General Introduction

The *Brassica* crops occupy a place of predominance in the oil seed map of India. They are the second largest source of edible oil next only to ground nut in our country. Their contribution to national oil seed busket is around 24 percent covering nearly 21 percent of the total oil seed acreage. (Agarwal etal, 1998)

Although rape seed mustard varieties are grown in 21 states and union territories, about 90 percent of production and 89 percent of area is concerned in six major producing states. These are Uttarpradesh, Rajasthan, Madhyapradesh, Haryana, Punjanb and Assam. The remaining states including West Bengal account for about 10 percent production (George et al., 1990) According to Sengupta and Mukhopadhya (1982) rape seed mustared grown in the state of West Bengal occupies 48 percent of total area.

India has 3 percent of world's land surface with 15 percent of the world's populations, creating tremendous pressure on land. This being further aggregated due to growth of population. According to 1971 census figures density of population per square kilometer was 177 but within a decade it has gone up to 221. The projection is that by 2000 AD. India's population will reach 1000 million from the 684 million in 1987 (Majumder 1987).

The crisis caused by population growth can never be overcome unless improvement in crop production occur. It is found that rate of growth of population is 2.24% per annum and the rate of growth of crop production is slightly above it. Improvements in yield are brought about through improved high yielding seeds, use of chemical feritlizers, irrigation, plant protection, better management and extension efforts (Choudhury and Sinha, 1998; Sharma and Sarala, 1998). But the spectacular gain in the field of crop production may be nullified by the population growth.

A recent study of FAO referring to 90 developing countries showed that in 2000 A.D., 72% of additional crop will have to come from yield, easy increase and more intensive cropping.

During the last few decades a number of varieties of agricultural crops have been released. These varieties revolutionise agricultural production. It is quite apparent that coverage under existing high yielding varieties is still unsatisfactory. One of the reasons is the limited adaptability of the varieties.

We do not yet have a range of cultivators to suit all environmental conditions prevailing in India. Thus there is necessity to study adaptibility of genetically different cultivars to unexplored region with a view to selecting crops of shorter duration because crops of shorter duration enables multiple cropping to be introduced even under rainfed condition thus increasing production per unit area. Such is the situation with oleiferous brassicas yielding mustard oil of commerce. Like all other agricultural crops in our country, short duration of *Brassica* varieties may give a boost to other crops such as rice, wheat, potato and other vegetable cultivation in the Rabi season in India.

The name rape seed mustard indicates a mixture of three species *Brassica campestris, B. juncea* and *B. nigra,* commonly referred to as rai (raya or laha), sarson (yelow sarson and brown sarson) toria (yellow toria and brown torialahi or Maghi laha), Banarasi rai or asli rai and pahadi rai. Among all these rapeseed mustard varieties yellow sarson has the highest oil content. The crop is grown mainly in the rabi season from September-October to February-March in our country. Owing to their nature and capacity to thrive well under poor conditions of moisture and fertility of soil, they are generally raised as rainfed, without fertilizar, resulting in low average yield. (Chanplivier, 1987; Banchereau, 1997).

As Darjeeling District of North Bengal also belongs to rainfed areas, there is enough scope to study the productivity of different varieties of rapeseed mustard specially *B. campestris* and *B. juncea* which are expected to the acclimatized in the region.

Recently a large number of varieties of mustard has been released by the Govt. of India, for their commercial utilisation through out India. It has been observed that a number of varieties are being utilised in southern part of West Bengal. But as per priliminary survey and local information, cultivation in North Bengal is limited only to yellow sarson type such as *B.campestris* YSB-9 and *B. campestris* NC-1, and sarson rai type, i.e., *B.juncea* B-85. The information also suggests that *B.campestris* YSB-9 is the best for the Raiganj range covering Malda and west Dinajpur district in West Bengal. Similarly *B. juncea* B-85 is suitable for the Jalpaiguri district West Bengal. However, *B. campestris* NC-1 is generally recommended for more oil content in the Jalpaiguri range.

Thus there is enough, scope to study the adaptibility of different varieties released by the Govt. of India to evaluate the relative performance of the plant

with special reference to their productivity in Darjeeling condition in West Bengal and to select the best one suitable for its commercial utilisation in the plains of the region.

The yield and productivity of rape seed mustard has also been subjected to wide fluctuation over the years depending upon the rainfall and moisture in the soil at the time of sowing. The production has also been affected by the attack of key pest *Lipaphis erysimi* Kalt. an aphid. It has been reported that the recent trend to productivity is around 800 kg/ ha at national level and 850kg/ha at state level against the attainable highest yield of 2405kg/ha obtained in France. The major reason for realising low yield in India vis a vis West Bengal is due to attack of the aphid. Bakhetia (1983) estimated that mean loss in yield of Brassica crops due to attack of aphids varies from 35.4 to 73% under different agro-ecological situations of the country.

The chemical control measures recommended so far have not been successful because of the fact that these highly toxic insecticides also kill all the parasites and predators, thereby upsetting the balance of natural ecosystem. Honey bees are the chief pollinators of this group of crops. These are also affected by the application of insecticides. This has in recent years led greater emphasis on the evaluation and selection of aphid resistant varieties of *Brassica* species.

Thus an attempt has been made to study infestation of *L. erysimi* Kalt on different cultivars of *Brassica* grown in different environmental condition of N.B.U. campus, 26°45', 86°25', and South Bengal, Berhampur-Seed Research Station 24°50'20" N 88°46' E to understand the nature of susceptibility or resistance to aphid attack of different cultivars of *Brassica* under various environmental conditions and to select better cultivar of early flowering type at the same time much resistant to aphid.

Rapeseed draws its economic importance from the substantial amount of fatty oils present in its seeds with 95 percent of the rapeseed produced in India being used for oil extractions. The cake left after oil extraction, known as rapessed meal (RSM), is a rich source of proteins (30035 percent) and is used as animal feed and manure (Grag and Thukral, 1995), Besides, rapeseed may serve as an inportant raw material for certain chemicals and pharmaceuticals. Mustard

oil is a rich source of sterols which find important applications in the synthesis of steroidal drugs. It therefore becomes inevitable to orient the state of research in this relatively less explored albeit economically important field of study.

The nutritive value of RSM is constrained by the presence of antinutritional factor such as glucosinolate. More than 100 glucosinolates have been identified so far which vary in content in the green leaves as well as in the seeds. Although, these compounds are apparently non toxic, the enzymes form microbial flora inhabiting the gastrointestinal tract render them toxic by hydrolysis. The hydrolytic products of glucosinolats such as isothiocynate thioxazolidones, nitriles and thiocyanates are toxic. These have drastic effect on thyroid gland, adrenal gland, kidney and liver (Youngs and Welter 1967). On the other hand such glucosinolate in leaf assist resistance to aphid-*Lipaphis erysimi* Kalt. The observation that higher concentration of allyl-iso thiocynate produced from glucosinolate after enzyme hydrolysis is responsible for aphid resistance was noted by Malik (1981). According to Malik (1981) the allyliisothicynate acts as repellant to aphid and thereby imposes resistance to the host plant. According to Teotia and Lal (1970) this mechanism of resistance may be termed as non preference mechanism. The enzyme myrosinase which hydrolise glucosinolate is generally present within the leaf tissue itself and is generally released due to mechanical damage of the tissue caused by aphid infestation.

Though glucosinolates have long been known as antinutritional and goitre inducing compounds but recently some of degraded products of them have been observed to show anticancer, (Massba et al., 1989; Graham and Mullin 1978; Bogaard et al, 1994; Heaney and Fenwichk 1995) antimutagenic (Jongen et al, 1986) and antioxidant activity to induce free radical scavenging properties of cell (Plumb et al 1996).

Thus after selecting cultivar or *Brassica* suitable for its commercial utilisation in the climate of Darjeeling District the chemical examinations of the cultivar of *Brassica* species with special reference to phytosterol and glucosinolate is very much needed for their identification. This will be helpful in connection with purposeful utilisation of isolated natural products in future.

In order to understand glucosinolate content in plant, an easy method for quntitative determination of glucosinolate is very much needed. Uptodate a number of methods have been reported. The methods are based on the

estimation of glucose released due to enzyme hydrolysis (Heaney and Fenwick, 1981), thymol test (Brezezinsk and Mendelewski 1984). Pd-glucosinolate complex (Moller et at, 1985) X-ray fluorescence spectroscopy (Evens et al 1989) GC-MS. (Uda et al, 1982) flash chromato graphy (Peterka and Fenwick, 1988) thermospray liquid chromatography (Hanson et al, 1988) isotachophoresis (Klein 1981) and HPLC (Youngs and Welter 1967) are also available. But Sorensen (1985) pointed out that it was necessary to use all the methods based on different glucosinolates as none of them gives reliable results for all glucosinolates.

Moreover, it has been the experience that those procedures involves freeze drying system, some amount of glucosinolate could escape from the tubes. This "evaporation effect" affects yield of different glucosinolates to different extent.

It is therefore necessary to standardise an easy and rapid colorimetric method for quantitative determination of glucosinolate in the plant part avoiding sophisticated instruments which are generally not available in any laboratory.

The study on seed germination behaviour of any economically important plant is very essential specially when raising of large number of seedlings is necessary in connection with its commercial cultivation. Decline in percentage of seed germination has been observed during storage of seeds in the environmental condition of Darjeeling district, where high humidity is very much prevalent. It reaches non-viability after several years of storage. Thus much of stored seeds are becoming useless after a certain period of time. It has been the experience that some of the chemicals like vitamin have the ability to stimulate germination seed having low germination capacity due to storage.

Thus attempt has been made to screen out certian chemicals which may be helpful to stimulate germination of seeds and specially those seeds which are becoming useless during storage. Very recently Yadav et al (1996) observed that early sowing of *Brassica* resulted in significantly higher seed production, oil and protein content as compared to those of later sowing. This was supported by Nanda et al (1996) who pointed out that flowering time had significant effect on the rate of dry matter accumulation, duration of filling period and total percentage of oil content in *Brassica* seeds. Growth performance of *B. napus* subsp. *oleifera* var *napus* was observed to vary according to change in date of

sowing of seeds of the plant in Himachal Pradesh (Rameshwar et al 1996).

As the variation of climatic condition from one sowing season to other differ, so it is very necessary to determine the optimum sowing time of the cultivar of *Brassica selected* for Darjeeling condition. This will ultimately become helpful for better understanding of its adaptibility in the ecological conditions in the plains of Darjeeling district from productivity point of view.

Again productivity is very much dependent on growth and development of plant (Jensen et al 1997; Gommel vind et al 1996; Nanda et al 1996) Several authors worked on that there was a close interaction among irrigation, plant density and nitrogen fertilizer for any cultivarof *Brassica* having commercial potentiality. (Rama et al, 1991; Ali and Zaman, 1996; Hocky et al, 1997; Thakuria and Gogol 1996; Kakati and Kalita 1996).

Thus much emphasis has been given on studying the effect of irrigation and nitrogen on growth and productivity of the cultivar of *Brassica* suitable for Darjeeling condition.

As intercropping of various plants is considered benifical due to economic advantage, this is very much encouraged in Agricultural practice now a days. But allelopathy or in other wards chemical interaction between plant to plant is a common phenomenon in nature (Molish 1937; Calla, 1963; Mc Calla and Duley, 1949), This phenomenon, should be taken into consideration during selection of species of Brassica for Darjeeling district.

Allelopathic effect of different species of *Brassica* on other plants has been observed by various authors (Bell and Muller, 1973; Muller, 1969). But no information is available in connection with isolation and characterisation of chemical inhibitor, Recently Brown and Morra (1996) claimed that in *B.napus* cv *Humas,* the tissue containing glucosinolates produced volatile chemicals that inhibited germination of seeds of lettuce. They also confirmed the presence of additional allelochemical specially in the leaf and stem tissue. But proper identification of the chemical inhibitor was not reported. In Darjeeling district the season of cultivation of wheat concides with that of mustard. So there is a possibility to grow wheat in intercropping system. Thus an attempt has been made to observe the allelopathic effect of mustard on wheat for its utilisation in intercropping system in the ecological condition of Darjeeling district, North Bengal.

With this background investigation has been carried out with the objective to select a cultivar of *Brassica* out of a number of cultivars available on the basis of their growth performance and adaptibility to Darjeeling condition and to study the selected cultivar from ecophysiological and chemical point of view so that the knowledge derived out of it will be of much help for purposeful utilisation of it to boost up the economy of the region.