grown in the off season with natural daylength which helped eliminate photoperiod-sensitive and late-maturing plants. Plants maturing by beginning of October 1988 were bulk harvested crosswise. The F_4 bulks were grown at Tel Hadya in the 1988–1989 main season in the blight disease nursery. Plants with resistance to ascochyta blight, early maturity and/or large seed, and other agronomic attributes were harvested individually. The F_5 progeny rows were grown in the blight disease nursery at Tel Hadya in the 1989–1990 main season. One line, FLIP 90-98C, was bulked in F_5 generation in 1989–1990 and its F_6 bulk was grown in the 1990 off season. Single plants from blight-resistant progenies were selected and F_6 progeny rows were grown in the 1990–1991 main season at Tel Hadya. Seven ascochyta blight-resistant F_6 progenies having uniform and agronomically desirable attributes were bulk harvested. The F_7 bulks of these seven germplasms were grown on large plots in 1991 off season for seed increase and further purification and were assigned a FLIP number. These FLIP lines were evaluated in the greenhouse for resistance against the mixture of six races of *A. rabiei* from October 1991 to January 1992. They were also grown in the ascochyta blight disease nursery in the field in the main season for confirmation of blight resistance. Simultaneously, they were grown in a blight disease-free plot for recording observations on other traits, such as days to 50% flowering, plant height, seed size, and yield.

All eight lines have resistance to ascochyta blight both in the field and greenhouse (Table 1) and have a typical kabuli type seed. Three of them, FLIP 90-98C, FLIP 91-22C, and FLIP 91-46C, have early maturity ($\leq$131 days to 50% flowering) and have the same flowering period as a local spring-sown cultivar. Another four lines, FLIP 91-2C, FLIP 91-24C, FLIP 91-50C, and FLIP 91-54C, have large seed size (40–50.6 g per 100 seeds) and medium maturity. One line, FLIP 91-18C, has both early maturity and large seed size. All eight breeding lines have plant height between 40 and 51 cm and are suitable for machine harvest.

Development of lines having three desirable traits (blight resistance, early maturity, and large seed size) was possible because of the large number of crosses (>6000) made since 1978 and the enormous amount of breeding material generated and evaluated at ICARDA. However, the low number of desirable lines that were obtained in the hybridization program compared with the amount of breeding material generated indicates the difficulty in combining these traits. In fact, crosses between the original resistant sources having several undesir-

Table 1. Pedigree and some agronomic characters of ascochyta blight-resistant, early maturing, large-seeded kabuli chickpea germplasms developed at ICARDA, Syria.

Trait and germplasm†	Pedigree	Blight score: Field 1991	Blight score: Field 1992	Blight score: Greenhouse 1992	50% flowering	100-seed wt.	Plant height
		1-9 scale‡			d	g	cm
Early maturity							
FLIP 90-98C	FLIP 83-7C × FLIP 84-92C	4	3	4	131.0	29.1	40
FLIP 91-22C	ILC 1919 × FLIP 84-99C	4	4	4	130.5	23.9	44
FLIP 91-46C	FLIP 81-293C × FLIP 84-93C	3	3	4	131.5	35.6	45
Large seed size							
FLIP 91-2C	FLIP 85-1C × FLIP 84-81C	4	3	3	135.0	49.4	43
FLIP 91-24C	FLIP 84-17C × ILC 4921	4	3	3	136.5	45.7	47
FLIP 91-50C	FLIP 85-42C × FLIP 86-93C	4	4	4	134.0	50.6	46
FLIP 91-54C	(ILC 519 × FLIP 83-47C) × ILC 519	4	2	4	132.5	40.0	51
Early maturity and large seed size							
FLIP 91-18C	ILC 1919 × FLIP 84-99C	3	3	3	131.5	45.5	49
Resistance source§							
ILC 72	NEC 42-1	4	3	4	139.0	27.7	51
ILC 3279	Stepnoj 1	4	3	4	139.0	28.1	52

† FLIP = Food Legume Improvement Program.
‡ Rating scale: 1 = free from disease damage; 9 = plants killed.
§ ILC 72 and ILC 3279 are original blight-resistant accessions used in the hybridization program.

able attributes did not result in the development of large-seeded and/or early maturing lines. The latter type could be developed through the second cycle of crosses.

These newly developed ascochyta blight-resistant, early maturing, and large-seeded kabuli chickpea germplasms will be of immense value to both chickpea scientists and growers. Small quantities of seed of these lines can be obtained from the Legume Program, ICARDA, Syria.

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References and Notes

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Registration of C-22, C-23, and C-24 Germplasms of Cicer Milkvetch

Three germplasms of cicer milkvetch (*Astragalus cicer* L.) were released by the USDA-ARS and the Colorado Agricultural Experiment Station in December 1993. They were selected for improved extended plant height (length of longest stem) and herbage yield and for improved or reduced plant spread. The C-22 (Reg. no. GP-125, PI 578122), C-23 (Reg. no. GP-126, PI 578123), and C-24 (Reg. no. GP-127, PI 578124) germplasms trace to a 304-plant population from 'Monarch' that was used to develop 'Windsor' (2).

The population had undergone two cycles of recurrent selection for extended plant height and herbage yield when grown under irrigation in spaced-plant, replicated nurseries at Fort Collins, CO. In each of the two cycles of selection, plants were evaluated for extended height and herbage yield in each of three harvests per year for 2 yr. Spread, an average of the north–south and east–west measurements of plant width, was taken in late September of each year. Emphasis was placed on selecting plants that did not express the photoperiod-induced dormancy trait following the second harvest in late July or early August (1). The selected clones for each germplasm were grown under isolation for the production of polycross seed. The germplasms did not have clones in common. Bumblebees (*Bombus* spp.) were the principal pollinators.

Germplasm C-22 consists of 35 parental clones selected for improved extended plant height and herbage yield. Mean extended height of the parental clones was 126, 121, and 144% of that of Monarch for the first, second, and third harvests, respectively. Mean herbage yield of the selected clones was 148, 137, 158, and 145% of that of Monarch for the first, second, and third harvests and for total yield, respectively. Mean plant spread for the selected clones was 107% of that of Monarch. Seed weight of the 35 clones ranged from 3.54 to 4.67 g 1000 seed^{-1} with a mean of 4.15 g, whereas seed weight of Monarch was 4.14 g 1000 seed^{-1}

Germplasm C-23 consists of 21 clones selected for improved extended height, herbage yield, and spread. Mean extended height of the parental clones was 118, 120, and 140% of that of Monarch for the first, second, and third harvests, respectively. Mean herbage yield of the selected clones was 163, 153, 197, and 164% of that of Monarch for the first, second, and third harvests and for total yield, respectively. Mean plant spread of the parental clones was 140% of that of Monarch. Seed weight of the parental clones ranged from 3.79 to 4.99 g 1000 seed^{-1} with a mean of 4.16 g.

Germplasm C-24 consists of 11 clones selected for improved extended height and reduced spread. Mean extended height of the parental clones was 129, 134, and 153% of that of Monarch in the first, second, and third harvests, respectively. Mean herbage yield of the selected clones was 128, 107, 137, and 121% of that of Monarch for the first, second, and third harvests and for total yield, respectively. Mean plant spread of the selected clones was 65% of that of Monarch. Seed weight of the parental clones ranged from 3.48 to 4.71 g 1000 seed^{-1} with a mean of 4.08 g.

An equal amount of polycross seed (by weight) from each parental clone within a germplasm was composited. Small quantities of seed (up to 25 g) will be provided to each applicant upon written request to the author. It is asked that appropriate recognition of germplasm source be made when these germplasms contribute to the development of an improved cultivar or when used for research purposes.

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Registration of Oh603 Germplasm Line of Maize

Inbred Oh603 (Reg. no. GP-295, PI 573098) is a yellow, flint maize (*Zea mays* L.) line developed by the Ohio Agricultural Research and Development Center, The Ohio State University, Wooster, OH. The line was released 6 Apr. 1993 for its potential value as a source of germplasm in the development of proprietary inbreds by the hybrid seed industry, particularly for specialty hybrids suitable for dry milling.

Oh603 was developed from the fourth random-mating cycle of the Ohio Synthetic Corn Belt-Tropical Flint population [OhSCB-TF(C0)]. In 1981, full-sib pollinated ears were selected on the basis of flintiness and large kernel size. Selfing and inbreeding of the full-sib progenies was initiated in 1982 and advanced to the S_3 by E.J. Dollinger. Inbreeding by the pedigree method was continued, and at the S_4 generation the breeding line was designated E1-1-1-2. The S_4 was evaluated in testcrosses with B73 during 1988 to 1990, and the S_5 was tested in 1989 and 1991. Average yield of S_4 and S_5 testcrosses in a total of 11 performance tests was 17% higher than B73×Mo17 and 5% higher than the average of two commercial hybrids. Pioneer brand 3343, Pioneer brand 3352, and DeKalb brand 656 were used as commercial checks. Each hybrid was not entered in every test; however, two of them were included in each test. Grain moisture of Oh603 × B73 was 1.7 g kg^{-1} lower than B73×Mo17 and 0.1 g kg^{-1} lower than the average of the commercial checks. Incidence of stalk lodging was 4 percentage points less than B73×Mo17 but 18 percentage points higher than the average of the commercial hybrids. Root lodging was negligible in all tests.

Grain compositional characteristics were determined using samples obtained from performance tests conducted at one location during two seasons with three replications per test.