SANRAG e - Newsletter

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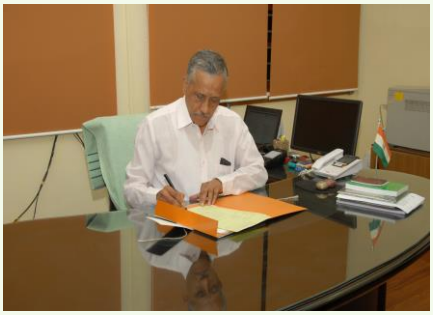
From President's Desk.....

ICAR-IINRG is now ICAR-NISA - Transformation of Indian Institute of Natural Resins and Gums to National Institute of Secondary Agriculture



Established on September 20, 1924, Indian Lac Research Institute had been the nodal Institute at national level for providing research and development support to all aspects of lac such as production, processing, product development, technology dissemination, information repository and national and international cooperation. It has immensely contributed towards all round development of lac besides maintaining India`s leadership in production, installed processing capacity and export. The Institute had been under administrative control of Indian Lac Association for Research (20.09.1924 to 31.7.1931), Indian Lac Cess Committee (1.8.1931 to 31.3.1966) and Indian Council of Agricultural Research since 1.4.1966.

The Institute hitherto had been providing R&D support only to lac, which is the only source of natural resin of animal origin. It was then proposed to include plant resins and gums also under the purview of the institute in view of production systems, economy and application areas, which were largely overlapping for lac and other natural resins and gums. This expansion enabled creation of a single national organization addressing the research and development needs of this class of natural materials, which were receiving greater attention due to increasing demand for natural products safer to human health and environment. The mandate of this Institute was therefore, expanded to include all natural resins and gums, besides lac and the name of the institute was changed to Indian Institute of Natural Resins and Gums (IINRG) on September 20, 2007. Adequate R & D support to this sub-sector enabled India to emerge as the leader in some more resins and gums besides maintaining leadership in lac, guar gum and karaya gum.

Presently, value addition of the produce and utilizing the crop residues is attaining high priority. Secondary Agriculture is high value addition to primary agriculture. It helps in using all parts of an agricultural produce (e.g. crop residues, animal hair, bones, viscera, etc), processing to enhance shelf-life, increasing total factor productivity, and generating additional jobs and income for farmers. Certain alternative agriculture activities like lac culture, beekeeping, mushroom cultivation, agri-tourism, etc, also fall under the ambit of secondary agriculture. By-products from agricultural crops, if processed appropriately for deriving industrial products could pave a way in getting better economic returns from agriculture. The advancement in technologies, equipment, and processes would enable enhanced secondary agriculture practices giving range of materials of better quality, yield, nutrition, and convenience. Hence, the secondary agriculture and the bioprocessing have potential to give a strong boost to the economy, societal status and environmental protection.

Keeping in view the importance of secondary agriculture in rural industrialization in order to improve farmer's income, it was proposed to further widen the mandate of the IINRG. Therefore, the Governing Body of ICAR Society in its 256th meeting approved the proposal and the new name of the Institute as National Institute of Secondary Agriculture.

Consequent to this decision of the Council, Indian Institute of Natural Resins and Gums has been rechristened as National Institute of Secondary Agriculture (NISA) w.e.f. September, 20, 2022.

Though, the institute would keep on working on the production and value edition of natural resins and gums, widening of the mandate would bring a lot of new responsibilities and open newer vistas of research. The institute would need to set its priorities and focus on value addition of prioritized commodities, sustainable utilization of the by-products and waste minimization to substantially reduce the environmental pollution besides creating wealth from the waste. Mere change in name will not enthuse and create newer opportunities - strengthening of the research infrastructure and required additional manpower dedicated to secondary agriculture and establishing regional stations in different agro-climatic regions would be the first requisite to bring out positive outcome in the near future. Relocating of CRP on Secondary Agriculture from CIPHET, Ludhiana to NISA, Ranchi as envisioned in the proposal would be the first justifiable action to initiate the NISA towards newer vision. Mandate and objectives of the institute would require to be drafted carefully keeping in mind the priorities under newer vision and mission.

This transformation of IINRG to NISA is work in progress. To become a world class institution would require collective thinking, dynamic leadership and wholehearted support from the Council.

Recent trends in the lac production in Eastern Plateau and Hills Region

According to Census 2011, a total of 3.3 crore population of the Jharkhand state comprises 76% of the rural population. About 26% populations belong to the tribal community and about 80 lakhs (91%) of the tribal inhabit rural areas. In the state, more than 75% population residing in rural areas is the target group and out of this about 31% are tribal. An empirical exploration of socioeconomic determinants in the state conducted (Singh et al., 2012) and the World Bank Report 2007 revealed the magnitude of gaps. About 20 to 28% of sampled households possessed host trees but were not involved in lac cultivation and about 35 to 59% of households were using less than 50% of the available host trees. Anthropological studies about the tribal indicate that their needs are comparatively lesser and differ in terms of choice. Migration problem is also observed in these areas. Consequently, the adoption rate is low and generally they are not early adopters. Be that as it may, Corbridge's work (1988) should be read as a structural account of the Jharkhand movement's lack of political traction over the years rather than as evidence for the historical dissolution of core Adivasi concerns relating to *'Jal*, *Jungle*, *Zameen* (water, forests, and land). Corbridge is careful to point out that the reservations 'has not brought a tribal middle class into existence; rather it has been captured by a pre-existing tribal elite', which is

Table 1. Agro-climatic Sub Zones under Eastern Plateau and Hills Region

Agro-climatic sub zones	Characteristics	Name of the districts (Numbers)
Central and North Eastern Plateau Sub *Zone IV*	i. Erratic and uneven distribution of rainfall ii. Coarse textured soils, crust formation on the soil surface iii. Low water retention capacity of the soil iv. Lack of safe disposal of runoff and drying of tanks	Bokaro, Deoghar, Dhanbad, Dumka, Giridih, Godda, Jamtara, Khunti, Koderma, Hazaribagh, Pakur, Ramgarh, Ranchi and Sahebganj (14)
Western Plateau *Sub Zone V*	i. Erratic/ uneven distribution of rainfall ii. Low water retentive capacity of the soil	Chatra, Garhwa, Gumla, Latehar, Lohardaga, Palamau and Simdega (7).
South Eastern Plateau *Sub Zone VI*	i. Uneven distribution of rainfall ii. Low water holding capacity, eroded soils iii. Shallow soil depth iv. Poor soil fertility	East Singhbhum, Saraikela and West Singhbhum (3)

predominantly male and many of whom originate in urban areas. The interplay of economic potential and socio-political vulnerability in Jharkhand has already seen dramatic developments. The livelihood contributions of forest resources are significant to the tribal communities of Jharkhand (Islam et al., 2013). Lac being mostly a subsidiary occupation however providing much-needed cash income in low agriculture activity seasons in Jharkhand (Magry et al., 2017).

Based on a survey in the local weekly markets of different lac-producing districts, the estimated national production of sticklac during 2019-20 was approximately 18,944 tons comprising *rangeeni* (6050 tons) and *kusmi* (12894 tons) sticklac. Among the lac-growing states, Jharkhand state ranks 1st (54.60%) followed by Chhattisgarh (18.37%), Madhya Pradesh (13.03%), West Bengal (5.57%), Maharashtra (4.50%), and Odisha (3.55%). These six states contribute more than 99 % of the total lac production in India. Among the different cropping season crops, *aghani* crop was ranked 1st with a contribution of 36.48 % followed by *jethwi* (31.58 %), *baisakhi* (17.58 %), and *katki* (14.36 %) in total lac production. In comparison to the average production during 2010-11 to 2019-20, the current year (2019-20) production of *rangeeni* crop declined by 9.24% while the production of *kusmi* crop enhanced by 23.11%, respectively. The increase in production was comprised of 13.64 % and 32.68 % for the *jethwi* and *aghani* crops, respectively. However, a decrease of 13.14% and 3.96% was observed in the case of *baisakhi* and *katki* crops, respectively. Overall, the total lac production for the year 2019-20 has increased by about 3.28 % in comparison to the average production. All India's annual lac production ranged from 15,000 to 20,000 during 1970-71 to 2019-20 with a peak level of 23,000 tons in 1972-73 and the lowest level of 9,000 tons in 2010-11. Similarly, Jharkhand state contributed about 7000 to 12000 tons annually during 1970-71 to 2019-20 with a peak level of 16,000 tons in 1973-74 and the lowest level of 4,000 tons in 2010-11.

The variation in the production of lac at the National as well as state level shows temporal impact coupled with the biotic and abiotic stress conditions. Natural enemies of lac insects include pathogens, parasites, and predators. Based on the Focus Group Discussions (FGDs), it has been indicated that about 30% yield losses can be avoided by checking the growth of the microorganisms. Predators (*Eublema amabilis* and *Psudohypatopa pulverea*) and parasites are the major natural enemies of lac insects causing about 30-40% crop loss on average. *Chrysopa* spp. is a sporadic pest and sometimes causes significant mortality (Mohanasundaram, 2014), in which *Chrysopa lecciperda* and *Chrysopa medestes* are the most prevalent in the lac ecosystem which causes considerable damage, especially to the winter season (*aghani*) *kusmi* lac crop (Mohanasundaram, 2019). Studies on the extent and nature of damage caused by parasitoids pertain mostly to extent of parasitization, and the seasonal and relative abundance of parasites associated with lac insects. Abiotic factors including climate and the extent of forward and backward linkages influenced lac production in India. Significant fall in lac production during 2010-11 was due to climatic factors and the declining trend from 2014-15 to 2017-18 was due to poor forward and backward linkages.

Major lac-producing districts namely Ranchi, Khunti, Gumla, Simdega, West Singhbum, and Palamu showed less variance compared to the minor lac-producing districts of Jharkhand state. Statistical analysis revealed a significant variation over time across minor lac-producing districts namely Bokaro, Chatra, Dhanbad, Deoghar, Dumka, Giridih, East Singhbhum, Garhwa, Hazaribag, Jamtara, Latehar, Lohardaga, and Saraikela Kharsanwa. The overall decline in the production level of rangeeni crops ranged from -5.54% in Western Plateau Sub Zone V to -6.98% in South Eastern Plateau Sub Zone VI. There was a significant enhancement in the export unit value of the lac and its value-added products in comparison to the Consumer Price Index (CPI) 1990-91 onwards. It indicates the technological breakthrough in the processing and value-addition industry which improved the earnings of foreign exchange reserves significantly.

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Calliandra calothyrsus – A Good Host for the Indian Lac Insect [*Kerria lacca* (Kerr.)] Cultivation in India

Calliandra calothyrsus Meissner is categorized as a shrub or small neotropical tree and belongs to the family Fabaceae. It is commonly known as *Calliandra* (English); *Kalliandra* (Indonesian) and *Barbillo* (Spanish). It is used as fodder for ruminant livestock, green manure, fuel wood, shade (coffee and tea plantation) or support for perennial crops, land rehabilitation, erosion control, and for honey and shellac production. *C. calothyrsus* was found to be a very good host for cultivation of both strains of lac insect, *Kerria lacca* and has got several advantages over lac cultivation on traditional lac host trees *viz*., *kusum*, *palas*, *ber* and a busy host plant *semialata*.

Ideally, *Calliandra* seedlings are grown in triangular method of planting by keeping four meter distance between plants and four meter distance between rows. Required agronomic practices *viz*., seed collection, weeding, earthing up, pruning, farm yard manure, fertilizer, pesticide application, irrigation *etc* are need to be followed for maintenance. Plants are pruned in the month of February-March for inoculation of winter season crop and in June-July for inoculating summer season crop of *kusmi* strain. Similarly, plants are pruned in the month of February-March for inoculation of rainy season crop and in April-May for inoculating summer season crop of *rangeeni* strain. Around 250 g broodlac is required for three to four year old plant. Broodlac in bundles of 80-100 g in synthetic nylon sleeves are tied to the plant. After settlement of nymphs/crawlers *phunki* lac (used up broodlac) is removed after 21 days of inoculation. Lac can be scraped from the phunki sticks and sold soon after.

First and second spray of pesticides Fipronil 5% EC/SC (1.5 ml per litre of water) along with Carbendazim 50% WP/ Hexaconazole 5% EC (1 g/ml per litre of water) are done after one month and two months of inoculation for *rangeeni* rainy season lac crop. In addition, third spray for *rangeeni* summer season lac crop may be done after three months of inoculation. Third spray of fungicide may be done if required during rainy season *rangeeni* crop.

First, second and third spray of pesticides Ethofenprox 10% EC (2 ml per litre of water) or Indoxacarb 15.8% EC (0.5 ml per litre of water) along with Carbendazim 50% WP/ Hexaconazole 5% EC (1 g/ml per litre of water) are done for *kusmi* winter season and summer season lac crops after one month, two months/45 days during winter lac crop and three months of inoculation, respectively. Fourth spray of fungicide may be done if required during winter season *kusmi* crop.

Crop is harvested in the following months depending on the crop and the strain used

a February for *kusmi* winter season crop
b July for *kusmi* summer season crop
c November for *rangeeni* rainy season crop
d July for *rangeeni* summer season crop

C. calothyrsus is very good host for cultivation of both strains of lac insect, *K. lacca*. Broodlac ratio (3 to 4 times) can be achieved from all four crops during crop cycle. It is estimated that Rs. 93,600 is required to cultivate lac on *C. calothyrsus* per hectare and gross income generated would be Rs.4,02,574 with a profit of Rs. 3,08,974 per hectare per crop season.

Applications and advantages

Calliandra seedlings

Lac on *Calliandra*

***Calliandra* as fodder**

- Lac cultivation can be started after 1.5 to 2 years of planting; a good host for both strains of lac insect; suitable for lac integrated cropping system; grows well under acidic soils and requires limited irrigation during summer season.
- Difficulty in lac culture operation in traditional lac host plants (on *ber* due to thorns and *kusum* due to bigger size) are not there in *C. calothyrsus*.
- Labour cost is reduced as it is a bushy shrub and women farmers can also easily cultivate lac on *C. calothyrsus.*

- *C. calothyrsus* leaves can be used as green fodder and wood can be used for fuel purposes.

Since, *C. calothyrsus* is a bushy and quick growing host plant and support both strains of *K. lacca,* therefore farmers can save energy in lac culture operations and it can be taken up on a plantation scale for lac cultivation and in lac integrated cropping system (LICS) to get additional income.

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Fusarium oxysporum - A new record of native Entomopathogenic fungi isolated from lablab bug, *Megacopta cribraria* (Hemiptera: *Plataspidae*) pest of *Flemingia semialata* in Assam

Stink bug or lablab bug, *Megacopta cribraria* (Hemiptera: *Plataspidae*) is an agricultural pest of lablab beans and other legumes and is native to India and China. This bug has been also recorded as a serious pest of *Flemingia semialata*, a host plant of lac insects in Assam. The adults of *M. cribraria* are small in size, about 4.47 mm long and 3.5 mm wide, brown in colour, active and strong fliers. Occurrence of this pest in the lac ecosystem has been recorded during the month of July to November with a peak during the month of September. The nymphs and adults feed on tender stems, petioles, and leaves by sucking the sap. Heavy infestation of this pest leads to secondary infestation of sooty mould and further leads to complete defoliation of the plant. Continuous monitoring in the Regional Field Gene Bank, Department of Entomology, Assam Agricultural University, Jorhat (Latitude: 25°45 N, Longitude: 93°30 E) revealed the occurrence of *M. cribraria* population abundantly in *Flemingia* crop and some of them were infected with white fluffy growth and they could not fly actively as compared to normal adult bug. The infected bug was collected for identification in the laboratory. The sporulated cadavers were inoculated on fresh Potato Dextrose Agar plates with streptomycin sulfate and incubated in BOD incubator at a temperature of 26 ± 1°C for 15 days for complete sporulation. Further, the pure culture was maintained by sub culturing the isolate. Pathogenicity test confers its efficacy on this pest. Efficacy of this isolate was again tested on some Lepidopteran pests of rice such as *Cnaphalocrocis medinalis, Pelopidas mathias, Psalis pennatula* which showed a promising result against rice leaf folder, *C. medinalis* with 10-20% mortality after 10 days of treatment. Fungal morphology was studied under light microscope at 40 X. These fungi had both macroconidia and microconidia and its chlamydospores were round and thick-walled with a diameter of 11.12 µm. Molecular characterization of the *Megacopta sp.* isolate was carried out by using ITS rRNA. Hence the fungus has been conferred as *Fusarium oxyosporum* and its GenBank accession number was assigned as OP389110. This is the first molecular characterization of *Fusarium oxysporum* isolated from the *Megacopta cribraria,* insect pest of the Lac host plant (*F. semialata)* and it is the first report related to isolation and molecular characterization of *Fusarium oxysporum* from insect cadaver (*Megacopta cribraria*) in Assam.

***Megacopta crabraria* recorded in RFGB, AAU, Jorhat**

White fluffy growth on *Megacopta crabraria*

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Description of a new host plant Showy *Desmodium* (*Phylldoium pulchellum*)

Taxonomical classification

Kingdom: Plantae
Phylum: Tracheophyta
Class: Magnoliopsida (Angiosperms)
Order: Rosales
Family: Fabaceae
Genus: *Desmodium*
Species: *Pulchellum*
Botanical name: ***Phylldoium pulchellum (L.) Benth.***

Synonyms: *Desmodium pulchellum* (L.) Benth., *Dicerma pulchellum* (L.) DC., *Hedysarum pulchellum* L., *Meibomia pulchella* (L.) Kuntze & *Zornia pulchella* (L.) Pers.

Common Names: Showy Desmodium

Vernacular Names

English: Showy Desmodium
Hindi: Jatsalpan
Kannada: Kadunhuralite, Jenukaddi, Kadumuduru
Malayalam: Katumudura, Kattumutira
Sanskrit: Lodhrah, Lodram
Tamil: Vellalothi
Telugu: Kondontinta, Karrantinta
Assamese: Ursi
Odisha: Salaparni

Distribution

The plant is distributed in the tropical areas and widely distributed in Bangladesh, India, Srilanka, and Southern China.

Description (Fig. 1)

Trunk and Bark

Phyllodium pulchellum is a stoutish shrub (1.2 – 1.5m high), characterized by its finely grey-downy branches i.e. each branches culminates with inflorescence

Leaves

Leaves are trifolioate, ovate to oblong leaflets, narrowly triangular stipules, orbicular persistent bracts which conceal the flowers and fruits. The middle one being oblong and more than twice as large as the lateral ones.

Flower

The inflorescence is racemes borne terminal or axillary. The bracts are leafy, orbicular, each enclosing few flowers. Flowers are typical Papilionaceous with yellowish Corolla.

Fruit

Pods are indented on both sutures, sessile; joints usually 2, slightly longer than broad, pubescent.

Seed

Seeds are orbicular

Flowering

September-October

Fruiting

November-December

Uses

Showy Desmodium is used in folk medicine in cold and fever, malaria, excessive menstrual flow. Leaves are applied to ulcers. Decoction of bark is used for diarrhea, eye afflictions. Decoction of flowers is used for bile and liver afflictions.

In India, paste of root mixed with sugar candy is used for abdominal and chest burning discomforts. In Bangladesh, bark decoction is used in hemorrhage diarrhea, poisoning and eye diseases. Flowers are used in biliousness. In Andhra Pradesh, India, leaves are used for treating wounds.

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a. *Desmodium pulchellum* a. Tree

b. Lac encrustation

c. Stem

d. Flowers

e. Pods

f. Leaves

Scope for laboratory synthesis of aleuritic acid

Aleuritic acid, a major component of lac resin is chemically tri-hydroxy derivative of palmitic acid (9,10,16- trihydroxy palmitic acid). It contributes about 35-40% of the total resin secreted by the lac insects. Due to the use of aleuritic acid in the perfumery industry as the starting material for the synthesis of perfumery compounds *viz*., ambrettolide, iso-ambrettolide, civetone and related compounds, it is highly demanded by the global market. The main sources of aleuritic acid are seedlac, shellac, and de-waxed shellac which are products of lac insects.

Applications of aleuritic acid

1. Aleuritic acid is used as a starting material for the preparation of macrocyclic "musk" perfumery compounds such as ambrettolide, iso ambrettolide, civetone dehydro-civetone, isocivetone, exaltone, dihydroambrettolide, exaltolide and their analogues.
2. It is used in synthesizing dilactones, substituted coumarin derivatives, and other bioactive compounds like prostaglandins, cyclin ureides, insect sex pheromones, and their analogues, juvenile hormone analogues, plant growth regulators, compounds of pharmaceutical interest, *etc*.
3. It is used to synthesize glucose monoaleuritate and L-arginine aleuritate which have high calorific value and are used for weight gain purposes as a substitute for dietary tripalmitin.
4. It is used for the preparation of antiultraviolet radiation proof and high-temperature resistant aerospace material as well as transparent water clear adhesive and plasticizers.
5. Aleuritic acid also has its application in the food packaging industry, as it can be used in the preparation of insoluble and infusible polyhydroxy ester films which are harmless and thermostable.
6. It may be used as a substitute for alpha-hydroxy acid, which is widely used in skin care formulations, such as sun protection lotions/creams, anti-aging preparations, and anti-wrinkle preparations.

Aleuritic acid market

India exported aleuritic acid to countries such as China, Switzerland, Netherlands, France, USA, Nepal, Spain, Japan, and Kenya. According to the data, in the year 2020-2021 (Apr-Nov), India exported aleuritic acid worth 6.67 million USD to countries such as China, Switzerland, Netherlands, and France. There is a large gap existing between the actual and potential production of aleuritic acid in our country. Compound annual growth rates for aleuritic acid over the period 1998-99 to 2018-19 were estimated to be 3.95%. There is a stable demand in the overseas market as revealed by the instability index. The domestic demand for aleuritic acid is steadily increasing over the years due to the establishment of new manufacturing units for ambrettolide in different regions of India. Future market predictions for aleuritic acid for the period 2019-20 to 2029-30 also showed a positive trend.

Production of aleuritic acid

At present, aleuritic acid produced on an industrial scale is from shellac through alkali hydrolysis method. In this method isolation of its sodium salt is done by saponification followed by the decomposition of the salt to obtain the free acid. This method takes around 10 to 15 days and the recovery is only 11-13% of the original content. Hence, there is a great scope for developing alternative methods which takes less time and gives more yield. *In vitro* production of aleuritic acid in the bacterial system using lac insect genes would be one such approach. However, this method poses challenges such as the expression of functional lac enzymes (eukaryotic origin) in the bacterial system (prokaryotic origin).

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Biotechnological interventions in climate smart ecosystem and productive insects

Scientists from Sher-e-Kashmir University of Agricultural Sciences and Technology-Jammu under DBT funded project aimed to scientifically validate people's perception regarding decline of ecosystem services, ecosystem natural enemies, decomposers and productive insects, *etc*. In limited trials conducted during last three years, significant decline was observed in population of *Apis* and Non –*Apis* bees (57.89 -

69.41%), natural enemies (58.09 – 61.13%), and scavengers (60.83 -70.32 %) in non-forest areas as compared to forest areas. The profound negative effect of CO_2 concentration was also found on the abundance of *Apis cerana* colonies and the effect varied up to the magnitude of 91.31%. To mitigate this issue, traditional hives were placed in different places which significantly increased the occupancy rate of *A. cerana* bees by 85.08% in three years. Furthermore, artificial nesting sites (bee houses) also resulted in 61.19 – 75.06% increase in the population of non-Apis bees. Managed pollination in forest ecosystem led to an increase in the fruit yield from 34.6 to 63.8% in peach and 12.9 to 20.59% in plum, respectively.

Beekeepers' perceptions regarding mortality in bees due to *Lantana camara* scientifically were validated. During the study, a strong correlation was observed between floral visits and bee mortality during dearth period (0.859) in comparison to honey flow period (0.098). Significantly higher intake of nectar from *L. camara* was also observed at sites close to apiary (0.57 µl) as compared to sites distant to apiary (0.26 µl) during the dearth period only. Furthermore, it was also found that significantly more number of bees died at higher concentrations and the maximum level of mortality was 15.77% in honey flow period and 46.58% in dearth period. To mitigate these issues, colonies were fed with supplementary material (honey + nectar) during the dearth period which reduced the mortality from 46.58 to 25.09%. Lantadene extract (extracted from *L. camara*) mixed with candy brought a significant reduction varying from 41.69 to 100% in Varroa mite infestation.

Apis mellifera resilient to high temperature and high CO_2 have been sorted out. Colony record for the past 4 years for *A. mellifera* was maintained for evaluation of climate smart bees with the promising hives exhibiting the most desirable characteristics. The three different selections are being maintained. Furthermore, climate resilient bees are being subjected to queen rearing. Among the 11 strains of lac insects maintained in the gene bank, Gole market strain was found as climate resilient. Inoculation of broodlac cells in meshes along with timely spray of Indoxacarb/spinosad and Bavistin further reduced the parasitism up to 97.71 % in last three years.

Lac insects with Normal CO_2 **Lac insects with Elevated CO_2**

RK Gupta
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Climate smart Beekeeping practices

Can plants communicate?

Have you seen the movie Avatar? The Pandora land, where everything was big and magnificent, be it humans, animals, birds, or trees. The interesting fact was that everything was linked to each other. If humans had to ride a horse or fly with a bird, they needed to attach their strings. Roots of one gigantic tree were attached to the other entire flora. All the creatures of Pandora land could communicate with each other, even species from two different kingdoms.

What about earth? Yes, we don't have ponytails that can be attached to animals and birds. Also, gigantic trees whose roots can spread to entire flora do not exist. But, is it possible for plants to communicate with nearby plants? The answer is YES! Is it possible for plants to communicate with humans? The answer is YES!

Plants can get information about threats, possible rivals, and hosts for plant parasites, as well as specifics about symbiotic relationships, through the transmission and perception of signals from nearby plants. Plants release signals as root exudates and volatiles to communicate inter- and intra-specifically. Besides chemical signals, plants also release microRNA (miRNA) as signals for communication. miRNAs are a class of single-stranded non-coding RNA of about 20-22 nucleotides that can regulate gene expression in both plants and animals.

Previously, it was considered that miRNAs were produced and functional in the same cell or nearby cells connected via plasmodesmata. However, the presence of miRNAs like miR399 and miR156 in phloem sap indicated their role in long-distance signalling and established that it can be transported throughout the entire plant. In a recent study, it was also discovered that miRNA is one of the signals used during plant communication. Though the roots of plants are not attached, they can release miRNA signals which can travel to neighboringg plants and change their gene expressions.

Plants can also establish cross-kingdom signalling via diet/ plant derived miRNA. In 1998, it was first discovered that dietary derived small RNAs (sRNAs) can influence gene expression in *Caenorhabditis elegans* through RNA interference. In a wide range of lower eukaryotes or invertebrates, natural uptake of diet-derived miRNAs or dsRNAs (double stranded RNAs) is well known to be biologically effective. Simpler metazoan organisms can uptake sRNA from environmental sources, including diet. Although nothing has been directly proven but diet/ plant derived miRNA has also been reported in human and mice. One of the miRNA, miR2911 found in honeysuckle, a well-known Chinese herb used for the prevention and control of epidemic diseases, was not degraded during the decoction preparation through boiling. Feeding decoction of honeysuckle to mice resulted in the elevation of miR2911 in the sera and lungs. The term nutrimirnomics has also been coined to underline how miRNAs and nutrition are closely related. It has also been shown that diet can significantly influence the expression of miRNAs.

Here, at ICAR-NISA, we work on natural resin – lac, which is produced by the tiny insect of the genus *Kerria*. They feed on the phloem sap of host plants and complete their whole life cycle on a single host only. These insects suck the phloem sap which is a complex nutrition rich in sugars, amino acids, vitamins, and organic and inorganic acids. The major components of phloem sap are sugars and amino acids. Apart from nutrients, it also carries different miRNAs which may play an important role in the growth and development of lac insects. Finding the miRNA in the phloem sap of host plants and their role in lac insects can not only open new avenues in exploring secondary diet for these insects but also increasing specific miRNAs through micro RNA encoded peptides (miPEPs) can help in increasing lac production at low cost and high efficiency.

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4	Joint Secretary	Dr. MF Ansari
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