fore, concluded that the metal ions combined with the imidazole groups of histidyl residues also.

The intrinsic association constants (log K) for metal-carboxyl and metal-imidazole systems were calculated by using the equation of Scatchard[17].

$$K = \frac{n_{M^+}}{(n - n_{H^+} - n_{M^+})C_f}$$

where n_{H^+} and n_{M^+} are the active sites covered by hydrogen ions and metal ions respectively and n is the total number of such sites in the protein molecule. The values of n (total number of titratable carboxyl and imidazoles) and n_{H^+} were taken from literature[16]. For the computation of log K of imidazole combination, the n_{M^+} was obtained by subtracting the n_{M^+} at pH 6.50 from that at pH 5.50. The log K values for the metal-carboxyl and metal-imidazole combination are summarised in table 1.

Table 1 *Intrinsic association constant (log K) and free energy change (ΔF°) for Ni(II), Co(II), Pd(II) and Be(II) with ovalbumin by pH-metric method*

	Carboxyl		Imidazole	
	log K	ΔF° Kcal/mol	log K	ΔF° Kcal/mole
Ni(II)	2.39	−3.28	3.23	−4 433
Co(II)	2.23	−3 06	2.42	−3.256
Pd(II)	2.10	−2.88	3 09	−4.290
Be(II)	2.49	−3.345	3.60	−5 023

The standard free energy changes (ΔF°) of these interactions were calculated by the following relation:

$$\Delta F^\circ = -2.303\,RT \log K$$

where R is the gas constant and T the absolute temperature. The free energy changes are given in table 1.

A comparison of log K values and free energy changes revealed the following order of reactivity:

Be > Ni > Co > Pd (carboxyl system)

Be > Ni > Pd > Co (imidazole system)

However, the log K values exhibited a stronger combination with imidazole than with the carboxyl sites.

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GENETIC CONSTRUCTION OF A PROMISING PLANT TYPE IN INDIAN TURNIP RAPE (*BRASSICA CAMPESTRIS* L)

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FOR crop improvement, creation of new ideotypes is a major concern of geneticists and plant breeders. In oleiferous *Brassica*, yield is a complex character which is determined by a series of component characters. The most important ones are: the number of branches and pods per plant and seeds per pod. In addition, physiological and biochemical attributes like photosynthetic rate and its duration[1], drought and frost tolerance and resistance to pests and disease play an important role in the productivity of this crop.

In general, a plant type possessing a good and compact canopy[2] suitable for high population density[3], a large fruiting area with dense pod-setting on branches, pods filled with well-developed seeds, thick-dark green-medium size leaves[4] and higher biomass production[5] are the desired attributes for higher yield in rapeseed and mustard. In this paper, a new plant type evolved by crossing two different ecotypes of *B. campestris* (brown-sarson and yellow-sarson), and its special features and superiority over their parents and conventional plant are reported.

YID1, an indigenous yellow-sarson strain and 71/6809, an exotic brown-sarson cultivar, were chosen as parents. YID1 is characterized by tetralocular pods with 30–40 bold (5.2 g/1000 seeds) yellow seeds, medium height (125–150 cm), long main axis with comparatively sparse pod setting (table 1). Semi-dwarf stature (90–130 cm), more secondary branches with higher pod density and 14–20 small brown seeds (2.6 g/1000 seeds) are the special features of 71/6809 (table 1). To combine seed number, colour and seed size of yellow-sarson and pod density and branching of brown sarson, crosses were made in 1979–80. The F_1 was back-crossed to YID1 (as male) in 1980–81. BC_1 generation was raised in 1981–82. The plants produced tetralocular pods with dull-yellow seeds. The seeds obtained by selfing the plants, were sown in 1982–83 in 2 rows of 3 m length. Recombinant plants with more branches than YID1, very high pod density and tetralocular pods with yellow seeds were

Figure 1. Comparison of pod setting on the main axis of the new plant type (centre) and female (right) and male (left) parents.

Table 1 *Data on yield components, yield and oil content in the new plant type and its parents.*

	YID 1	New plant type (71/6809 × YID 1)	71/6809
Plant height (cm)	135	119	122
Primary branches per plant	7.7	11.1	8.4
Secondary branches per plant	2.3	10.6	19.5
Pods on primary branch	27.2	47.3	47.3
Pods on secondary branch	2.8	10.0	26.6
Pods per plant	215	536	932
Pods density per cm	0.83	1.3	1.7
Seeds per pod	36	32	19
Seeds per plant (pods × seeds/pod)	07740	17152	17708
1000 seed weight (g)	5.2	4.0	2.6
Estimated yield per plant (g)*	40.2	68.6	46.0
Actual yield per plant (g)	40	50	40
Oil content (%)	45.5	45.6	42.8

$$^{*}\text{Estimated seed yield} = \frac{\text{Total seeds/plant} \times 1000\ \text{seed wt.}}{1000}$$

located in this generation. These plants were sibbed by hand emasculation and pollination and the seed thus obtained was sown in 1983–84 in an unreplicated 3 × 3 m plot with 60 cm row spacing and 10 cm plant spacings. The crop received 40 kg each of N, P and K per hectare and one post-sowing irrigation. The data on important components of yield (listed in table 1) were collected on 10 random plants of the recombinant as well as parents for comparison.

The data on different characters given in table 1 show the superiority of new ideotype over the parent one, YID1 in respect of plant height, number of primary and secondary branches per plant, pods on branches as well as on the whole plant (figure 1), seeds per plant and seed yield per plant. It also shows significant superiority over the other parent (71/6809) in respect of seeds per pod, seed weight and oil content. It surpassed both the parents in respect of primary branch per plant single plant seed yield, and production of compact and erect branches. Dark green thick medium size leaves, semi-dwarf plant with stiffer, non-lodging and non-breaking stem are the other features of economic importance of this genotype.

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SOME ASPECTS OF THE DALY GAP

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A Daly Gap exists where the volume of intermediate eruptives is less than the volumes of more basic and more acidic eruptives. It is sometimes argued that the presence of a Daly Gap in a basalt-rhyolite volcanic province argues against crystal fractionation models being applicable to the petrogenesis of the eruptives[1,2]. It will be argued here that the Daly Gap in many basalt-rhyolite volcanic provinces may not necessarily argue against crystal fractionation models being applicable.

In the following discussion we will assume that crystal fractionation of mafic melts, resulting in trachytic and rhyolitic eruptives, occurred in basalt-rhyolite provinces. Complicating factors such as the volumes of basic, intermediate and acidic rocks forming intrusions, the different viscosities of melts of differing compositions and the definitions of the terms basic, intermediate and acidic are ignored here as they may unnecessarily complicate the simplistic model that is being examined.

Mafic eruptives such as alkali basalts, transitional basalts and tholeiites are generated in relatively large volumes through the partial melting of mantle material. Such large volumes constitute a factor in support of the eruption of large volumes of mafic eruptives.

A factor which decreases the volume of mafic eruptives is the differentiation of some mafic melts to form trachytic and rhyolitic melts through crystal fractionation. It is well known geologically, however, that in most basalt-rhyolite volcanic provinces mafic eruptives are far more voluminous than either trachytic or rhyolitic eruptives. For the Tertiary Focal Peak Shield Volcano in southeastern Queensland and northeastern New South Wales, Australia, the ratio of the volumes of acidic to mafic eruptives is estimated to be between 1 to 10 and 1 to 40 while trachytic eruptives probably account for less than one percent of the volcanic pile[3]. Consequently, the factor of crystal fractionation probably favours the formation and eruption of relatively minor volumes of trachytic eruptives. A factor against the frequency of eruption of trachytic melts is, however, the possibility of additional crystal fractionation giving rise to rhyolitic melts.

The factor of crystal fractionation should, at first sight, be even less in favour of the eruption of rhyolitic