



ISSN NO. 2320-5407

Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/13842
DOI URL: <http://dx.doi.org/10.21474/IJAR01/13842>



INTERNATIONAL JOURNAL OF
ADVANCED RESEARCH (IJAR)
ISSN 2320-5407
Journal Homepage: <http://www.journalijar.com>
Journal DOI:10.21474/IJAR01

RESEARCH ARTICLE

WILD ROSEHIPS (*Rosa moschatasyn brunonii*): SUSTAINABLE LIVELIHOOD OPTION AMONG WOMEN IN NORTH WESTERN HIMALAYA OF KULLU VALLEY, HIMACHAL PRADESH, INDIA

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Manuscript Info

Manuscript History

Received: 30 September 2021
Final Accepted: 31 October 2021
Published: November 2021

Key words:-

Rosehips, Women Saving and Credit Groups, Sustainable, Livelihood

Abstract

The paper describes the status of wild rosehips (*Rosa moschata syn brunoni*) in the Northwestern Himalayan district of Kullu Valley, Himachal Pradesh, India. Research work was carried out with the Women Saving and Credit Groups in the rural parts of the district which emerged as a sustainable livelihood option in the region while conserving natural resources.

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Introduction:-

Rosa moschata syn brunonii(Rosaceae) is one of the most commonly found wild rose species in Northwestern Indian Himalaya among 120 rose species distributed throughout the world (Sharma et al. 2012). Indian Himalaya Region (IHR) covering 11 States and one Union Territory harbors 10 different species of wild rose in which *Rosa moschata syn brunonii* is mostly found in Kullu Valley of Himachal Pradesh (Kaul et al. 1999). In Kullu Valley, this wild rosehip species is locally called as 'Kujja' and 'Nunu'. The species is native to Afghanistan, Pakistan, Nepal, Si-Chuan, Europe, South Africa and South Andes(The International Plant Names Index). It is found abundantly in higher (1800-4000 m amsl) altitude as compare to low altitude (1100-1300 m amsl) of Kullu Valley (Sharma et al. 2012). *Rosa moschatasynbrunoni* is a wild bush which have inimitable musky aroma and is characterized by morphology as single white flowers arranged in corymbs or cymes, pinnate leaves, purplish thorn, red or orange color fruit (Verma et al., 2011). Different species of rose has been extensively used in floriculture industries and pharmaceutical industries for its wide range of uses and medicinal properties (Mahmood et al. 1996). Numerous studies have been reported for its benefits and chemical composition across the globe (Phetcharat et al., 2015; Cavalera et al., 2016). The rosehip species is also reported to have rich vitamin C content, high antioxidant properties, and is useful as antimicrobial, diuretic, dermatitis, antispasmodic effect, eczema, sunburnt skin, healing scarring and diminish photo-aging properties (Demir and Ozcan, 2001; Basim and Basim, 2003; Erenturk et al., 2010). It has high antioxidant activity, anti-inflammatory action, anti-diabetic and anticancer effects also (Marmol et al., 2017). Fruit of *Rosa moschata* is very rich in minerals, vitamins, bio-active compounds (Karami et al., 2016). Use of species root by local for treating eye disease and joint pain relief are also documented by researchers (Kaul et al., 1999; Shashni et al., 2017). In some parts of world, rosehips are used to make soup, tea, jam, jelly, soap and many other skin care products (Brinkworth et al., 1992). Bulgaria and Turkey are the major producer of rose oil with 5 metric tons of oil and had become major producers of rose oil worldwide (Verma et al., 2011). Rose oil is one of the most expensive essential oil due to its low yield and lack of natural and synthetic substitute (Verma et al., 2011). Rosehip seed oil obtained from *Rosa canina* and *Rosa rubiginosa* is available in the international market and

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recommended for pharmaceutical, cosmetic and nutritional purposes (Dabrowska et al., 2019). But the other species seed oil and their usage pattern is still underutilized. In India, especially in IHR no such work has been carried out in terms of harnessing its economic benefit. Therefore, to harness the same and promote it as a sustainable livelihood option among women in the Kullu Valley of Himachal Pradesh current activity was carried out.

Materials and Methods:-

From 2014 to 2019, all the literature work, research, field work, women mobilization through women saving and credit groups (WSCGs), awareness, capacity building on harvesting and post harvesting techniques, value addition in terms of procurement, processing, product development, testing, labelling and marketing of the rosehip was done.

1. Resource Mapping and WSCGs: Resource mapping was done in the Gadsa region of Kullu valley where the maximum population of the species was found (Figure 1). The activity was carried out in the rural areas of Kullu valley involving 203 women members with 22 groups which were pre formed by the JAGRITI a community-based organization. They were involved in various steps of value addition in rosehip enterprise. Around 800 women were also sensitized on the sustainable harvesting and post harvesting technique of rosehips. During the three years project implementation period women based enterprise was developed for their socio-economic benefit and sustainable livelihood pattern.
2. Harvesting and post harvesting techniques: Rosehips were harvested between 15th October to 15th November every year when it is completely matured. After that rosehip are dried for 15 to 20 days first day in sun and shade dry afterwards. Once the rosehips are completely dried these are decoded in shredder machine and outer shell, seeds and hairy parts are separated. Outermost covering of the rosehips is used for making tangy herbal tea and seeds are used for oil extraction.
3. Product development: Two products as rosehip tea and rosehip seed oil has been developed from the species. Tea was developed through the rosehip outer shell and oil was extracted from the seed through supercritical extraction method.
4. Product Testing: Extract preparation was performed according to Chandra et al., 2014 with slight modifications. Shade dried, cleaned and grounded Rosehip cover (20 gm) was boiled for 30 minutes in 100 ml of water. The solvent extract was then evaporated under reduced pressure at 40°C using a rotary evaporator to obtain semi-solid materials. The semi-solid material is then processed using lyophilizer. The semi-greasy extract is obtained after lyophilization which yields 37.92%. The extract was stored in 4°C for further analysis.

Total Phenolic Content:

The total phenolics content were determined using the Folin-Ciocalteu method (Baba & Malik, 2015). 200 µl sample (10 mg/ml) was made up to 3 ml using distilled water and 500 µl of Folin-Ciocalteu's reagent was added. The mixture was allowed for sonication thoroughly for 3 min. 2 ml of 20 % (w/v) sodium carbonate was added and incubated for 1 hr in dark. The absorbance was recorded at 765 nm using UV-Spectrophotometer (Ultraspec 2100 Pro, Healthcare Biosciences AB, Uppsala, Sweden). The total phenolic content was calculated as Gallic acid equivalent (GAE) by the following equation:

$TPC = (C \times V) \div M$ (Where TPC is the total phenolic content in GAE mg/g, C is the concentration of Gallic acid obtained from the standard calibration curve, V is the volume of the extract solution in ml and M is the weight of the extract in g) (Genwali et al., 2013).

Total Flavonoid content:

The total Flavonoid content was analyzed by the aluminum colorimetric method (Chang et al., 2002) with slight modifications. 50 µl (10mg/ml ethanol) made up to 1ml with 80 % methanol and 4 ml of distilled water with 300 µl of 5% NaNO₂ were mixed in the solution. The mixture is allowed to stand for 5 min and 300 µl of 10 % AlCl₃ is mixed in the solution. After 6 min 2 ml of sodium hydroxide solution were added and made up final volume 10 ml with distilled water. The solution is mixed thoroughly by sonication and absorbance was recorded after 15 min at 510 nm using UV-Spectrophotometer. The total flavonoid content was calculated using the equation.

$TFC = (C \times V) \div M$ (Where TFC is the total flavonoid content in rutin equivalent per g dry weight, C is the concentration of rutin obtained from the standard calibration curve, V is the volume of the extract solution in ml and M is the weight of the extract in g) (Genwali et al., 2013).

Antioxidant properties 2,2-Diphenyl-2-picryl hydrazyl radical scavenging assay DPPH (2,2-Diphenyl-2-picryl hydrazyl) Radical Scavenging Activity was performed according to the method (Brand-William et al., 1995) with

slight modifications (Akter et al., 2010). In brief, 1mg/ml stock solution was diluted to a series (25 μgml^{-1} -200 μg^{-1}) with 70% (v/v) methanol. 2.8 ml 0.06 mM DPPH is mixed and absorbance at 517 nm against methanol as a blank was recorded using UV- Spectrophotometer after incubation at 37°C for 30 min. The DPPH radical scavenging activity as percentage inhibition was calculated by the equation:

$\% \text{ inhibition} = [(\text{Abscontrol} - \text{Abssample}) \div \text{Abscontrol}] \times 100$ The standard calibration curve was plotted against different concentration and DPPH scavenging. The concentration of the sample necessary to decrease the DPPH concentration by 50% was obtained by interpolation from linear regression analysis and denoted as IC₅₀ value ($\mu\text{g/ml}$).

Ferric-reducing antioxidant power assay:

FRAP assay (Ferric-reducing antioxidant power) was performed as per the method (Benzie and Szeto, 1999) with slight modifications. The stock solution was prepared with mixing of 300 mM acetate buffer with pH 3.6, 10 mM TPTZ in 40 mM HCL, and 20 mM FeCl₃.6H₂O solution. The working solution includes 25 ml of acetate buffer, 2.5 ml of TPTZ and 2.5 ml of FeCl₃.6H₂O. Different dilutions were made using sample distilled water and FRAP reagents 0-100 μl . A blank solution was prepared by mixing of 2 ml FRAP reagent with 1 ml H₂O. All the concentrations for recording absorbance were allowed to stand for 30 min in the dark and after that optical density was recorded at 593 nm using UV- Spectrophotometer.

For the fatty acid composition of the rosehip seed oil AOCS method was used.

Certification and marketing: FSSAI certification of the products were also done for the wider marketing and acceptability among consumers. Marketing of the developed products were also done through various regional, state and national level agencies.

Results and Discussion:-

Women Saving and Credit Groups: Awareness programmes on wild rosehips and its sustainable harvesting and post harvesting techniques was organized among the women saving and credit groups. They were educated on the economic and healthcare benefits of the rosehips. Training on sustainable harvesting practices such as time of collection, collection method, amount of collection and post harvesting techniques such as cleaning, sorting, drying, storage and packaging were imparted (Figure 2).

Protocol for sustainable harvesting and post harvesting techniques: Protocol for sustainable harvesting and post harvesting techniques were developed. Sustainable harvesting protocol includes; proper time of harvesting when rosehips are completely matured, harvest only 60 to 70% from the plant, avoid cutting of branches while harvesting, use of scissors and gloves and transportation of produces in clean dry sacks. Post harvesting techniques includes proper grading (discard unwanted rosehips), drying (sun dry for first day followed by shade dry for next 15 to 20 days), storage (clean, dry and tight containers), processing (deshelling, cleaning and separating pods, seeds and hair), product development (maintaining hygienic condition), packaging and labelling techniques were imparted.

Product development:

On the basis of project implementation two types of herbal/natural product were developed from the wild rosehip (*Rosa moschata*) species. The product developed are rosehip tea and rosehip seed oil (Figure3).

Testing:

Products developed from the rosehip such as tea and oil has been tested for various physicochemical parameters. Total phenolics and flavonoids in the rosehip tea was found 660 \pm 1.52nmg GAE/g and 498 \pm 0.50 mg Rutin/g. While antioxidant activity of DPPH was found 2.72 \pm 0.01 AAE $\mu\text{g/ml}$ and FRAP 32 \pm 3.14 μM ascorbic acid value. The fatty acid composition of seed oil was identified and measured as palmitic acid (4.71 %), stearic acid (2.56 %), oleic acid (10.28 %), linoleic acid (54.84 %), α -linolenic acid (21.46 %) and γ -linolenic acid (<0.01 %) using International Organization for Standardization (ISO) 5508:1990 & 5509:2000 method. The products have shown good results on various parameters hence can be taken as a good healthcare product in terms of tea and face oil.

Enterprise development:

FSSAI certification of the product developed from the rosehips has been done for its wider acceptance in the market. currently, products are fetching a good return in the national and international market. The products are marketed

through various regional, state and national level agencies. With this entrepreneurial activity the women enterprise earned the net amount of INR 9,00,000/- (USD 12,111/-) during three years' time period.

Conclusion:-

The rosehip-based enterprise in the Kullu Valley is running successfully even after the completion of the project activity. To make it more sustainable and economically viable further the focus should be given on developing a basket of products. The activity in the region is continuously uplifting the socioeconomic condition of women and conserving the natural resources. From the activity it is very clear that various semi wild forest produces has a potential to develop a local livelihood provided sustainable harvesting and post harvesting techniques are inculcated and resultant economic value is recognized.

Acknowledgements:-

Author highly acknowledge Director, G. B. Pant National Institute of Himalayan Environment, Kosi – Katarmal, Almora, India for providing the necessary facility at Himachal Regional Center of the Institute. Authors also acknowledge all the members of Women Saving and Credit Groups of Kullu Valley which were preformed by the JAGRITI a community-based organization.



Figure 1:- Wild Rose Bush and Rosehips after maturation.



Figure 2:- Women Saving and Credit Groups training programmes; Harvesting of Rosehips; Harvested Rosehips; Women Selling Rosehips.



Figure 3:- Rosehip mint tea packed in container; Rosehip tea packed in tea bags; Rosehip seed oil packed in amber bottle.

Authors Contributions

Authors were the research team of the project and carried out all the research and developmental activities of the project. Authors also wrote the manuscript.

Funding's

The study was funded by Department of Science and Technology, New Delhi, India under the Project No: SEED/WS/005/2015.

Competing Interests

The authors declare that they have no competing interests.

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