

Advance Production Technology of

Nigella

(*Nigella sativa* L.)



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PREFACE

Nigella (*Nigella sativa* L.) is an annual herbaceous plant belonging to the family *Ranunculaceae* is an important seed spice crop has origin from Mediterranean region through west Asia to north India. *Nigella* is widely cultivated throughout South Europe, Syria, Egypt, Saudi Arabia, Iran, Pakistan, India and Turkey. In India it is cultivated commercially in Punjab, Jharkhand. H.P. Bihar and Assam. Small scales cultivation is also taken at U.P., Rajasthan. M.P., Tamil Nadu and West Bengal states. It has been used as herbal medicine for more than 2000 years. It is also used as a food additive and flavour in many countries. *N. saliva* volatile oil has been shown to possess various constituents, many of which are capable of inducing beneficial pharmacological effects in humans. In Aayurveda it is mentioned as an important medicine for many diseases.

Cultivation of *nigella* in India is taken mostly as traditional way and there are low levels of adoption of improved cultivation methods. The Improved cultivation technology generated at NRCSS, Ajmer and AICRP on spices at various location in the country has been complied in form of Advanced Production Technology of *Nigella*. This book shall prove highly useful to enhance the knowledge of various aspect of *nigella* cultivation to field functionaries, grower, student and other having interest in *nigella* cultivation.

We hope that technical bulletin will provide relevant information's. Suggestion if any for its improvement are welcome for future publication.

Ajmer

Authors

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Introduction

Nigella (*Nigella saliva* L.) used as dried seed in food, flavour, medicine and seed oil as pharmaceutical and perfumery industries is important seed spices have origin from Mediterranean region through west Asia to north India. Its higher value of medicinal properties mentioned in various religious and old literatures dated more than 2000 year back. It is cultivated or used since the civilization of human population. As black cumin it is mentioned in ancient Greek, Roman and Hebrew texts as a condiment and component of herbal medicines. A bottle of black cumin oil was found in the tomb of King Tutankhamen, implying that it played an important role in ancient Egyptian practices. In India it is generally used as garnishing on bread, vegetable curry preparations. In Bengal it is used as Phanchphorn for many vegetable preparations. It is one of important spices used for pickle preparation throughout the country.

Climate

Nigella is a cool season crop and is cultivated in the northern plains during winter season. Fairly warm weather during sowing with a temperature of 20-25°C is desirable. Cold weather is congenial for the early growth period and crop requires warm sunny weather during seed formation and maturity.

Ecological Requirement

Cultivation and maximum plant growth and yield of Nigella, requires cooler climate with a temperature range 5-25°C although Nigella is grown under diverse range of environments, but flourishes well in cooler regions with the optimum being 12-14°C. A rainfall of 400-500 mm helps in good growth of the plant. Excess water later must be drained out to the field as plants are susceptible to water logging and frost sensitive at any growth stage. Plants begin flowering 80-100 days after sowing depending on the average temperature. Higher temperature accelerates flowering, but if prolonged generally reduces the number of flowers, or flowers drop after pollination. Seed reaches physiological maturity in 130-150 days again depending on temperature.

Soil

Nigella can thrive on wide range of soils. which are rich in organic matter and free from water logging. However, loamy, medium to heavy soils with better fertility level are most suitable. The land should get sufficient sunlight free from shade. The place should be airy with good provision of irrigation water. Soil pH range near about neutral reaction but can be grown well on soil having 5.0-8.5 pH. However, sandy loam to heavy soils with medium fertility level are most favourable. Higher pH (or sodicity) is more favourable to invite root rot disease in the crop.

Recommended varieties

In India different varieties has been developed for Nigella cultivation for different areas.

| S.No. | Variety | Salient features |
|-------|--------------------------|---|
| 1 | Ajmer Nigella-1 (AN-1) | This variety is developed by ICAR-National Research Centre on Seed Spices, Ajmer (Rajasthan). It is suitable for cultivation in semi-arid region under irrigated conditions. The plants height goes up to 30-35cm. This variety matures in 135 days has resistance to root rot. The ovary is pentamerous and each capsule contains approximately 65 seeds. The seeds of this variety contains about 0.3% of essential oil. The average seed yield is 800kg ha ⁻¹ . This variety was released at national level during 2019-20 and suitable for all parts of country. |
| 2 | Ajmer Nigella-20 (AN-20) | This variety is developed by ICAR-National Research Centre on Seed Spices, Ajmer (Rajasthan) through mass selection. This variety matures in 140-150 days. This variety was released at state level during 2014-15. It is suitable for all parts of Rajasthan. Average yield of this variety is 1000-1200 kg ha ⁻¹ . Suitable sowing time determine is 15-30 October. This variety contains ~28% total oil and 0.3% essential oil |
| 3 | Azad Kalonji | This variety was developed at Chandra Shekhar Azad University of Agriculture and Technology (CSAUST), Regional Research Station, Kalyanpur, Kanpur. It takes about 135- 145 days to produce seeds. Average seed yield of this variety is 900-1000 kg ha ⁻¹ . |
| 4 | RajendraShyama | It was released from Department of Horticulture, Tirhut College of Agriculture, RAU Dholi (Bihar). This variety was recommended for West Bengal and Bihar states only. It takes 140-150 days to produce seeds. Average seed yields 700-800 kg ha ⁻¹ . |
| 5 | Pant Krishna | This variety was developed by pure line selection from indigenous selection at G.B. Pant University of Agri. Science and Technology (GBPUAT), Pantnagar, Uttarakhand. Plants of this cultivar are medium, bold seed and suitable for cultivate in U.P. & Uttaranchal. |
| 6 | NS-44 | This variety is developed by Jawaharlal Nehru Krishi VishwaVidyalaya (JNKVV), Jabalpur, Madhya Pradesh. It matures in 140 - 150 days. It yields 450 to 650kg ha ⁻¹ . |
| 7 | NS-32 | This variety is also developed at JNKVV, Jabalpur. It matures in 140-150 days. It yields 450-550kg ha ⁻¹ . |
| 8 | Kalajeera | Kalajeera is also an improved variety of nigella. It matures in 135-145 days. It produce seeds of 400-500 kg ha ⁻¹ . |

Preparation of land

The field should be well prepared for getting good germination, growth and yield. About 2-3 ploughings are required, first ploughing should be done by soil turning plough followed by light ploughings by harrow or cultivator or desi plough. The soil should be prepared well for getting better tilth. The surface of field should be well leveled and smooth which may be divided into convenient size of beds. Pre sowing irrigation should be given for better and uniform germination of seeds.

Time of sowing

Optimum time for seed sowing is mid September to mid October. The seed can be sown up to November. However, good yield are obtained when sowing is done in time. Late sown crop give poor yield.

Seed rate

The crop is raised through seeds and 5-7 kg seed required for sowing in one hectare in different states.

Seed treatment

To check the incidence of soil borne diseases, the seeds should be treated with *Trichoderma* culture @ 10.0 g/kg seed before sowing.

Sowing method

The crop can be sown by two methods i.e. line sowing and broadcasting. However, line sowing is better because it facilitates inter culture operations and plant protection measures. The seeds are sown 1.5-2.0 cm deep at row spacing of 30 cm and plant-to-plant spacing of 15 cm. If initial moisture is less, light irrigation can be given and seeds germinate within 10 days after sowing. Care should be taken at irrigation that water does not flow too fast in the beds otherwise seeds may be carried away and gather towards bunds resulting in the uneven distribution of the plants.

Manures and Fertilizers

The manure and fertilizers should be applied based on soil testing report of fertility status. In general add 5-10 tons of well decomposed FYM or compost prior to field preparation. Well rotten manures are advisable as partially rotten manures hampers the chlorophyll synthesis in plant at sufficient/excess soil moisture conditions and also invites soil borne diseases. In addition, 40 kg

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N, 20 kg P₂O₅, and 20 kg K₂O should be applied through fertilizers. Total quantity of phosphorus, potash and 1/3 dose of nitrogen should be applied as basal dose while rest of the nitrogen in two equal split, first at 30 days after sowing, while rest at flowering as top dressing in standing crop. If initial crop growth is poor, 1.0 % solution of urea can be sprayed after 3 weeks of sowing. In slightly alkaline or sodic soils, micro-nutrient application is advisable for both higher yield and quality of produce.

Weed Management

In India Nigella crop grown during rabi season of winter month. Weeds consist of broad and narrow, leaf are common in the field. Major weed flora associated with crops are:

| S.No. | Type of weed | Hindi Name | Botanical Name |
|-------|-------------------------|---|---|
| 1 | Broad leaved weeds | Bathua Kharbathua Junglee Cholai Safed Senji Krashneel Junglee Palak Gengla Satyanashi Satgathiya | <i>Chenopodium album</i> <i>Chenopodium murale</i> <i>Amaranthus viridis</i> <i>Melilotus indica</i> <i>Anagallis arvensis</i> <i>Portulaca oleracea</i> <i>Vicia sativa</i> <i>Argemone maxicana</i> <i>Spergularia arvensis</i> |
| 2 | Narrow leaved weeds | Zeeri Junglee Zai Dhoob Ghans Makada Sama Ghans Pyaji | <i>Plantago pumila</i> <i>Avena fatua</i> <i>Cynodon dactylon</i> <i>Dactyloctenium aegyptium</i> <i>Echinochloa colonum</i> <i>Asphodelus tenuifolius</i> |
| 3 | Weeds of Cyperus family | Motha | <i>Cyperus rotundus</i> <i>Cyperus iria</i> |

Nigella seeds germinate within 10 days so initially crop should be kept weed free for better growth of plants. Field should be kept clean and weed free during 30-60 days of sowing by hand weeding. Nigella requires only 2-3 hoeing and weeding. First at 30 days & second on 60 days after sowing. If required third weeding can be done. During first weeding the plants should also be thinned to the desired distance. Chemical control of weeds can be done with a pre-plant application of the herbicide. Weed control during the vegetative phase, pre-plant incorporation of fluchlvalin @ 0.75 to 1.0 kg/ha or per-emergence application of Oxadiargyl @ 0.075 kg/ha or per-emergence application of Oxyflurofen (a) 0.15 kg/ha or Pendimethalin @ 0.75 to 1.0 kg/ha after dissolving in 400-500 liters of water is recommended. Excess use of herbicide imparts soil toxicity,

it is harmful to soil micro fauna, flora and soil builder elements. So eco-friendly approaches should be adopted like, mulching, manual weeding/ hoeing and crop rotation to reduce weed population and improve quantity and quality of crop yield.

Irrigation

If soil moisture is not sufficient at the time of sowing, a light irrigation can be given just after sowing for proper germination. Subsequent irrigation be given at 15-25 days intervals depending on climate and soil conditions. In all 3-5 irrigations are sufficient to raise the crop. Precaution should be taken during irrigation that water flow should be slow to escape flowing of soil and seed with irrigation water. Most critical stages for irrigation are flowering and seed formation. Therefore crop should not be allowed to face water stress at flowering and seed formation stages. Excess moisture causes root rot so irrigation should be given as per requirement of crop.

Plant Protection

A-Insects

Aphids and capsule borers are common pests of Nigella crop during vegetative growth to capsule maturation. Cutworm and termite infestation are vary from place to place

Aphids

Aphids are major yield reducing factor of crops at all growing areas. Aphids suck the sap from the young growing twigs, flower buds & fruits and devitalize the plants. The population start developing on the crop during vegetative stages but heavy population develop during flowering and fruiting stages there by causes significant losses in yield at harvest of the crop and also affect oil content on seeds. Timely management of aphids is necessary to prevent the crop from economic losses.

Control

- Apply only recommended dose of fertilizers and irrigation. Excessive use of nitrogenous fertilizers and irrigation make plant succulent and help in higher aphids population build up on the plants.
- At early colonization of aphids, spraying of botanical insecticides like Neem Seed Kernel Extract (NSKE) at 5%, Neem oil 2 % give good control and prevent the buildup of large colony on the plants for some time.
- In case of higher population development spraying of either of Dimethoate 0.03%, Metasystox 0.03%, Imidachlorprid 0.005% or Thiomethoxam 0.025% give effective control. Repeats the spray in 15 to 20 days after first application if necessary.

Capsule Borer

Borer infestation starts at fruit forming stages. The borers attack young fruits, capsules and bore inside the fruit. Damaged capsule fail to form seed in it. Early detection and appropriate control measures should be necessary to prevent damage of borers on crop.

Control

It can be controlled by application of Endosulfan 0.03% or Chloropyriphos 0.04%. Spraying should be done twice or thrice at interval of 10-12 days. If the infestation is detected at early stage hand picking and distraction of larva should be advised to check the population of the borer.

White fly

The population of white fly is generally found at early stages of crop growth. Adult and immature stages found on lower surface of leaves and feed on them. They suck the sap of leaves. Affected leaves turn white to pale grey in colour. Severely affected plant fail to produce seed capsule.

Control

- It is sap sucking insect can be suppressed by spraying of systematic insecticides. Spraying of imidachloroprid 0.005% or Dimethoate 0.03% effectively control white fly population on the crops.
- Application of botanical insecticides like NTSKE 2-5%. neein oil 1-2% also found effective in reduction of white fly population.

Cutworm

Cut worm infestation is found serious in some areas. The larvae remain inside the soil near the base of the plant. They remain in hide under the soil during day time and come above the soil surface at night. At night the larvae feed on voraciously the leaves and tender stems and branches.

Control

- To control this insect regular field inspection should be made to detect the appearance of the pest. Application of Phorate 10 gm @ 10kg/ha or Fenvalrate dust@ 25 kg/ha in the soil near the base of the plant can be useful to bring this pest under control.

Termites

This insect damage Nigella crop generally at full vegetative growth stage by cut the plant stem near soil surface and falls down. Initially plant look like lodging but ultimately die. To monitor this insect regular field inspection should be made to detect the appearance of the pest.

Control

- Application of Phorate 10 G @ 10 kg/ha or Fenvalrate Dust 1% @ 25 kg/ha in the soil near the base of the plant can be useful to bring this pest under control. Broadcast chloropyrifos 20 E.C. or endosulfan 35EC @ 4 lit./ha mixed with sand is also effective control of termites.

B-Diseases

Root rot is major disease of Nigella plant. Affected plant show wilted symptom and die within 10-20 days of infection. The seeds treatment (10g/kg seed) and soil application (2.5 kg/ha mixed in 50 kg FYM or vermi compost) with consortia of *Trichoderma viride* and *Pseudomonas fluorescence* prove effective in control of disease.

Harvesting and yield

The crop matures in 135-150 days after sowing. It should be harvested when the seed attained full maturity in capsule and have turned to full brown/black colour. The delay in harvesting may cause shattering of seeds. Average seeds yield of 5-10 quintals can be obtained from one hectare of land. The seeds are separated by rubbing plants or by stick beating. The seeds thereafter are winnowed and dried.

Processing

Essential oil can be extracted from Nigella seed. The seeds contain 0.5 to 1.6% of essential oil, which is used in food, flavour and pharmaceutical industries. To obtain the oil, seeds are crushed and distilled with steam. A yellowish brown volatile oil with a specific odour is received. A carboxyl compound, nigellone is the important constituent possessing medicinal and preservatives quality. The fatty oil obtained by the extraction of the seed is reported to be used for edible purposes. Extraction with benzene and subsequent steam distillation of extract to remove the volatile oil gave about 31% of reddish brown, semi-drying oil.

Product and use

The dried black seeds of Nigella are the commercial product being used in food, flavour and medicines. The essential oil from Nigella seeds has also demand in the pharmaceutical and perfumery industry. The main alkaloids present in Nigella seeds are nigellmin, nigellicin and are known to possess anticarcinogenic properties. The seeds of Nigella are being used as spice from the ancient times in preparation of pickles, as one of the ingredient. Seeds are scattered as

preservative between folds of linen or woolen to stop insect attack. The oil can be used as a stabilizing agent for edible fats. Indians, Middle Easterners, Turks and Egyptians commonly sprinkle whole Nigella seeds on breads to provide flavors and textures. In the Middle East Nigella is added to bread dough. In North Indian cooking, whole seeds are dry roasted or fried in oil to give a more intense aroma. They are used in curries, dals, yogurts, vegetables and chutneys. In Iran, Nigella is used mostly to enhance vegetable dishes. Nigella is an essential ingredient in a spice mixture of Bengal, Bangladesh and Sikkim called panchphoron (five spice blends). It is blended with cumin, mustard seed, ajowan and black pepper and is fried in mustard oil to flavor eggplant, cabbage, squash and meats.

Medicinal Properties of Nigella

Nigella sativa also known as black cumin, black seeds and kalonji. In many parts it is misinterpreted with onion seeds which look similar to nigella seeds. Actually both are entirely different seeds. Kalonji seeds are darker than onion seeds with uniform size. Typically kalonji seeds are pointed from one end and rounded from another end. Little bit smaller than onion seeds in size. Upon organoleptic evaluation, kalonji seeds are somewhat bitter and pungent while onion seeds do not have any particular taste. So we should be careful while procuring kalonji seeds from grocery store. Traditionally kalonji seeds are being used as spice and condiments in different Asian cuisines. Kalonji seeds are essential ingredients of pickles due to their preservative effect. Apart from taste and flavor, kalonji seeds are an integral part of our kitchen because of their wonderful medicinal properties and are being used in food by one or other way. Historically spices in general are categorized as home remedies for animal and human ailments including common cough and cold to severe diseases like cancer. Medicinal properties of nigella seeds are very well mentioned in ancient religious literature. Considerable volume of research for establishing its medicinal properties has been done in West Asia and Indian subcontinent. Its essential oil contains very important bioactive compounds thymoquinone along with thymohydroquinone (THQ), dithymoquinone, trans-anethole, p-cymene, limonene, carvone, α -thujene, carvacrol, and β -Pinene in various concentrations. Besides essential oil (0.1-0.4%), nigella seeds are a rich source of seed fatty oil (10-25%) with good proportion of polyunsaturated fatty acids (PUFA) like linoleic, linolenic acid and monounsaturated fatty acids (MUFA) like oleic, palmitoleic, palmitic acids together with arachidonic, eicosadienoic, stearic, and myristic acid. Other important biomolecules such as sterols and saponins, phenolic nigella seeds contain compounds, alkaloids, novel lipid constituents and fatty acids. The major sterols in nigella seeds identified were β -sitosterol, campesterol, stigmasterol, and 5-avenasterol while Tocopherols exhibited attractive scavenging potentials of

free radicals which are believed to terminate lipids peroxidation. Phytosterols are important part of human diet and are gaining greater interest due to their nutraceutical and medicinal benefits in lowering low density lipoprotein and total cholesterol level. The total sterols content of nigella seed oil as estimated by different researchers was found to be between 18 and 42% of the unsaponified matter. Among the foremost tocopherols recognized in black cumin seeds, α and γ -tocopherol and β -tocotrienol are well recognized. Steroidal glycosides of new and known structures have been isolated from *N. sativa* seeds. Moreover, alkaloids of diverse types have been isolated from the seeds of nigella, which include novel Dolabellane-type diterpene alkaloids: nigellamines A1, A2, B1, and B2 and nigellamines A3, A4, A5, and C possessing lipid metabolizing property, and indazole class of alkaloids: nigellidine, nigellicine, and nigellidine-4-O-sulfite. The large traditional use of nigella seeds as panacea (universal healer) in North African societies came from Islamic belief and also Bible. *Nigella sativa* is cited by many research papers for its multiple benefits as antiviral, anti-inflammatory, anti-cancer and analgesic. To date, a number of studies showed that nigella seeds and its component including TQ have revealed a remarkable natural therapy for treatment of a wide range of illnesses including chronic noninfectious (neurologic disorders, DM, hypertension, dyslipidemia, inflammatory disorders, cancer, etc.) and infectious disease (bacterial, fungal, viral, and parasitic infections). From the information it can be concluded that, though there are many research studies with nigella seeds showing therapeutic properties such as immunopotential, bronchodilatation, and being antitumor, antihistaminic, antidiabetic, antihypertensive, antiinflammatory, antimicrobial, hepatoprotective, and gastroprotective, which are attributed to its quinone constituents in the seeds. There are enough citations both religious and based of traditional uses that support *Nigella sativa* as being panacea. However, systematic clinical studies beyond animals are needed to reconfirm above claim so that intake of nigella seeds as whole or in powdered form or its oleoresin as prophylactic treatment may be recommended. The Food Safety and Standards Authority of India (FSSAI) and as per The Gazette of India dated 26/12/2016, an adult except pregnant women can intake 5-10g of nigella seeds per day. As nigella seed contains 10-20% oil, 1-2ml of seed oil can be consumed/day/adult.

Chemistry

The analysis of *Nigella* seeds gives the following figures: total ash 3.8-5.3%, ash insoluble in acid 0.0-0.5%, volatile oil 0.5-1.6%, ether extract (crude oil) 35.6-41.6%, alcoholic acidity as oleic acid (FFA-3.4-6.3%). The chemical constituents found in nigella seed are glucosides-melanthin and melanthingenin, bitter substances and a crystalline active principle nigellone, essential oil, fixed

oil, resins and tannins. The amino acid presents in dormant seeds are cystine, lysine, aspartic acid, glutamic acid, alanine and tryptophan. The seed contain 0.5 to 1.6% essential oil.

Composition of Nigella seeds

| S.No. | Components Per (100 gm seed) | Value in gm |
|-------|------------------------------|-------------|
| 1 | Moisture | 4 |
| 2 | Protein | 22 |
| 3 | Fat | 41 |
| 4 | Carbohydrate | 17 |
| 5 | Fibre | 8 |
| 6 | Ash | 4.5 |
| 7 | Sodium | 0.5 |
| 8 | Potassium | 0.5 |
| 9 | Calcium | 0.2 |
| 10 | Phosphorus | 0.5 |
| 11 | Iron | 10 mg |
| 12 | Thiamin | 1.5 gm |
| 13 | Pyridoxine | 0.7 mg |
| 14 | Tocopherol | 30 mg |
| 15 | Nicion | 6 mg |

Others information on Nigella Crop

1. Taxonomic Classification of *Nigella sativa* L.

| | |
|---------------|----------------------------------|
| Domain | Eukarya |
| Kingdom | Plantae (Plants) |
| Subkingdom | Tracheobionta (Vascular plants) |
| Superdivision | Spermatophyta (Seed plants) |
| Phylum | Magnoliophyta (Flowering plants) |
| Class | Magnoliopsida (Dicotyledons) |
| Subclass | Magnoliidae |
| Order | Ranunculales |
| Family | Ranunculaceac (Buttercup family) |
| Genus | <i>Nigella</i> |
| Species | <i>sativa</i> |

Distribution of *Nigella saliva*

Countries of Mediterranean region to India, it is cultivated as spice crop or medicinal plant and it is also widely found as weed of many crops. Nigella is a minor cultivated crop from Morocco to

northern India, in sub-Saharan Africa particularly Niger and eastern Africa especially Ethiopia, Egypt and in Russia, Europe and North America and Sri Lanka, Pakistan, Bangladesh, Nepal of South-east Asia where Nigella is grown as minor seed spice crop.

In India Nigella is cultivated commercially in the states like Punjab, H.P., Madhya Pradesh, Assam, West Bengal, Jharkhand and Bihar. It has also been noticed to occur wild in these areas. It is also cultivated in small scale in Uttar Pradesh, Rajasthan and Tamil Nadu.

Nigella in different languages

Nigella is usually confused with the other seed spices belonging to family Apiaceae viz, siahzira (*carum carvi* L.) and kala zira (*Buniumpersicum* (Bioss)). Botanically and structurally the Nigella seed is altogether different from above seed spice and belongs to a different family. Nigella commonly it called on different name in different Indian states and other countries of the world.

| Language | Name |
|---------------------|------------------------------|
| Bengali | Kalojira |
| Hindi | Kalaunji. Kalonji (कलौंजी) |
| Kannada | Mangrela |
| Maithili | Mangrela |
| Malay | Jintanhitam |
| Malayalam | Karinjeeragam, Karutajirakam |
| Nepali | Mugrelo. Mungrelo |
| Newari (Napalbhasa) | Mugrela, Haji |
| Punjabi | Kalaunji |
| Sanskrit | Krishna-jirake |
| Tamil | Karunjiragam |
| Telugu | Nallajilakarra |
| Urdu | Kaloniji |

Botany of Nigella plant

Nigella is an erect annual herb with a well-developed yellow-brown taproot, producing many secondary and tertiary roots. The stem up to 70 cm is profusely branched, subteretic, ribbed, often becoming hollow with age puberulous and light to dark green. The leaves are alternate and extipulate, the petiole, 1-6 cm, present only on basal leaves. The blade is 7x5 cm, pinnately dissected into thin sublinear lobes usually described as feathery and normally green but may

become red/brown with age. *N. saliva* is a variable species but can be distinguished from other species in the genus by its blue, petaloid sepals, triangular seeds and tuberculate capsular fruit s with carpels united to the apex.

The flowers are pale green with young, light blue when mature, solitary and terminal, initially pale green becoming pale blue or white; the pedicel is 4-8 cm inserted on a 2 mm diameter yellow/ brownish, depressed receptacle. There are five ovate sepals up to 17x 12 mm, tapering at the base into a claw 2-3 mm. There are normally eight petals each with a short glabrous claw; the stamens upright becoming horizontal with age. The ovary is compound. 4-9 mm with a free stigma of 5-9 mm. flowering is protandrous and pollination mainly by insects. In older flowers the stamens bend, as noted and self-pollination mainly by insects.

The fruit is a capsule up to 16 x 12 mm in diameter, grayish initially, yellow/brown when mature, with persistent semi-erect stigma, opening at the base, containing numerous dark brown but generally black seeds. The seeds are obpyramidal, up to 3 x 2 mm in diameter, the testa pitted and wrinkled the embryo minute and embedded in grayish fatty endosperm.

Other Nigella Species

Nigella genus contain many species, the most important is *N. saliva* L., which is generally used as spice and for other medicinal purposes. Other important Nigella species is *Nigella arvensis* L. have minor importance. While *Nigella damascene* L. is the well-known blue-flowered ornamental love-in-the mist. It is hardy annual grown for rich coloured blue or white flowers, interesting seed Pods and delicate spidery foliage. *Nigella hispanica* (also Called Love-in-a-mist and fennel flower) sometimes called *Nigella papillosa*, though this is generally just be the uncultivated type *Nigella hispanica*, is similar to *Nigella damasacena*. The seed pod of *N. damascena* is an inflated capsule while *N. hispanicas'* seed pod has more sections and several filaments that rise and twist, like a corkscrew, from the top of the pod.