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Baculovirus biopesticides - an ecofriendly approach for insect-pest management

DINESH RAI • GEETA SHARMA • AK PANDEY
Received: March 5, 2013; Revised: April 28, 2013; Accepted: May 10, 2013

ABSTRACT Chemical pest control agents, though extensively used in all countries of the world, have been widely regarded as ecologically unacceptable. Therefore, there is the increased social pressure to replace them gradually with biopesticides which are safe to human and non-target organisms. At present, the world market for microbial pesticides is in excess of US $ 125 million per annum which is still less than 1 % of the total global market for agrochemical crop protection of $ 20-25 billion. Baculoviruses pesticides are ideal tools in integrated pest management programs as they are usually highly specific to their host insects; thus, they do not affect other arthropods including pest predators and parasitoids. Effective public extension services and farmer education toward application of biopesticides are much needed to expand the use of these products worldwide.

KEYWORDS Baculovirus, biopesticides, nuclear polyhedrosis virus, Granulovirus, IPM

INTRODUCTION Biopesticide is a formulation made from naturally occurring substances that controls pests by non toxic mechanisms in eco-friendly manner, hence gaining importance all over the world. Biopesticides may be derived from animals (e.g. nematodes), plants (Chrysanthemum, Azadirachta) and micro - organisms (e.g. Bacillus thuringiensis, Trichoderma sp., Nucleopolyhedrosis virus), and include living organisms (natural enemies), their products (phytochemicals, microbial products) or byproducts (semiochemicals) which can be used for the management of pests injurious (Mazid et al. 2011, Sharma and Malik 2012). The time-tested indigenous technical knowledge (ITK) of using natural materials for the control of pests has been very effective; but due to the introduction and uses of chemical pesticides many ITKs have been forgotten. Biopesticides pose less threat to the environment and human health. They are generally less toxic than chemical pesticides, often target specific, have little or no residual effects and have acceptability for use in organic farming.

Biopesticides fall into three major categories: plant-incorporated protectants (PIPs), biochemical, and microbial pesticides. Microbial pesticides consist of microorganisms (bacteria, fungi, viruses, or protozoans) as the active-ingredient, and they have been successfully used in controlling insect pests. Though, each microbial active-ingredient is relatively specific for its target pest, microbial pesticides can control many different kinds of pests. One of the most widely used microbial pesticides is Bacillus thuringiensis, popularly known as Bt. The bacterium produces crystalline proteins and specifically kills one or a few related insect species. Binding of the Bt crystalline protein to insect gut receptor determines the target insect species. Biochemical pesticides are naturally occurring substances that control pests by non-toxic mechanisms. Such examples are insect sex-pheromones (that interfere with their mating and population build-up), various scented extracts (that attract insect pests to traps) and some vegetable oils (Singh et al. 2012). Plant-incorporated protectants include substances that are produced naturally on genetic modification of plants. Such examples are incorporation of Bt gene, protease inhibitor, lectins, chitinase etc. into the plant genome so that the transgenic plant synthesizes its own...
Morphological variability pattern of Sri Lankan weedy rice - an ecological appraisal

APT SUBHASHI • DISNA RATNASEKERA • UIP PERERA

ABSTRACT
Weedy rice (Oryza sativa L. f. spontanea) is one of the most widespread and problematic weeds in rice ecosystems with diverse characteristics. The study was carried out to determine the morphological variation pattern of the weedy rice populations in relation to agro-ecology of Sri Lanka. Twelve weedy rice populations collected from infested locations in Ampara, Matara and Kurunegala districts representing dry, wet and intermediate zones were evaluated in a common garden for ten quantitative traits to estimate the phenotypic diversity. The diversity level of weedy rice populations was high as revealed by Shannon-Weaver Index. Dry zone of Sri Lanka has more diversity hotspots of weedy rice. Analysis of variance revealed significant differences (p< 0.05) among populations than within populations implying the presence of substantial amount of genetic variability. Seed shattering percentage exhibited the highest variation while thousand seed weight showed the lowest variation explained by coefficient variation (CV). Principal component analysis indicated that the first two components accounted for 72.3% of the total variation and number of tillers, plant height (cm) at both seedling and heading stages, panicle length (cm), seed shattering % and the thousand seed weight (g) were the major determinants of genetic diversity in the weedy rice collection. Clustering identified two clusters and they were not associated with the geographical distribution of the populations. All the analysis based on plant morphology suggested that weedy rice in Sri Lanka has great variability but no association with ecology of the country.

KEYWORDS
Oryza sativa f. spontanea, diversity, genetic resources, coefficient variation, PCA

INTRODUCTION
Rice (Oryza sativa L.) is one of the major staple crops in the world and is particularly important in Asia, where approximately 90% of world’s rice is produced and consumed (Khush 2004, Zeigler and Barclay 2008). It is the staple food of Sri Lankans, providing 45% of total calorie requirement and 40% of total protein requirement of an average Sri Lankan diet (Census and Statistics 2007). It occupies 17.6% (0.7 million ha) of the total agricultural land area in the island (Agstat 2008), contributing 14.2% to total agricultural GDP of the island (Census and Statistics 2009, Central Bank 2009). Rice cultivation is distributed in almost all agro-ecological zones except for elevations above 2000m (Gunatilaka and Somasiri 1995). According to the spatial distribution of rainfall, Sri Lanka has traditionally been generalized into three climatic zones in terms of Wet Zone (rainfall >2500mm), Dry zone (rainfall <1750mm) and Intermediate zone (between 1750 to 2500 mm) (Punyawardena et al. 2003). The year is divided into two seasons coinciding with the monsoon rain as “Maha” (northeast monsoon falls during December to February) and “Yala” (southwest monsoon falls during May to September) and rice lands are cultivated in these two distinct seasons. Cultivars used in ancient time, were entirely traditional and most cultivars were tall with droopy leaves which may have facilitated the direct-seeded rice crop to overcome heavy weed infestation with trivial yield (Senadhira et al. 1980). The current rice production model with a few high-yielding modern varieties over a massive area has significantly improved the food security in the country, but has...
Standardization of recipe for the preparation of dried wild pomegranate (anardana)-long gourd appetizer

MM BHAT • NS THAKUR • RAKESH SHARMA
Received: Jan 05, 2013; Revised: May 15, 2013; Accepted: June 10, 2013

ABSTRACT Studies were undertaken to prepare a palatable and nutritious appetizer from dried wild pomegranate in combination with long gourd juice. Different combinations of dried pomegranate powder (6-12g), long gourd juice (13-19g) with herbs and spices were tried for the standardization of product. Out of 7 recipes, the best recipe (R4) consisting of 9g wild pomegranate powder, 16g long gourd juice, 0.4g mint leaves powder, 0.4g ginger powder, 0.5g common salt, 1.5g black salt powder, 41.50g sugar powder, 0.25g cumin powder, 0.1g cardamom powder, 0.4g black pepper powder and 0.02g carmozine was standardized for the preparation of appetizers from freshly dried as well as 6 months stored arils. The appetizers prepared from the best recipe had appealing colour, body, flavour and good sugar: acid blend. The quality of the appetizers prepared from 6 months stored arils was comparable with that of freshly prepared; however negligible changes in sensory and chemical characteristics were found. The sale price for 700 ml bottle of appetizer was worked out to be very low as compared to the market price of any fruit squash available in the market.

KEY WORDS Wild pomegranate, dried arils, appetizer, long gourd, sensory evaluation

INTRODUCTION Wild pomegranate (Punica granatum L.) is one of the important wild fruit with great economic importance because of its high acidic nature. It is widely distributed in drier and sub marginal land of mid hill region of outer Himalaya at an elevation of 900 to 1800 m above mean sea level. In India, it grows in the hilly slopes of Jammu and Kashmir, Himachal Pradesh and Uttarakhand. However, it is found growing wild in some parts of Solan, Sirmour, Mandi, Shimla, Kullu, Bilaspur and Chamba districts of Himachal Pradesh (Bhrot 1998).

The fruit is laxative, diuretic and allays thirst, its arils are used for curing vomiting, biliousness, sore throat, sore eye, brain diseases, spleen complaints, chest troubles, scabies, bronchitis, ear ache, liver and kidney disorders (Saxena et al. 1987). It also contains good amount of minerals like phosphorus, calcium, potassium and iron (Parmar and Kaushal 1982). Wild pomegranate is too acidic which cannot be used for table purpose but can be a good souring agent for use in chutneys, curries and other culinary preparations in dried form.

On the other hand, long gourd has also great therapeutical value. It is cardio tonic, laxative, diuretic, tonic to liver, antipyretic and wholesome to fetus (Kirtikar and Basu 1991, Rumezan et al. 2006).

Further, spice based beverages are gaining importance in the market for their consistency of flavour, aroma and stability in storage and presence of natural antioxidants which have carminative properties and aid digestion through stimulation of appetite (Griffin 1992, Sharma et al. 2002). Keeping this in view, the present investigation was undertaken to standardize palatable and acceptable wild pomegranate-long gourd appetizer.

MATERIALS AND METHODS
Pre-treatment and drying of arils
Wild pomegranate fruits were procured from Narag area of District Sirmour (HP) at proper maturity. The fruits were washed and the arils were extracted manually.
Pollination studies in some promising plum cultivars under mid hills of Uttarakhand

ABDUL KAREEM • DC DIMRI
Received: March 05, 2013; Revised: April 23, 2013; Accepted: April 28, 2013

ABSTRACT
Six plum cultivars were studied for their anthesis and pollen germination studies under mid hills of Uttarakhand. The opening of flowers (anthesis) commenced after 8 hrs, reached a peak between 12 hrs and 14 hrs, thereafter, the anthesis declined reaching to a minimum at 18 hrs. In different plum cultivars, anther dehiscence started from 10 hrs and continued up to 16 hrs and the maximum extent of anther dehiscence, i.e. peak time of anther dehiscence, was recorded at 14 hrs. So it can be logically concluded that the best time for collecting pollens was in between 12 to 14 hours of a day as there is a maximum anther dehiscence during this period. All the plum cultivars produced viable pollen with fairly good germination capability; even then most of the plum cultivars are self-unfruitful, indicating that there might be some other factors which are responsible for their unfruitfulness. This needs in depth study to identify the exact mechanism involve in unfruitfulness of the plum cultivars.

KEYWORDS
Chilling, anthesis, pollen dehiscence, receptivity, pollen germination, pollen morphology, self-incompatibility

INTRODUCTION
Plum belongs to the genus Prunus of the sub-family Prunoideae and the family Rosaceae. Cultivated plums and Japanese plums (Prunus salicina Lindl.). Most of the Japanese cultivars are self-unfruitful and require cross-pollination to set satisfactory crop, but occasionally some cultivars like Santa Rosa and Methley set good crop with their own pollen and behave as a self-fruitful one (Carvalho et al. 1992). The unfruitfulness in plum cultivars is mainly due to unusual flower structure, poor pollen viability and germination and incomplete pollen tube growth, leading to premature and delayed pollination (Thompson and Liu 1973). So to understand its pollination behaviour and to know the mechanism involved in unfruitfulness in plum cultivars, it was considered desirable to undertake the present study.

MATERIALS AND METHODS
The present experiment was carried out at Horticultural Research Block of G.B. Pant University of Agriculture and Technology, Hill Campus, Ranichauri, Tehri Garhwal (Uttarakhand). The Research Block is situated at an elevation of 1950 m amsl, between 30°15' North latitude and 78°02' East longitude. The studies were conducted on 15-year old plum cultivars, viz. Methley, Santa Rosa, New Plum, First Plum, Ramgarh Maynard and Black Chamba. The trees were trained in a modified central leader system and uniform orchard management practices were followed. The experiment was laid out in Randomized Block Design (RBD) with four replications. One tree under each replication was used as unit per treatment. Observations on the following parameters were recorded periodically, to undertake studies on anthesis and pollen behaviour.

Time of anthesis
For recording the time of anthesis, two branches having uniform buds were tagged in four different directions of the tree in each cultivar. Each day the number of flowers opened, were recorded at an interval of 2 hrs starting from 8 hrs and continued till 18 hrs. The time of the
Effect of mulching on strawberry production under mid hill conditions of Uttarakhand

NN Patil • VK Rao • DC Dimri

ABSTRACT The field experiment conducted on strawberry (Fragaria x ananassa Duch.) cv. Chandler at Research Block of Department of Horticulture, College of Forestry and Hill Agriculture, GB Pant University of Agriculture and Technology, Hill Campus, Ranichauri, Tehri Garhwal, Uttarakhand during 2010-11 to study the effects of different mulching material on plant growth, yield and quality of strawberry cv. Chandler under mid hill condition. All the plant growth, yield and quality characters were superior with black polyethylene mulch followed by transparent polythene, paddy straw while, plants without mulch (control) resulted poor growth and yield.

KEYWORDS Strawberry, mulching, organic and inorganic mulches, growth, fruit yield

INTRODUCTION The cultivated strawberry (Fragaria x ananassa Duch.) is one of the important refreshing and delicious soft fruit of the world. In India it is cultivated to a limited extent in Uttar Pradesh, Himachal Pradesh, Madhya Pradesh, Uttarakhand, Maharashtra, Karnataka, Punjab and Haryana. In Uttarakhand, its area is confined to Udham Singh Nagar, Dehradun, and Nainital districts. Its cultivation especially in hilly areas of India has recently receiving great momentum with the large business houses establishing a number of agro-based outlets. There is a tremendous scope for its cultivation near cities and canning units where the fruits can be utilized immediately after harvest as strawberry is very perishable in nature.

The irrigated mid-hill region of Uttarakhand is well suited for strawberry and runner production. In the state, water is the single factor, which directly influences the yield of strawberry. Mulches also promote crop development, early harvest and increase yields. Mulching is commonly practiced in strawberry cultivation to keep the fruit clean and protect from its contact with soil to avoid fruit rot. It is amongst the few fruit crops, which give quicker and very high returns per unit area on the capital investments, as the crop is ready for harvesting within six months of planting and now due to several technological advances in its cultivation like introduction of day neutral varieties and protected cultivation. Strawberries remain available as fresh throughout the year (Sharma 2002). Therefore, considering the importance of different mulching in various crops, the present investigation was carried out to study the effect of different mulching material on growth, yield and quality of strawberry cv. Chandler.

MATERIALS AND METHODS The field experiment was conducted on strawberry (Fragaria x ananassa Duch.) cv. Chandler at Research Block of Department of Horticulture, College of Forestry and Hill Agriculture, GB Pant University of Agriculture and Technology, Hill Campus, Ranichauri, Tehri Garhwal, Uttarakhand during 2010-11. The experiment was laid out in randomized block design with three replications. There were total eight treatment of mulching materials viz., inorganic mulches viz. black polythene, transparent polythene, silver colour polythene, paper cutting waste, paddy straw, pine needles and dry leaves of Eupatorium adenophorum (Kalabansa). The strawberry runners of uniform size were transplanted on raised beds of 3.0 m × 1.2 m.
Impact of front line demonstration on replacement of indigenous cultivar with improved variety of barnyard millet

AK SHARMA • SUCHETA SINGH
Received: Jan 05, 2013; Revised: May 28, 2013; Accepted: June 10, 2013

ABSTRACT A study was conducted in villages of Pauri Garhwal district where demonstration on PRJ-1, a variety of barnyard millet, developed by GB Pant University of Agriculture and Technology, Hill Campus, Ranichauri and released in 2003 from SVRC (State Variety Release Committee) for cultivation in the Uttarakhand hills, was done. Exploratory research design was used for the study. In total 100 demonstrations were conducted in three years. Techno effectiveness was found to be very high, the variety was thus accepted by most of the farmers. Hence, it can be concluded that the seed production of improved variety of PRJ 1 of barnyard millet should be produced and popularized in the area for not only the sustainable production but for an economic and nutritional boon in the hill areas. Because, lesser known cereals (millets) are suitable for hilly conditions with minimum eternal inputs in a fragile ecosystem.

KEYWORDS Front line demonstrations, barnyard millet, variety replacement

INTRODUCTION Traditional farming is a sustainable way of life for livelihood in North-west Himalayan region. The lesser known cereals (barnyard millet, finger millet and foxtail millet) suitable for hilly conditions with minimum input are grown in fragile ecosystem. With bare minimum requirements and devoid of irrigation facilities, small and fragmented holdings are proclivities of common hill farmers. Moreover, green revolution technologies have hardly paid any impact in production/ productivity of regions. Local or indigenous varieties are being utilized in prevailing rainfed farming systems of Uttarakhand. Small millets, viz. barnyard millet, finger millet and foxtail millet are the main component of cropping sequence of the district. Barnyard millet is the fourth important crop of the district and covers 17925 ha area with 22767 tonne production and 12.70 q/ha productivity.

Barnyard millet is an old and adaptive crop of Uttarakhand and is commonly known as Jhangora or madira in the region. The grains of barnyard millets are eaten in various forms like rice preparation, puddings and during the fasting time. It is considered to be the important ingredient in baby and infant food preparations. Various traditional recipes are prepared in Garhwal region including famous old age preparation in food “Arse” from flour of barnyard millet. It is sometimes used as kheer in important religious occasions in Garhwal region.

A unique and old age traditional system of cropping pattern is followed in remote and inaccessible villages wherein, selected plots will be used in cultivation of barnyard millet and another for finger millet. Barnyard millet - wheat - finger millet - fallow is the most common two years crop rotation practices in the district. This system, called as Sar facilitates grazing of the animal in one check during winters. In whole, low intensive cropping system, resource poor farmers and rainfed situation lead to very low production as well as productivity per unit area/input. This dependency on natural factors of production restricts the growers to get the handsome returns of their produce. Keeping in view the inherent problems of district viz. fragmented or absentee land holdings, low productivity...
Seed germination and seedling growth of wheat and barley on influenced by the allelopathic effect of walnut (Juglans regia L.) leaf extracts under mid hills of Uttarakhand agri-silvi system

BIRENDBRA PRASAD • ABHISHEK BAHUGUNA • RAM JI MAURYA • SANDHYA BAHUGUNA
Received: April 2, 2013; Revised: May 28, 2013; Accepted: June 10, 2013

ABSTRACT A laboratory experiment was conducted to observe the effect of Juglans regia L. leaf extracts on germination and subsequent seedling growth of wheat (cv.VL-907) and barley (cv.PRB-502) under West Himalayan agri-silvi system. Eleven treatments comprised of distilled water (Control =0 %), 10 %, 20 %, 30 %, 40 %, 50 %, 60 %, 70 %, 80 %, 90 % and 100 % concentration of leaf extracts were employed. The effect of aqueous extracts was found inhibitive indicating a direct proportional relationship with concentration dependent manner on seed germination and subsequent seedling growth of wheat. Invariably there was a decrease in root, shoot as well as seedling length, fresh and dry weight of seedling and vigour index I and II with increasing walnut leaf extracts concentration on wheat. However, barley seed showed a considerable resistance against walnut leaf extract and no significant reduction and trends was observed for seed germination and subsequent seedling growth i.e. fresh and dry weight, vigour index I and II for different concentration of leaf extracts.

KEYWORDS Allelopathy, walnut leaf, germination, wheat, barley

INTRODUCTION

Allelopathy is defined as the direct or indirect harmful or beneficial effects of one plant on another through the production of chemical compounds that escape into the environment, Rice (1984). Allelochemicals are present in many types of plants and are released into the rhizosphere by a variety of mechanism, including decomposition of residues, volatilizations and root exudation. These chemicals are known to affect germination, growth, development, distribution and reproduction of a number of plant species, Inderjit and Malik (2002). However, the effect of these chemicals on other plants are known to be dependent principally upon the concentration as well as in combination, in which one or more of the substances are released into the environment.

The inhibitory effect of walnut on associated plant species is one of the oldest examples of allelopathy, which produce a non-toxic colorless chemical called hydrojuglone. Hydrojuglone is found in leaves, stem, fruit hulls, inner bark and roots. When exposed to the air or soil compounds, hydrojuglone is oxidized into the allelochemical juglone, which is highly toxic, Bertin et al. (2003). Rain washes juglone from the leaves and carries it into the soil. Thus, neighbouring plants of the walnut are affected by absorbing juglone through their roots, Rietveld
Correlation and path coefficient analysis of yield and yield components of Indian mustard (Brassica juncea L.)

SHWETA

Received: Sep 16, 2012, Revised: Mar 25, 2013, Accepted: Apr 15, 2013

ABSTRACT Character association among seed yield and its component traits was studied through phenotypic correlation coefficients and path analysis. Seed yield exhibited positive and significant association with plant height, number of primary branches per plant, number of secondary branches per plant, siliquae per plant, seeds per siliqua and 1000 seed weight. Path analysis revealed that characters viz., seed yield exhibited The highest positive direct effect on siliquae per plant followed by 1000 seed weight, seeds per siliqua, number of primary branches per plant, days to 50% flowering, days to maturity and plant height. Considering both, the correlation coefficients and path coefficients together, siliquae per plant, 1000 seed weight, seeds per siliqua, number of primary branches per plant and plant height emerged as important components of seed yield which should be given due importance during indirect selection criteria.

KEYWORDS Correlation, path analysis, Indian mustard

Indian mustard [Brassica juncea (L.) Czern and Coss] is an important rabi oilseed crop. Oleiferous Brassicas, collectively known as rapeseed-mustard are important oilseed crops of India. Among the four oleiferous Brassica species, major area is under Brassica juncea which contributes 80% of the total rapeseed-mustard production in the country.

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The success of any breeding programme in general and improvement of specific trait through selection in particular, totally depends upon the variability present in the available germplasm of a particular crop. Main thrust in any crop improvement programme is to enhance yield. As an established fact, yield is a complex trait and is dependent on many other ancillary characters which are mostly inherited quantitatively. The characters which have high and positive correlation with yield can be used in the indirect selection for yield and as an alternate mode of selection for yield improvement.

Use of simple correlation analysis could not fully explain the relationship among the characters. Therefore, the path coefficient analysis has been used by many researchers for a more and complete determination of impact of independent variable on dependent one. The path coefficient analysis helps the breeders) to explain direct and indirect effects and hence has extensively been used in breeding work in different crop species by various researchers (Green 1980, Marinkovic 1992, Shalini et al. 2000, Ali et al. 2002). The objectives of this study were to estimate the relationship among yield components and best selection criteria for yield improvement in mustard.

In the present investigation one hundred three diverse genotypes of Indian mustard were grown in augmented design during the rabi 2008-09 and 2009-2010 at Regional Research Station, Saini, Kaushambi of C S Azad University of Agriculture and Technology, Kanpur. Each row 5 m long with row to row and plant to plant spacing of 45 cm and 20 cm, respectively. The standard agronomic practices were followed to raise the crop. Data were recorded on days to 50% flowering, days to maturity, plant height (cm), number of primary branches per plant, number of secondary branches per plant, siliquae per plant, seeds per siliqua, 1000 seed weight (g) and seed yield per plant (g). Correlation coefficient were calculated as per the methods suggested by Wright (1921)
Genetic variability study in bacterial wilt resistant F₆ progenies of tomato (Solanum lycopersicum L.)

SANJAY CHADHA • AMIT BHUSHAN

ABSTRACT Twelve bacterial wilt resistant F₆ progenies of tomato along with three bacterial wilt resistant standard checks were studied for the extent of genetic variability with respect to fruit yield and contributing traits in mid hill conditions of Himachal Pradesh. Analysis of variance indicated sufficient amount of variability among the genotypes for all the traits. It was observed that the estimates of PCV, GCV, heritability and genetic advance were of the same nature for majority of traits. All the four estimates were high for total and marketable fruits per plant, moderate for gross yield per plant and low for days to 50 per cent flowering and pericarp thickness. For rest of the traits also, at least three components of variability showed same nature. This implies that the traits total fruits per plant, marketable fruits per plant and locules per fruit followed by plant height, average fruit weight and marketable yield can be improved through selection based on phenotypic performance. Whereas, recombination breeding will prove effective in improving the traits viz., days to 50 per cent flowering, days to first harvest, pericarp thickness, total soluble solids and duration of fruit harvest.

KEYWORDS Tomato, variability, heritability, genetic advance

Tomato is one of the most popular and widely grown vegetable crops of commerce in the world, ranking second in importance to potato but tops the list of processed vegetables (Choudhary 1996). Tomato is extensively grown during summer-rainy season in hills. The summer-rainy season crop grown in lower and mid-hill pockets of the north-western hills fetches high prices being off-season crop of the plains. Bacterial wilt is one of the most important constraints in humid tropical and sub-tropical areas causing huge losses. Hence, identification and development of new improved disease resistant cultivars is very important to further boost up the production and productivity of the crop in wilt prone areas of Himachal Pradesh. In order to select superior genotypes, the knowledge regarding the extent of genetic variability with respect to fruit yield and component traits is highly desirable. Therefore, the present study was undertaken on 12 bacterial wilt resistant F₆ progenies of tomato along with three standard checks to measure the extent of genetic variability.

The experimental material comprised 12 bacterial wilt resistant F₆ progenies of tomato viz., (BRH-2 × SUN 7611)-1-1-2-1, (BRH-2 × SUN 7611)-1-1-2-2, (BRH-2 × SUN 7611)-1-3-2-1, (BRH-2 × SUN 7611)-1-3-2-2, (SUN 7721 × Hawaii 7998)-3-2-1-2, (SUN 7721 × Hawaii 7998)-3-2-1-3, (Hawaii 7998 × SUN 7611)-2-2-1-2, (Hawaii 7998 × SUN 7611)-5-2-1-1, (BT 18 × SUN 7611)-5-1-8-1, (BT 18 × SUN 7611)-6-2-1-2, (BT 18 × SUN 7611)-6-3-1-B and (BT 18 × SUN 7611)-7-1-2-2 along with three bacterial wilt resistant standard checks [Palam Pink (Determinate), Palam Pride (Indeterminate) and SUN 7711 (Hybrid)] and two susceptible checks (Roma and Solan Gola). These were grown in randomized block design at Vegetable Research Farm of CSK HPKV, Palampur (Himachal Pradesh) during 2008 following recommended package of practices. Susceptible checks were planted as every 10th row to ascertain the presence/severity of disease in the experimental field. Ten competitive plants from each genotype were used to record observations on the traits, plant survival (%), days to 50% flowering, days to first

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More information available in the source document.

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Physico-chemical characteristics of buransh (Rhododendron arboreum) - a nutritious and edible flower

SN SOLANKI • AK HURIA • CS CHOPRA

ABSTRACT The present investigation was carried out in the Post Harvest Laboratory of the Department of Food Science and Technology, GB Pant University of Agriculture and Technology, Pantnagar. Rhododendron arboreum is also known as Buransh. It is very attractive edible flower. The flowers used in the present study were obtained from Bhimtal town of Nainital district (Uttarakhand). The colour of Buransh petals was red. Average weight of inflorescence was 24.01 ± 3.92g and 15 ± 2.18 flowers were present in an inflorescence. Length and width of petals were 5.13 ± 0.45 and 5.88 ± 0.64 cm, respectively. The inflorescence contained 67.63 ± 3.37 % edible portion. Buransh petals contained 89.28 ± 0.56, 8.5 ± 1.60, 2.69 ± 0.12, 0.80 ± 0.03 and 0.68 ± 0.04 %, moisture, TSS, acid, ash and pectin, respectively. The respective content of reducing, non-reducing and total sugars was 5.16 ± 0.09, 5.46 ± 0.79 and 10.91 ± 0.86 %. Petals contained 250.5 ± 3.5 mg/100g ascorbic acid and 214.35 ± 3.56 mg/100g anthocyanins.

KEYWORDS Rhododendron arboreum, edible flower, compositional aspects

Rhododendron means “rose tree”. The name Rhododendron came from the Greek word rhodon means a rose and dendron means a tree. The family of Rhododendron is Ericaceae. Rhododendrons were originally found in Nepal but they are also distributed in the mountain tracts of Europe, Asia, Malaya, and North America. The Rhododendron arboreum is common in the temperate Himalayas, from Indus to Bhutan between altitudes of 4000 to 11000 ft, in Khasi hills between 4000 to 6000 ft, and also in Manipur (Chopra et al. 1965). Today there are over 1,000 species of Rhododendrons. It is the ‘National Flower’ of Nepal and the ‘State Flower’ of Sikkim in India, West Virginia and Washington in the United States (Anon 2008).

Some species of Rhododendron are frequently cultivated for ornamental purposes all over the world, but in India Rhododendron arboreum is the only one that seems to be cultivated in some hill stations and that too very rarely (Chopra et al. 1965). Rhododendron arboreum is locally known as Buransh in Garhwal, Brons in Almora, Bras in Kumaon, Bhorans and Ghonas in Nepal, Billi in Nilgiris, Arawal in Punjab and Allingi in Tamil. Deep red or pale pink flowers have sweetish sour taste (Purohit 1960). Rhododendron arboreum flowers possess pharmacological and anticancer properties (Dhar et al. 1968). The red blooms of Buransh flowers are supposed to be good for the heart patients. Traditionally, the petals of the flowers are used in the preparation of chutney by the hill people. At home scale, small quantities of juice extracted from flower is used for preparing jelly and squash (Vyas et al. 1989) and syrup (Bhatt et al. 2007). Rhododendron lapponicum leaves and flowering tops can be infused and drunk as tea. White flowers of Rhododendrons can also be used for the preparation of jelly (MacNicol 1967). The present work was
Acridity reduction and value addition of elephant foot yam grown in Bilaspur district of Himachal Pradesh

RAVINDER SINGH • YS DHALIWAL • REENA KAUSHAL
Received: March 8, 2013; Revised: April 10, 2013; Accepted: April 26, 2013

ABSTRACT Different methods were tried to reduce the acridity and make different products of acrid local variety of zimikand commercially grown in Bilaspur district of Himachal Pradesh. Among different treatments, the lowest oxalate content was observed when cubes were treated overnight in 5 % sodium bicarbonate solution followed by further overnight dip in 2.5 % citric acid solution and fried to a golden brown colour. Zimikand products like pickle, chips and flakes were also prepared and evaluated organoleptically for acridity, colour, flavour and texture by using 9 point hedonic scale. The products were ‘liked very much’ for their overall acceptability.

KEYWORDS Zimikand, acridity, elephant foot yam, pickles, flakes

The corms and leaves of most cultivars of the edible aroids are consumed in various parts of the world and form staple diet in some regions of Africa. The larger proportion of yam produced annually is marketed as fresh corms. Only a small fraction goes to market in processed forms (Kumar 2007).

Elephant foot yam (Amorphophallus campanulatus L.) locally called zimikand is cultivated in large scale in those areas of district Bilaspur which are prone to monkey menace as it is not attacked by them. It is also low input demanding crop but acridity is one of the major problem in local cultivated variety (Anon 2009). It means if eaten raw, it cause swelling of the mouth, tongue, throat and feel as if hundreds of small needles are digging into them. The acridity is due to the dual action of the sharp raphides of calcium oxalate (Sen and Choudhary 2003). On chewing the corms, the stinging effect felt on the lips and tongue is accompanied by increase in salivation, slight hearing impairment and headache (Sakai 1979). Hence, zimikand is not used in its raw form and is always consumed by thoroughly cooking/processing the corms as calcium oxalate which causes acridity is easily broken down by these culinary methods. The climate of district Bilaspur of Himachal Pradesh is very much suitable for growing this crop and the local farmers reap a bumper harvest during the season. But the presence of acridity limits the use of zimikand both as food as well as feed. As compared to the commercial variety, the local variety is highly acrid in taste and is not utilized at the rate it is produced. The farmers are unable to market their produce for consumption purpose and are forced to sell it at throw away price. The local people utilize it mainly for preparation of curry after preliminary processing but the acrid taste still remains a problem. The traditional processing in some areas involves boiling of cut corms which reduces its nutritional value. Hence, an attempt was made in the present study to reduce the level of acridity in the local variety using simple processing methods.

The different methods in the literature for removing acridity in family Araceae uses concentrated acids and alkali like hydrogen peroxide, hydrochloric acid and sodium hydroxide that are highly concentrated, pungent and require
Response of bio-fertilizers and NPK levels on the growth and yield of garlic in north western Himalayas

KC SHARMA • LK SHARMA • AK SHARMA • VINOD SHARMA
Received: March 8, 2013; Revised: April 10, 2013; Accepted: April 26, 2013

ABSTRACT Garlic is the second most widely used cultivated Allium after onion and has long been recognized all over the world as valuable spice for foods and a popular remedy for various ailments and physiological disorders. Indiscriminate use of synthetic fertilizers imparts reduced nutritive value and sensory parameters, whereas integration of organic amendments and microbial inoculants reduces the NPK doses and improves the soil health and plant nutrient availability resulting in higher crop yields besides being environmentally safe. On farm trials were conducted during rabi seasons of 2009 and 2010 to study the effect of bio-fertilizers (Azotobacter and PSB) in combination with four levels of NPK fertilizers (0, 50, 75 & 100 % NPK) on growth and yield of garlic cv. ‘GHC-1’ in Kullu district of Himachal Pradesh. The application of bio-fertilizers either alone or in combination resulted in significant improvement in plant height, number of cloves/bulb, mean bulb weight and bulb yield and benefit cost ratio. The increased bulb yield was to the tune of 20.44 %, 15.67 % and 10.43 % with the combination of bio-fertilizers (Azotobacter + PSB), PSB and Azotobacter, respectively over un-inoculated control. The application of NPK fertilizers significantly increased all the growth and yield parameters along with bulb yield with each incremental level of NPK. The interaction effects showed that bulb yield and benefit cost ratio increased in a linear manner with the application of bio-inoculants integrated with increasing levels of NPK fertilizers. The highest yield (188 q/ha) was recorded when the plots were supplemented with 100 % NPK + clove treatment of both the inoculants. Furthermore, it was observed that the garlic yield (187 q/ha) obtained with the application of 75 % NPK +Azotobacter +PSB was at par with that of recommended NPK (100 %), thus resulting in net saving of 25 % NPK fertilizers with maximum benefit cost ratio (4.05).

KEYWORDS Garlic, biofertilizers, NPK, growth, yield

Garlic is the second most widely used cultivated Allium after onion and has long been recognized all over the world as valuable spice for foods and a popular remedy for various ailments and physiological disorders. It is rich source of carbohydrates, proteins, phosphorus and ascorbic. The crop is gaining popularity in Himachal Pradesh as an important cash crop resulting in high economic returns to the growers. The production and productivity of garlic in India is very low as compared to many countries. Unawareness of the farmers about improved technology like high yielding varieties, integrated nutrient management and proper plant protection measures are the main reasons for its low production.

Indiscriminate use of synthetic fertilizers imparts reduced nutritive value and sensory parameters, whereas integration of organic amendments and bio-fertilizers reduces the NPK doses and improves the soil health and plant nutrient availability resulting in higher crop yields besides being environmentally safe. Azotobacter chroococcum, a non-symbiotic bacteria is the potential bio-fertilizer and has the capability for contribution nitrogen to a number of non-legumes by tapping atmospheric nitrogen

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<td>Annual member</td>
<td>₹ 500/- per year</td>
<td>US $ 30 per year</td>
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<tr>
<td>Life member</td>
<td>₹ 3,000/- (one time)</td>
<td>US $ 200 (one time)</td>
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<tr>
<td>Subscriber (organization) member</td>
<td>₹ 1,500/- per year</td>
<td>US $ 100 per year</td>
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   (i) Life member          (ii) Annual member          (iii) Organization/ Subscriber member

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