ISSN 2394 - 9554

International Journal of Research in Science and Technology

Volume 5, Issue 2: April - June 2018

Indian Academicians and Researchers Association
www.iaraedu.com

International Journal of Research in Science and Technology

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Research Papers

International Journal of Research in Science and Technology
Volume 5, Issue 2 : April - June, 2018
ISSN 2394 - 9954

AN ELECTRONIC ATTENDANCE SYSTEM USING ARDUINO UNO

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ABSTRACT
Attendance is one of the work ethics which is valued by most employers in educational institution. Attendance of the students and academic success are co- related. Therefore, there is a need of proper attendance management systems as well. Most of the educational institute and government organization in the developing countries still use paper based attendance systems.

Our project aims to design the student's attendance system which could effectively manage attendance report of the students in the institute like "Modern College of Arts, Science and Commerce, Ganeshkhind". Fingerprint is considered to be the best and fastest method for biometric identification. The experimental result suggest that many fraudulent issues can overcome using fingerprint based attendance system and improves the reliability of the attendance records.

Keywords: Biometric, Fingerprint, Attendance, Optical Sensor, Arduino

INTRODUCTION
Attendance of the employees is an important factor in the organizations like educational institutions, industries, hospitals etc. In the manual method attendance is recorded on a paper. In the colleges student's everyday attendance record is maintained on paper by taking their signature in the class. This method is cumbersome and time consuming. a lot of researchers and designers have come up with various other methods in taking attendance. Some of these methods include: Web-Based**,** Smart Board, Mobile devices**,** RFID chips and Biometric based attendance system [4]. Comparison of different biometric techniques has shown that fingerprint biometric is a reliable, mature and legally accepted biometric technique]. Therefore, Fingerprint based attendance system can be used for identification of large number of students in universities [8].

A solution to overcome this problem is an Electronic attendance system that will record the attendance automatically by taking just a fingerprints of the present students. This paper present a fingerprint based biometric system that records the attendance automatically. The system consists for a fingerprint sensor which is used to detect the person's identification. For Example, in educational system, the student needs to place their finger on fingerprint sensor to obtain their attendance. By making use of this system, we overcome this issue such as proxy signatures, so no student can give attendance for their friend who is absent. At the end we can generate the reports for the further analysis.

From manually marking the attendance in attendance registers to using high-tech applications and biometric systems, these systems have improved significantly. It can also be designed using RFID and AVR microcontroller, 8051 and raspberry Pi. In this project, In the present study fingerprint Module and Arduino are used to take and keep attendance data and records. By using fingerprint sensor, the system will become more secure for the users. Following sections explains technical details of making **a fingerprint based biometric attendance system using Arduino.**

SYSTEM OVERVIEW
Required Components
1. Arduino.
2. Fingerprint Module.
3. Push Buttons.
4. L.E.D.'s.
5. Resistor (1K, 2.2K).
6. Power Supply.
7. Connecting Wires.
8. 16*2 LCD.
9. RTC Module.

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FINGERPRINT SENSOR

Fingerprint sensor module captures finger's print image and then converts it into the equivalent template and saves them into its memory as per selected ID by Arduino. All the process is commanded by Arduino like taking an image of finger's print, convert it into templates and storing as ID etc.

This is optical fingerprint sensor module with TTK UATR interface for direct connection to microcontroller. the user can store the fingerprint data in the module and can configure it in 1:1 or 1: N mode for identification of person. The Finger Print module can directly interface with 3V or 5V microcontroller.

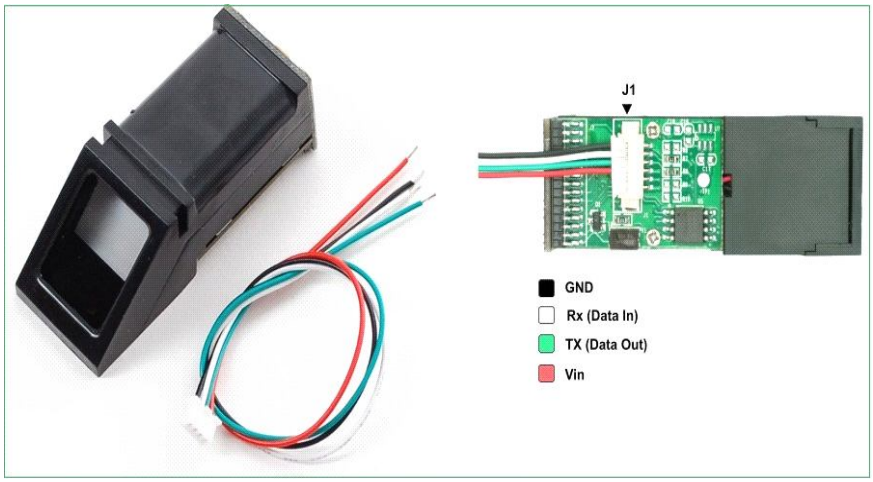

Figure 1

ARDUINO UNO MICROCONTROLLER

Arduino is an open source computer hardware and software company, project and user community that designs and manufacture kits for digital devices.

The present work is based on family of microcontroller design primarily by smart projects, using various 8-bit Atmel AVR micro-controller or 32 bit Atmel ARm processions. These systems provide deter of digital and analog inputs, outputs pins. That can be interfaced to various extension board and other circuits. The board feature serial communication interface, including USB on some models for loading programs from computer. For programming the micro-controller, the Arduino platform provides integrated developing environment (IDE) based on the processing project, which include support for C & C++ programming language.

Figure 2

ARDUINO UNO MICROCONTROLLER

A Light Emitting Diode is a two lead semiconductor light source. It is P-N junction diode it emits light when activated. When a suitable voltage applied to the leads, electrons are able to recombine with holes within the device, releasing energy from photon's.

Figure 3

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JUMPER WIRES

The wires are used for connecting the fingerprint sensor to Arduino and from Arduino to bread board. Only through these connecting wires power is supplied to the system and simultaneous operation are performed.

Figure 4

LED DISPLAY

It is the message for the user after performing the corresponding action. It is used as an indicator to show the communication between User and the sensor LCD display shows the acknowledgement of the given presence.

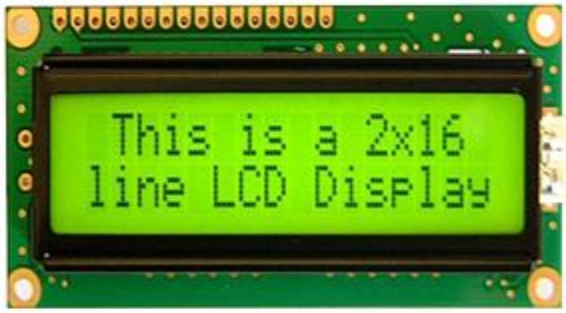

Figure 5

BLOCK DIAGRAM OF PROJECT

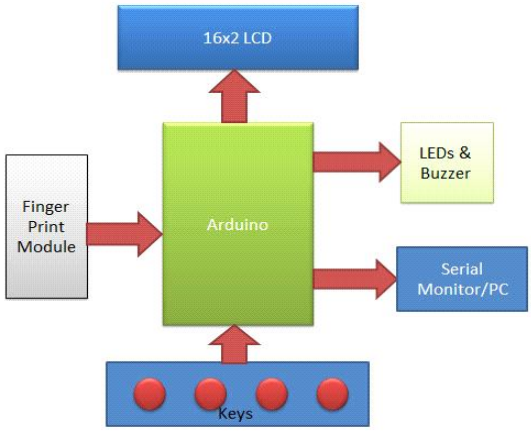

Figure 6

DETAIL CIRCUIT DIAGRAM

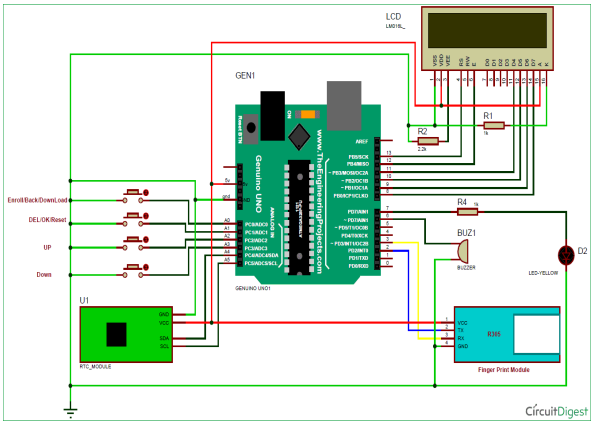

Figure 7

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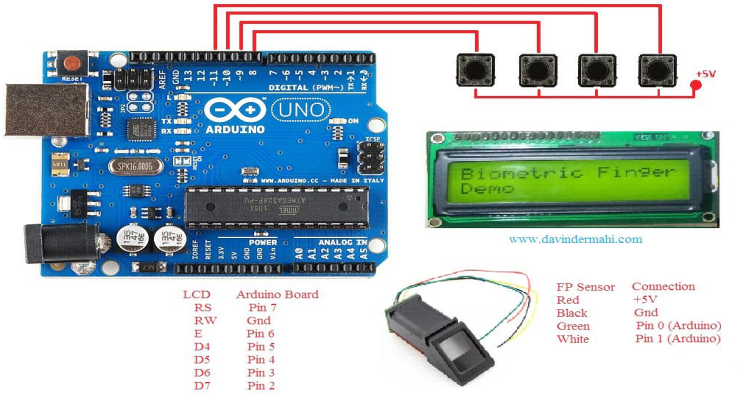

Figure 8

4.1 EXPERIMENTAL SETUP

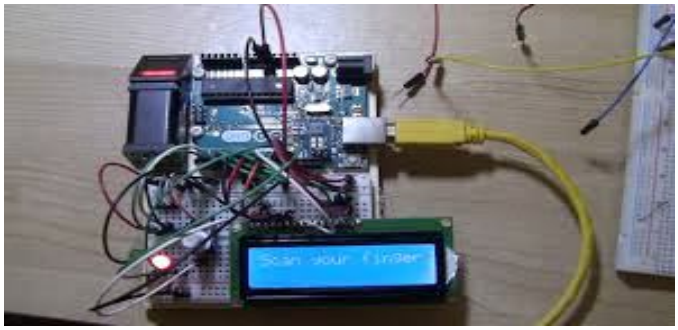

Figure 9

WORKING

Working of this fingerprint attendance system is fairly simple. First of all, we need to enroll fingerprint of the user with the help of push buttons. To do this user need to press ENROLL key and then LED asks for entering ID for the fingerprint to save it in memory by ID name. So now user needs to enter ID by using up/down keys after ID. User needs to press OK key (DEL key). Now LED will ask to place finger over the fingerprint module and then module takes finger image.Now the LED will say to remove finger from fingerprint module and again to place finger again. Now user needs to put his finger again and module take image and coverts it into templets and store it by selecting ID into fingerprint module. Now the user will be register and he/she can feed attendance by putting their finger over fingerprint module. By the same method, all users will be resister into system.

Whenever user places his finger over fingerprint then fingerprint module capture finger image, and search finger image, and search if any ID is associated with this fingerprint in the system. If fingerprint ID is detected, then LCD will show match found and in the same time buzzer will be once and LED will turn OFF until system is take input again.

WORKING ATTENDANCE SYSTEM FLOWCHART

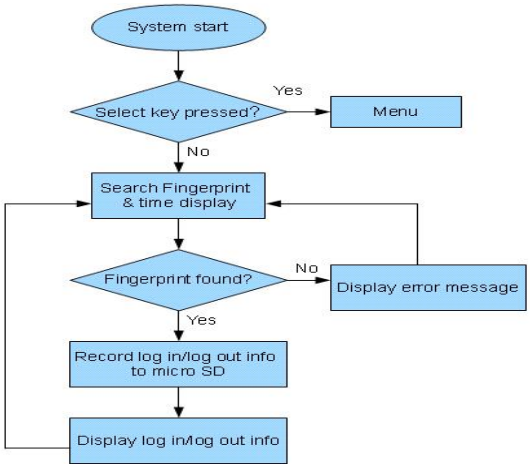

Figure 10

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FUTURE SCOPE

The attendance management system can be improved by adding the feature that indicate if the employee or student is late. Some of the future enhancement for this are to be extended

1) Details of the student like Full name, Roll number,.Semester, Gender.

2) The system can be enhanced to track the arrival and exit time of the student for additional monitoring.

3) It provides accuracy and reliability.

4) Easy way to communicate with the management team.

5) Eliminates errors and saves time.

6) Spend less time on calculating payroll of each

CONCLUSION

Biometric technology is an effective tool to verifying identify and detect fraudulent issues. Analysis confirmed that the biometric data can be set and confirm the identity of the user. Expanding the user of biometric will be enhance the ability to detect fraudulent issues in the presence of the student in the class or employee in an organization. In terms of efficiency and performance, the present work has provided a comparison with the traditional method attendance system. By using the flash memory, the data is well structured. This system is user friendly and very reliable. Therefore, that can be implemented either in organization or educational institutions

ACKNOWLEDGMENTS

We are thankful to the Department of Electronics and Mr Deepak Kumbhar for their support and guidance. towords the development of the project.

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International Journal of Research in Science and Technology
Volume 5, Issue 2 : April - June, 2018
ISSN 2394 - 9954

SYNTHESIS AND ANTIMICROBIAL ACTIVITY OF SOME NEW 2-NITROPHENOL INCORPORATED AZO DYES

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ABSTRACT
Some new azo dyes containing 2-nitrophenol moieties were synthesized by coupling 2-nitophenol with the diazonium salts of different aromatic amines Aniline, o-Nitro aniline, p-Toluedine, α-Naphthylamine, Sulphanilic acid, m-Nitro aniline, Benzedine and Anthranilic acid. Structures of newly synthesized confirmed using the IR and NMR spectra. Theses dyes also tested for antimicrobial activity by using disc diffusion method. The compounds analysed for its antibacterial action showed moderate to significant inhibitory effect at some specific concentrations against the tested pathogens.

Keywords: Azo dyes, 2-nitrophenol, antimicrobial activity.

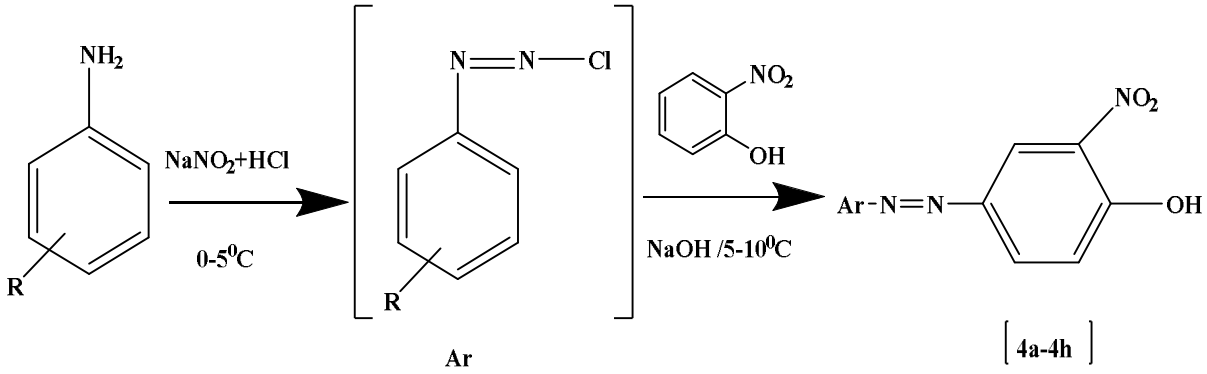
INTRODUCTION
Azo dyes are the most important group of synthetic colorants. The compounds containing azo moieties are of great importance because of a wide range of applications such as organic dyes[1], indicators [2], radical reaction initiators [3] and therapeutic agents [4]. Azo dyes are in use as dyestuffs for wool, leather and synthetic fabrics due to their excellent coloring properties [5]. These compounds have also received special attention in coordination chemistry due to their mixed hard–soft donor character and versatile coordination behavior [6-9]. Azo compounds are the most fundamental class of commercial dyes and are well colored that have been used as dyes and pigments[9, 10]. Azo compounds are known to be involved in a number of biological reactions such as inhibition of DNA, RNA and protein synthesis, carcinogenesis and nitrogen fixation[5, 6] also known for their use as antibacterial[12-17], antifungal, antiseptics, anticancer, anti-inflammatory and other useful chemotherapeutic agents[18-21].

In the present research work 2- is coupled with diazonium salt of eight different aromatic amines VIZ: Aniline, o-Nitro aniline, p-Toluedine, α-Naphthylamine, Sulphanilic acid, m-Nitro aniline, Benzedine and Anthranilic acid.

METHODS AND MATERIALS
All the chemicals used in these experiments were of analytical grade. All the melting points were determined by open capillary method and are uncorrected. The products were confirmed by ^{1}H NMR (Burker avernce II 400 NMR Specrtometer) and IR technique (Shimatzu). The biological activity was evaluated against two kinds of bacteria gram positive and gram negative. The products were recrystallized by ethanol as solvent.

GENERAL PROCEDURE FOR SYNTHESIS OF AZO COMPOUNDS
Substituted aromatic amines (0.01mole) were mixed with 2.5 ml conc. HCl and 2.5 ml (4N) cold solution of $NaNO_2$ was added with the stirring. The temperature of the reaction was maintained up to 0-5^0 C. Diazonium salt solution prepared above was added drop wise to the alkaline solution of 2-nitrophenol. The reaction mixture stirred for 10 – 20 minutes maintaining the temperature 5-10^0 C. The colored product so obtained is filtered washed with water and recrystallised from 80% ethanol. The general Scheme for the synthesis of azo dyes of 2-nitrophenol is shown in figure (I).

Figure I: General Scheme for the synthesis of azo dyes of 2-nitrophenol.



ISSN 2394 - 9954

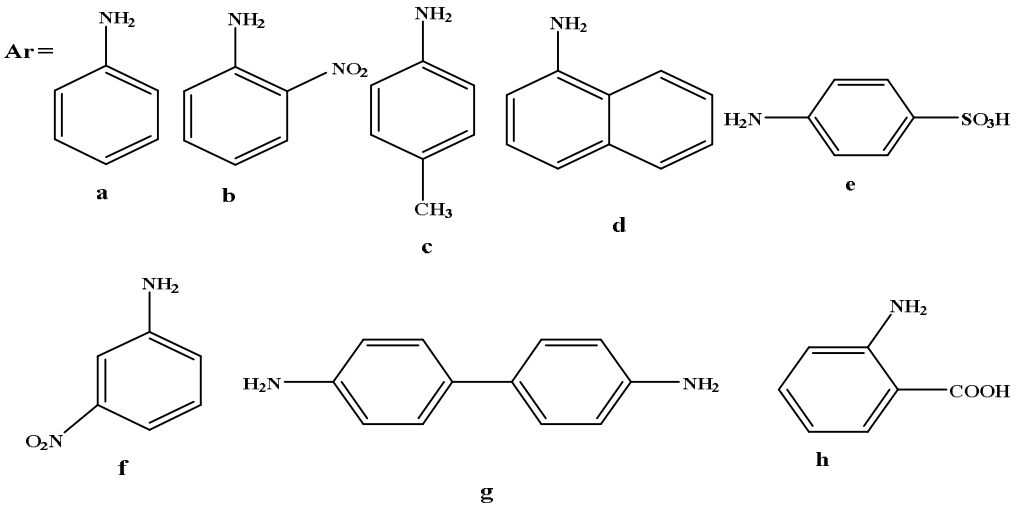
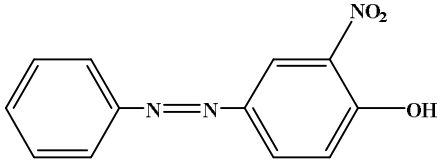
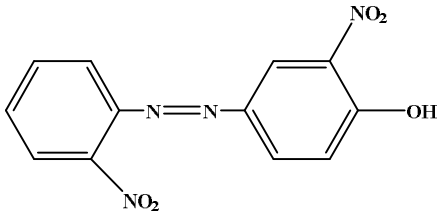
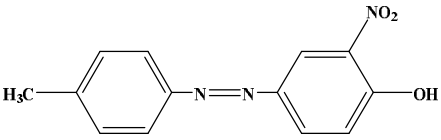
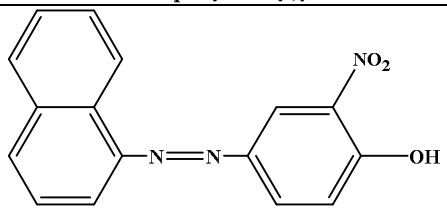
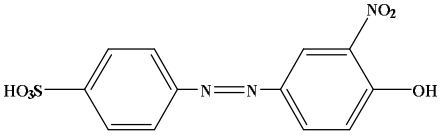
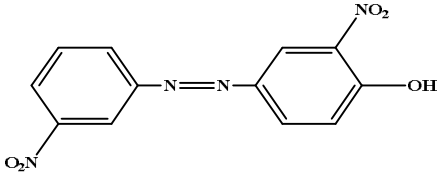


Table (I): The code, compound name, molecular formula, molecular weight, melting point and percentage yield of synthesized compounds of 2-nitrophenol

Sr. No.	Structure	Molecular Formula	Molecular Weight	Melting Point	Yield
4a	 2-nitro-4-(phenyldiazenyl)phenol	$C_{12}H_9N_3O_3$	243	176^0 C	43%
4b	 2-nitro-4-((2-nitrophenyl)diazenyl)phenol	$C_{12}H_8N_4O_5$	288	142^0 C	52%
4c	 2-nitro-4-(*p*-tolyldiazenyl)phenol	$C_{13}H_{11}N_3O_3$	257	153^0 C	48%
4d	 4-(naphthalen-1-yldiazenyl)-2-nitrophenol	$C_{16}H_{11}N_3O_3$	293	160^0 C	55%
4e	 4-((4-hydroxy-3-nitrophenyl)diazenyl)benzenesulfonic acid	$C_{12}H_9N_3O_6S$	323	312^0 C	48%
4f	 2-nitro-4-((3-nitrophenyl)diazenyl)phenol	$C_{12}H_8N_4O_5$	288	275^0 C	55%

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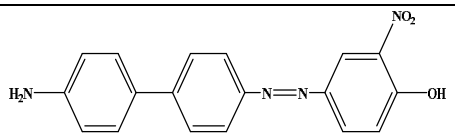
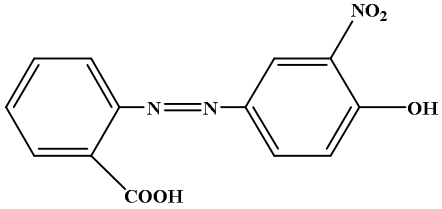
4g	 4-((4'-amino-[1,1'-biphenyl]-4-yl)diazenyl)-2-nitrophenol	$C_{18}H_{14}N_4O_3$	334	328^0 C	51%
4h	 2-((4-hydroxy-3-nitrophenyl)diazenyl)benzoic acid	$C_{13}H_9N_3O_5$	287	282^0 C	40%

ANTIMICROBIAL ACTIVITY

The newly synthesized azo compounds 4a-4h were analyzed for their antimicrobial activity against four gram positive and gram negative bacteria viz. *Escherichia coli, Staphylococcus aureus, Pseudomanas aeroginosa and Salmonella typhi* by using agar well diffusion method[18]. These compounds were mixed in Ethanol to form the solution of concentration 1mg/ml. sterile disc were dipped in the solutions, dried it and placed on the nutrient agar medium spreaded with the bacteria. The plates were further incubated for 24 to 48 hours at 37^0 C and the diameter of zones of inhibition was measured in millimeter.

RESULT AND DISCUSSION

The azo dyes synthesized were characterized by IR and NMR spectroscopic methods. IR and ^{1}H-NMR spectra showed the expected signals which correspond to various groups present in each compounds. The IR and ^{1}H-NMR spectral values for different synthesis dyes are shown in table II.

Table (II): FTIR AND ^{1}H NMR data of azo compounds of 2-nitrophenol

Compound	Spectra	Spectroscopic Data
SDB 4a	IR (KBr. cm^{-1})	3232 (Phenolic –OH stretch), 1625 (C=C Aromatic), 1539 (N=N), 1261 (C-N Stretch), 1328 (NO_2).
	NMR (δ ppm)	4.48 (s 1H of –OH), δ7.07-8.42 (m 8H of Ar-H).
SDB 4b	IR (KBr. cm^{-1})	3603 (Phenolic –OH stretch), 1614 (C=C Aromatic), 1512 (N=N), 1261 (C-N Stretch), 1332 (NO_2).
	NMR (δ ppm)	δ 3.63 (s 1H of –OH), δ6.57-8.47 (m 7H of Ar-H).
SDB 4c	IR (KBr. cm^{-1})	3194 (Phenolic –OH stretch), 1606 (C=C Aromatic), 1514 (N=N), 1255 (C-N Stretch), 2920 (C-H of CH_3), 1327 (NO_2).
	NMR (δ ppm)	δ 2.39 (s 3H of –CH_3), δ 3.74 (s 1H of –OH), δ6.91-8.38 (m 7H of Ar-H).
SDB 4d	IR (KBr. cm^{-1})	3595 (Phenolic –OH stretch), 1612 (C=C Aromatic), 1508 (N=N), 1255(C-N Stretch), 1323 (NO_2).
	NMR (δ ppm)	δ 4.16 (s 1H of –OH), δ6.73-8.11 (m 10H of Ar-H).
SDB 4e	IR (KBr. cm^{-1})	3562 (Phenolic –OH stretch), 1618 (C=C Aromatic), 1535 (N=N), 1228 (C-N Stretch), 1340 (NO_2).
	NMR (δ ppm)	δ 3.51 (s 1H of –OH), δ 3.24 (s 1H of –SO_3H), δ7.31-8.44 (m 7H of Ar-H).
SDB 4f	IR (KBr. cm^{-1})	3576 (Phenolic –OH stretch), 1620 (C=C Aromatic), 1531 (N=N), 1263 (C-N Stretch), 1344 (NO_2).
	NMR (δ ppm)	δ 3.55 (s 1H of –OH), δ6.65-8.48 (m 7H of Ar-H).

SDB 4g	IR (KBr. cm^{-1})	3273 (Phenolic –OH stretch), 1616 (C=C Aromatic), 1535 (N=N), 1253 (C-N Stretch), 3074(N-H Stretch), 1325 (NO_2).
	NMR (δ ppm)	δ 6.70 (s 1H of –OH), δ 3.57 (s 2H of $–NH_2$), δ 7.28-8.40 (m 11H of Ar-H).
SDB 4h	IR (KBr. cm^{-1})	3277 (Phenolic –OH stretch), 1616 (C=C Aromatic), 1535 (N=N), 1236 (C-N Stretch), 1638 (C=O, Stretch of COOH), 1319 (NO_2).
	NMR (δ ppm)	δ 5.09 (s 1H of –OH), δ 7.10-8.10 (m 7H of Ar-H), δ 8.38 (s 1H of –COOH).

ANTIMICROBIAL ACTIVITY

A total eight azo compounds of 2-nitrophenol have been synthesized, recrystaliesed and used separately for its study of antimicrobial activity against four gram positive and gram negative bacteria viz. *Escherichia coli, Staphylococcus aureus, Pseudomanas aeroginosa and Salmonella typhi*. The data of antimicrobial activity of these newly synthesized azo dyes of 2-nitrophenol 4a-4h against four pathogens are presented in the tables 1-4.

Antibacterial properties of the synthesized azo compounds of 2-nitrophenol viz 4a – 4h [Zone of inhibition (mm)]

Table (1): Effect of azo compounds of 2-nitrophenol viz. 4a – 4h on the growth response of *Escherichia coli*.

Conc.(mg/ml)	4a	4b	4c	4d	4e	4f	4g	4h
0.5	I (>10)	I (11)	I (>10)	I (13)	I (>10)	I (10)	I (13)	I (>10)
1.0	I (10)	I (>10)	I (>10)	I (11)	I (>10)	I (10)	I (11)	NI
1.5	I (10)	I (13)	I(>10)	I (13)	I (>10)	I (11)	I (10)	NI
2.0	I (11)	I (11)	I (>10)	I (11)	I (>10)	I (11)	I (13)	I (>10)
2.5	I (13)	I (14)	I (>10)	I (10)	I (>10)	I (11)	I (>10)	I (>10)
3.0	I (10)	I (11)	I (10)	I (13)	I (10)	I (13)	NI	I (12)

I = Inhibition, values of inhibition are given in parenthesis, NI = No inhibition

Table (2): Effect of azo compounds of 2-nitrophenol viz. 4a – 4h on the growth response of *Staphylococcus aureus*.

Conc.(mg/ml)	4a	4b	4c	4d	4e	4f	4g	4h
0.5	I (13)	I (12)	NI	I (>10)	I (10)	I (10)	I (>10)	I (11)
1.0	I (13)	I (11)	I (>10)	NI	I (>10)	I (10)	I (10)	NI
1.5	I (>10)	I (>10)	I (>10)	NI	I (11)	I (13)	I (10)	I (11)
2.0	I (12)	NI	NI	I (>10)	I (10)	I (10)	I (>10)	I (>10)
2.5	I (10)	I (11)	I (>10)	I (>10)	I (12)	I (11)	NI	I (11)
3.0	I (14)	I (10)	I (>10)	I (>10)	I (12)	I (11)	I (>10)	I (>10)

I = Inhibition, values of inhibition are given in parenthesis, NI = No inhibition

Table (3): Effect of azo compounds of 2-nitrophenol viz. 4a –4h on the growth response of *Pseudomonas aeroginosa*.

Conc.(mg/ml)	4a	4b	4c	4d	4e	4f	4g	4h
0.5	NI	I (>10)	I (10)	I (10)	NI	NI	I (>10)	I (12)
1.0	I (>10)	I (13)	I (10)	I (>10)	NI	NI	I (10)	I (11)
1.5	I (11)	I (14)	I (>10)	I (11)	NI	I (>10)	I (>10)	I (>10)
2.0	I (10)	I (14)	I (11)	I (11)	NI	I(>10)	I (>10)	I (12)
2.5	I (>10)	I (24)	I (10)	I (12)	NI	I (10)	I (10)	I (13)
3.0	I (12)	I (10)	I (10)	I (>10)	I (13)	I (16)	I (10)	I (11)

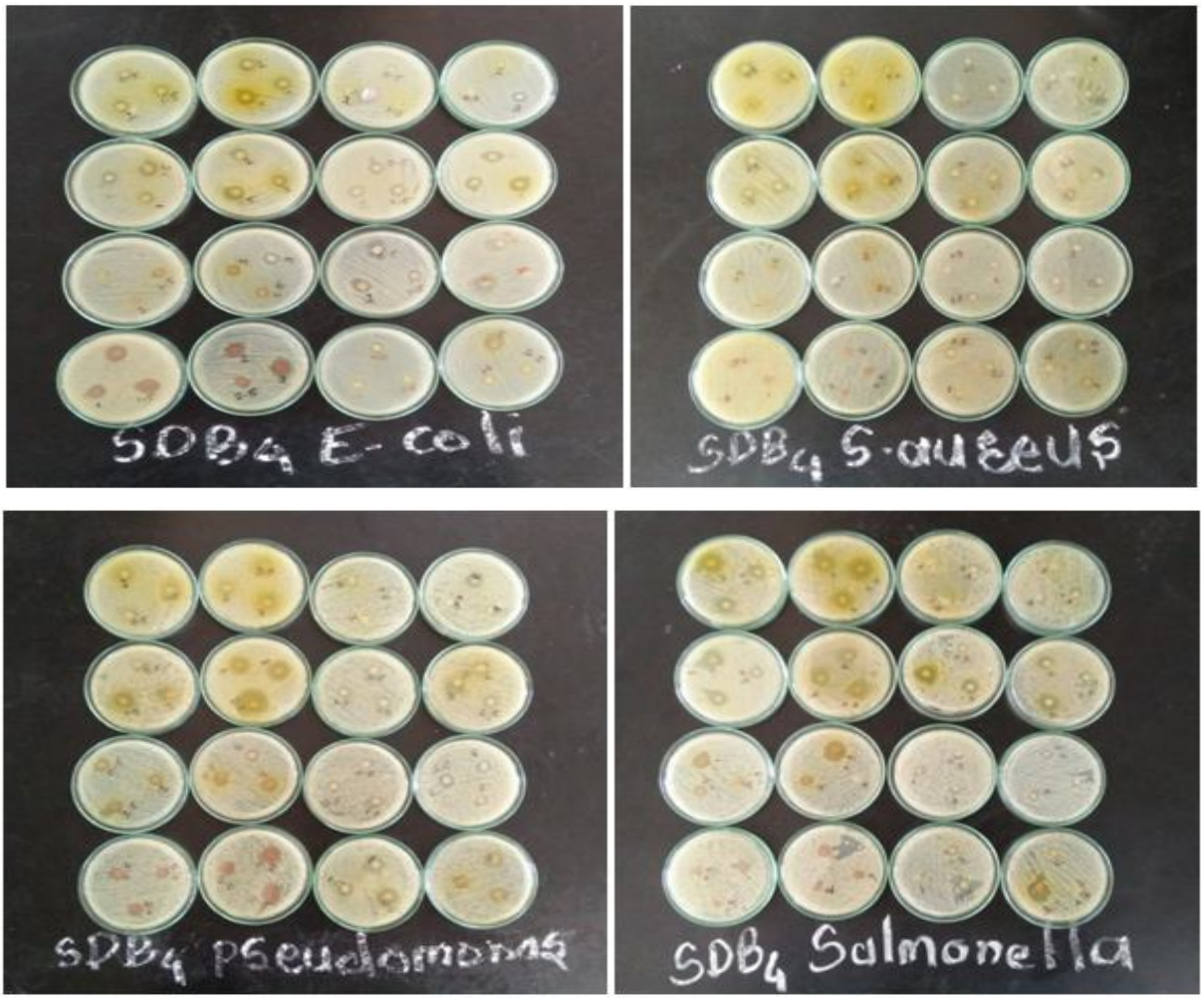
I = Inhibition, values of inhibition are given in parenthesis, NI = No inhibition

ISSN 2394 - 9954

Table (4): Effect of azo compounds of 2-nitrophenol viz. 4a – 4h on the growth response of *Salmonella typhi*.

Conc.(mg/ml)	4a	4b	4c	4d	4e	4f	4g	4h
0.5	I (>10)	I (>10)	I (10)	I (>10)	NI	I (>10)	I (10)	I (11)
1.0	I (12)	I (11)	I (11)	I (11)	NI	I (13)	I (10)	NI
1.5	I (16)	I (15)	NI	NI	NI	I (11)	I (10)	I (21)
2.0	I (13)	I (10)	I (10)	I (>10)	NI	I (10)	I (10)	I (>10)
2.5	I (14)	I (12)	I (17)	I (>10)	I (10)	I (11)	I (10)	I (>10)
3.0	I (13)	I (13)	NI	NI	NI	I (13)	I (10)	I (17)

I = Inhibition, values of inhibition are given in parenthesis, NI = No inhibition



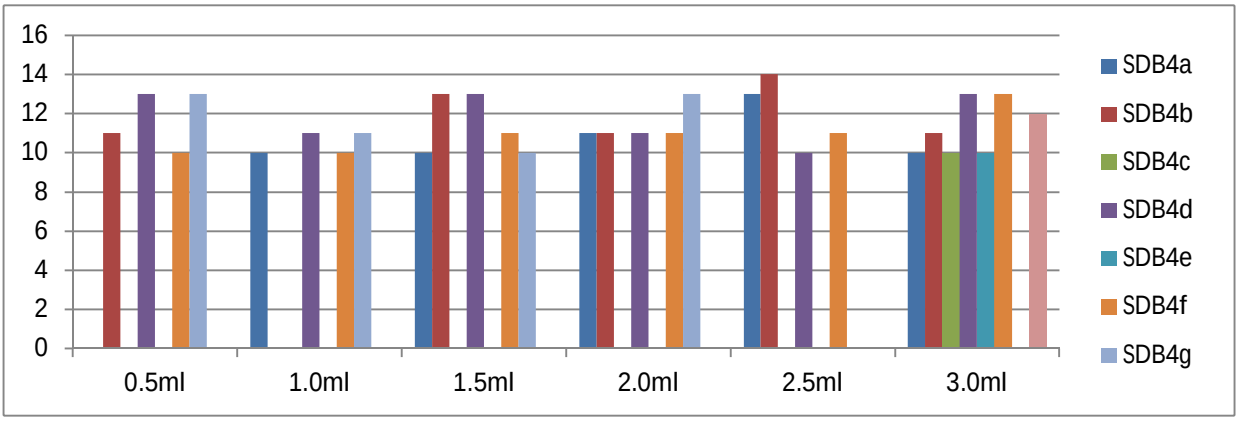


Figure 1: Graph showing effect of azo compounds of 2-nitrophenol viz. 4a– 4h on the growth of *E.Coli*.

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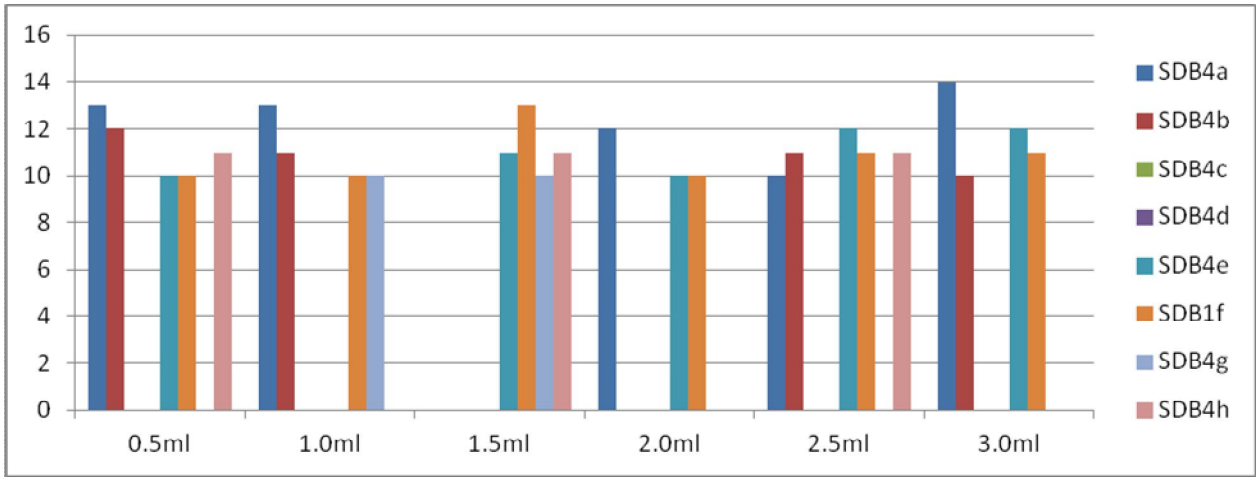

Figure 2: Graph showing effect of azo compounds of 2-nitrophenol viz. 4a– 4h on the growth of *S. aureusus.*

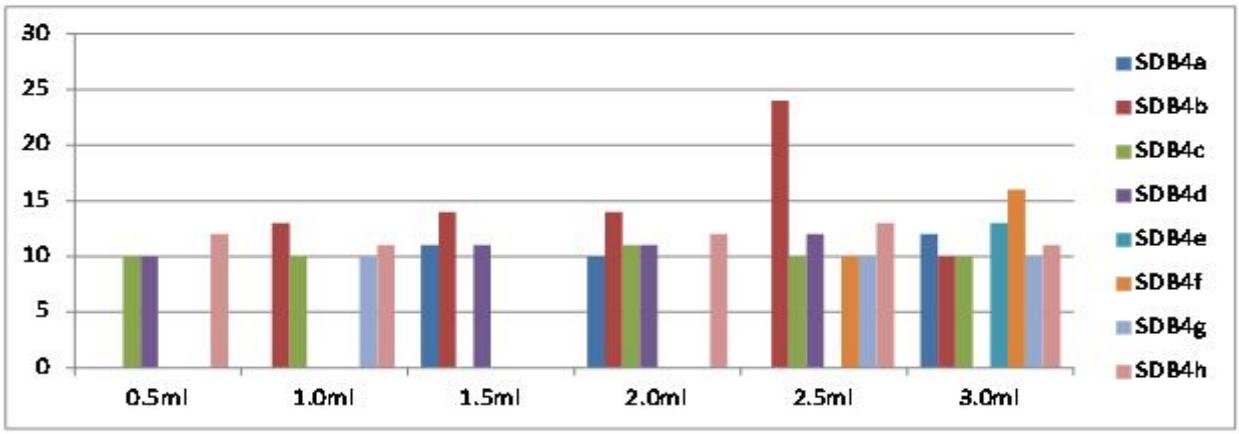

Figure 3: Graph showing effect of azo compounds of 2-nitrophenol viz. 4a– 4h on the growth of *P. aeroginosa.*

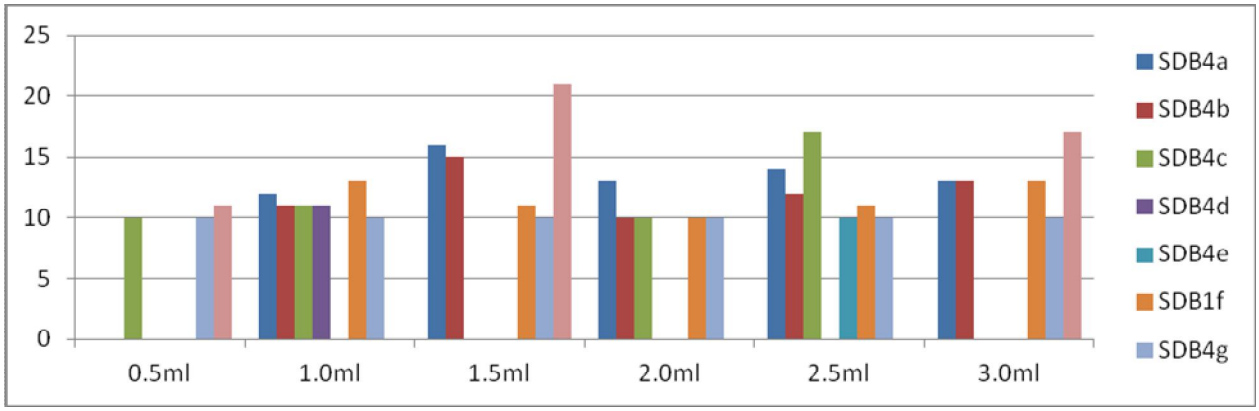

Figure 4: Graph showing effect of azo compounds of 2-nitrophenol viz. 4a– 4h on the growth of *S. typhi.*

CONCLUSION

All the eight novel azo compounds 4a–4h containing 2-nitrophenol moiety were successfully synthesized in excellent yield and their structures are confirmed using elemental analysis, FTIR & 1HNMR spectroscopy. The results on antimicrobial activity reveal that all the eight newly synthesized compounds viz 4a–4h found to have moderate antibacterial effect against *E.Coli, S. aureus, Pseudomonas aeroginosa,* and *Salmonella typhi* nearly at all the concentrations analysed.

ACKNOWLEDGEMENT

Authors are very thankful to Sophisticated Analytical Instrument Facility (SAIF) Chandigarh and Head department of Chemistry, Shri. Shivaji College, Akola for availing the spectral data. Also thankful to Dr. N. S. Kulkarani, HOD of Microbiology for giving me practical help and guidance for carrying out antibacterial evaluation against micro-organisms.

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International Journal of Research in Science and Technology
Volume 5, Issue 2 : April - June, 2018
ISSN 2394 - 9954

CURRENT STATUS AND POTENTIAL OF WILD EDIBLE PLANT ORIGIN NTFPS IN SALEKASA TEHSIL OF GONDIA DISTRICT (MS), INDIA

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ABSTRACT
Forest provide several types of non-wood or non-timber forest products (NTFPs), used for generating energy, edible, fodder, fiber, floss, gums, resin, minor wood, raw materials for medicines etc. Non-Timber Forest Products (NTFPs) make an important contribution to the livelihood of the households who gather and consume them. Wild edible plants play a significant role in the sustenance of tribal people residing in and within forested areas. Survey of wild edible plants has been carried out in ten villages of Salekasa tehsil, District- Gondia, Maharashtra, India. This article briefly describes current status wild edible plants NTFPs. This study focuses on the wild edible plants traditionally used for human consumption and its aim is to present data about the status and diversity of plants used as a nutrition source. The present study deals with the documentation of 85 wild edible plants, belonging to 78 genera and 56 families which are consumed traditionally by forest dwellers. The article concludes that forest dwellers are significantly depends on NTFPs used for edible purpose.

Keywords: Wild edible plants, traditional knowledge, forest dwellers, NTFPs, Gondia district.

INTRODUCTION
Historically, there has been little interest in NTFPs, because most NTFPs were consumed by local populations, and not marketed. Hence the name 'minor forest product' was often given to the NTFPs (Michael Arnold and Ruiz Perez, 2001). Populations living near or in forests have a long history of Non-Timber Forest Products (NTFPs) extraction for sustenance or sale. As implied in the term, NTFPs include all biological materials, except timber, that are found in the forest, such as wild food plants, honey, resin, spices, wildlife products, fuel wood, charcoal, and raw materials for handicrafts, such as rattan, vines, bamboo, and grasses.

Many non-timber forest products are harvested each year from forests around the world. Many of the products harvested are forest botanicals that are used personally or are sold as commercial trade in the food products industry. Berries, herbs and mushrooms are among some of the most valuable non-timber forest food products being harvested and sold to established markets throughout the world (Barfoot, 2006).

Wild edible plants have always been important in the folk traditions of the Mediterranean region (Hadjichambis *et al*., 2008). It is estimated that there are more than 30,000 edible plants known to man today. However, of these, only about 30 crop plants are used to provide more than 95% of man's plant food needs (Plotkin, 1988; ten Kate & Laird, 1999). This means that the large majority of food plant species are neglected. The neglected plants in many cases are wild food plants (WFPs), which grow naturally in the bush and do not have to be planted or tended before producing edible parts (FAO, 1988).

Wild edible plants are reported to play a vital role in supplying food for poor communities in many rural parts of the world (Sundriyal *et al*., 2003). Vegetables play a crucial role to meet the nutritional needs of the people in remote areas.

There are many useful wild species that are consumed as food (Haridasan *et al*., 1995). Systematic investigation of wild edible plants of Sikkim Himalaya is reported in recent times (Sundriyal and Sundriyal, 2001). Some traditional beverages, narcotics, wild edible plants and foods have also been reported for Ladakh (Navchoo *et al*., 1990). Andel (2006) reported the food products that include wild fruits, vegetables, nuts, edible roots, bush meat, edible insects, and honey and food additives like spices, flavorings, food colorants, fermentation agents.

Wild plants are an important source of edible fruits, leafy vegetables, and herbs, and are particularly important in ensuring food security and maintaining the nutritional balance in people diets (Taylor, 1995). During famine, wild plants become essential to human survival and at other times they both prevent the need for cash expenditure and provide a source of income to cash-poor households (Guedje *et al*., 2003).

Earlier work on wild edible plants from Maharashtra like Nasik, Amravari, Buldhana, Kolhapur, Jawhar were carried out by Vartak (1959); Vartak and Kulkarni (1987); Kulkarni and Kumbhoikar (1992), Patil and Patil (2000), Bhogaonkar *et al*., (2010), Kshirsagar *et al*., (2012), Mahadkar and Jadhav (2013), Joshi *et al*., (2013), Zode *et al*. (2016)). Similarly, in Tirora tehsil of Gondia district observed that total 45 plants NTFPs species, 26 plants used as edible, 31 for medicinal, 15 for commercial and only 4 plants were used as construction purpose

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(Zode *et al.*, 2014) Therefore forest dwellers of Gondia district especially living in and within forest area are more dependent on NTFPs (Zode *et al.*, 2015)

Wild foods provide a greater dietary diversity to those who rely on them. Ethnobotanical surveys of wild plants indicate that more than 7000 species have been used for human food at some stage in human history (Ogle *et al.*, 1985). The wild plants from forest provide many essential nutrients which help to improve both the physical and mental well-being of tribals. In remote, the forest areas where vegetable cultivation is not practiced and market is not available tribals depend on locally available plants which can be used as vegetables. This study reveals that forest dwellers living in particular area depend on wild plants as food sources and they have considerable knowledge on their use.

Given the dramatic loss of traditional knowledge regarding wild edible plants, our aim was to documenting the indigenous traditional knowledge, from the local inhabitants the edible use of wild plants growing in their ambience. It is hoped that the results of this research will help play an important role in initiating dialogue and planning among national and international scientific communities.

MATERIAL AND METHODS

The study was carried out in the Salekasa tehsil of Gondia district (MS), India (Figure 1 & 2). The total 10 villages were selected from the Tehsil for present study. These villages were chosen on the basis of forest area, their location in and around the forests. In each village, 5 households were sampled also by random sampling. Therefore, total number of household surveyed was fifty.

The Primary data was collected through, group discussion, semi-structured interviews and household survey (Martin, 1995; Pretty *et al.*, 1995). The information of wild edible NTFPs was collected through personal conversation with local inhabitants and also through market surveys by using the methods of Chadwick and Marsh (1994). For the classification and identification of plant species following floras used: Flora of Kolhapur District (Yadav, S.R. *et al.*, 2002), 'Flora of Maharashtra State: Dicotyledones' Vol. I. (Singh *et al.*, 2000), 'Flora of Maharashtra State: Dicotyledones' Vol. II. (Singh *et al.*, 2000), 'Flora of Maharashtra State: Monocotyledons' (Sharma, 1996), Flora of Nagpur District (Ugemuge, 1986) and Pteridophyte flora of the Western Ghats – South India (Manickam and Irudayaraj, 1992).

Fig. 1: Map showing Maharashtra state in India

Fig. 2: Map showing Gondia district.

RESULTS AND DISCUSSION

Forest resources, mainly plants and plant products, have an important role in the daily life of forest dwellers. The forest communities are largely dependent on the forest produce for their sustenance. During the investigations, diversity of useful wild plant species was identified as NTFPs in the study area. A total of 85 wild edible plant species are gathered and consumed in the study areas by forest dwellers. These species belonging to 78 genera and 56 families were identified as wild edible plants (Figure 3). All data pertaining to plant materials are listed based on their respective taxa, and are ordered alphabetically together with their botanical, vernacular, the part(s) used, and season of availability (Table 1).

While analyzing the life forms of the wild edible vegetable species, it was noticed that, 39% were trees, 32% herbs, 15% shrubs and the remaining 12% climbers and 2% fungi (Figure 4). In the present study show that maximum utilization parts from tree and herb species while the utility of climber species was minimum.

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For getting the kindness from the 85 wild edible species, the forest communities were found to use different plant parts. Underground vegetative parts of 11 species are also used for edible purposes. Care must be taken for conservation of the species presently threatened or likely to be so in future due to use of their underground vegetative parts. Similarly, aerial vegetative parts (Leaves, Young leaves, Leafy shoot, above ground part, Young stem and Tendril) of the 28 plants species are also used as NTFPs for edible purpose. So far the use of reproductive organs (Flower, Unriped fruits, Ripe fruits, Fruiting body, Young inflorescences, Young pod & Seeds) of 51wild edible plants used by forest dwellers (Table 2). If such uses are not within limits, injuries are certain to be conveyed to the community to affect sustainability and stability. Thus if these issues need to be addressed one must take into account the number of species in which the plant is either totally uprooted or reproductive organs are heavily exploited. It is not unlikely that their over exploitation might force these species to become rare and eventually disappear from the site. Thus these species also deserve attention for conservation.

Many wild edible plants have been quoted and cited in the different selected villages, demonstrating that there is a common used pattern regarding the wild edible NTFPs. However, a few differences in the ITK regarding the consumption of wild edible plants between these selected villages were observed. It has been found that villagers of Managad, having highest ITK regarding 83 of wild edible plants. While Bijepar and Toyagondi were found to have ITK of about eighty two and eighty wild edible plant species respectively. Similarly in other villages were found to have ITK of about in 78-54 wild edible species as showing in Figure 5. The consumption of wild edible plants is an addition or a complement to a diet of cultivated food plants, while the quantity of indigenous traditional knowledge varies slightly among the studied localities.

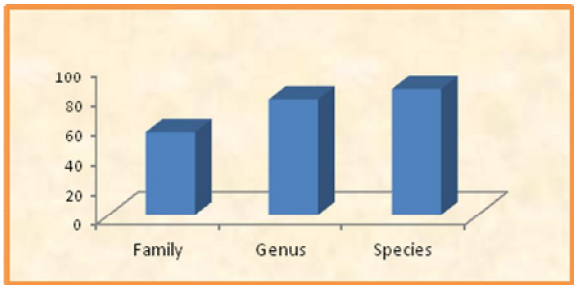

Figure 3: Taxonomic analysis of wild edible plant

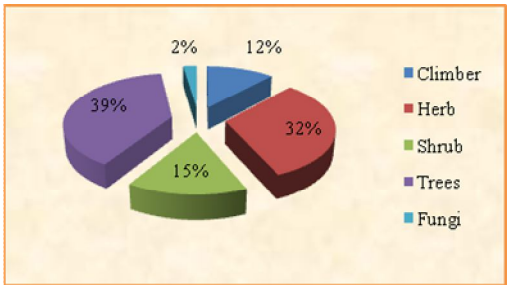

Figure 4: Life forms of wild edible plant NTFPs

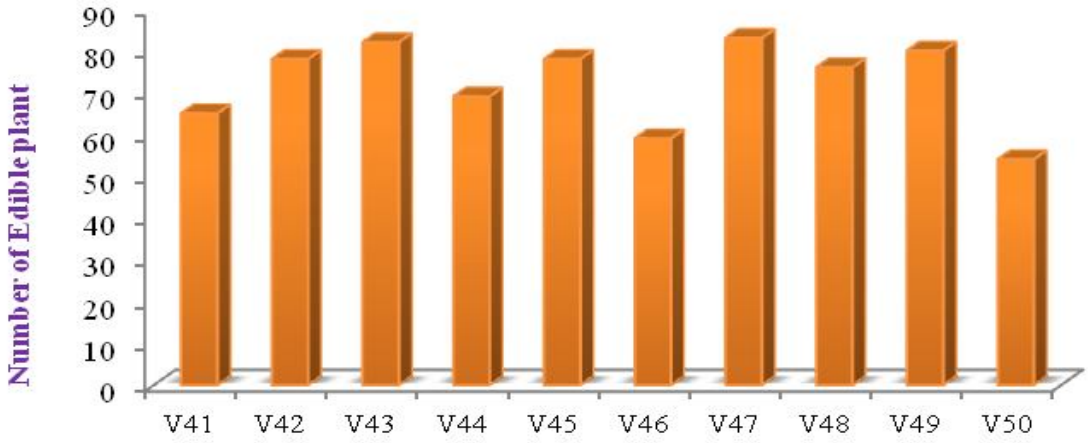

Figure 5: Analysis of wild edible plant found in selected villages in Salekasa tehsil

Name of selected villages: Darrekasa (V41), Baajiyadand (V42), Bijepar (V43), Daldalkuhi (V44), Durgutola (V45), Jamakudoh (V46), ManagadV(47), Pipariya (V48), Toyagondi (V49), Sategaon (V50).

CONCLUSIONS

The data we have presented here showed that used of 85 NTFPs as wild edible plants are still important activities in all the selected areas. The majority of the wild edible plants mentioned were species commonly found in the surroundings of villages. Today's traditional diet is very different from the past. The consumption of wild edible plants is an addition or a complement to a diet of cultivated food plants, while the quantity of indigenous traditional knowledge varies slightly among the studied localities.

In recent generation has lost the traditional knowledge necessary to identify, gather and process these species. An emphasis on the sustainable harvesting of wild edible plants will help increase and maintain the region

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biodiversity. There is a need for systematic incorporation of information on current use of wild food resources in any programme dealing with sustained for security and rural developed for the benefit of the local people.

Over- exploitation of these species is likely to damage the forest ecosystem. In view of these, the forests must be saved and these species should be sustained as such. The scientists have to come up for judicious selection of edible species from the wilderness for their large scale cultivation based on assessment of their proximate principles, nutrient status and medicinal properties to address the issue of food security for the future generations.

Table 1: An account of Edible wild plants documented from forest dwellers settled in study area

Sr. No.	Plant species	Family	Habit	Local name	Edible parts
1	*Acacia catechu*	Mimosaceae	Trees	Khair	Stem bark
2	*Achyranthes aspera*	Amaranthaceae	Herbs	Kutri,Chilati	Seeds
3	*Aegle marmelos*	Rutaceae	Trees	Bel	Ripe Fruits
4	Agaricus sp.	Agaricaceae	Fungi	Yeru satya	Fruiting body
5	*Alangium salvifolium*	Alangiaceae	Trees	Akawal	Ripe Fruits
6	*Aloe vera*	Liliaceae	Herbs	Korphad	Leafy twig
7	*Alternanthera sessile*	Amaranthaceae	Herbs	Galighosh	Leafy twig
8	*Amorphophallus campanulatus*	Araceae	Herbs	Suran	Rhizome
9	*Annona reticulata*	Annonaceae	Trees	Ramfal	Ripe Fruits
10	*Annona squamosa*	Annonaceae	Trees	Sitaphal	Ripe Fruits
11	*Azadirachta indica*	Meliaceae	Trees	Kadunimb	Ripe Fruits, Young leaves
12	*Bauhinia purpurea*	Caesalpiniaceae	Trees	Kanchanvrush	Flowers, Ripe Fruits
13	*Boerhavia repens var. diffusa*	Nyctaginaceae	Herbs	Khaparkuti	Leaves
14	*Buchanania cochinchinensis*	Anacardiaceae	Trees	Charoli	Ripe Fruits, Seeds
15	*Careya arborea*	Lecythidaceae	Trees	Kumbhi	Ripe fruit
16	*Carissa carandus*	Apocynaceae	Shrubs	Karvanda	Unripe Fruits
17	*Cassia fistula*	Caesalpiniaceae	Trees	Bahawa	Flowers
18	*Cassia tora*	Caesalpiniaceae	Herbs	Tarota	Young leaves
19	*Coccinia grandis*	Cucurbitacae	Climbers	Jungali kundru	Unripe fruits
20	*Colocasia esculenta*	Araceae	Herbs	Dhopa, Chamkura	Leaves
21	*Commelina benghalensis*	Commelinaceae	Herbs	Kena	Leafy twig
22	*Cordia dichotoma*	Boraginacea	Trees	Shelwat, Bhokar	Ripe & Unripe Fruits
23	*Cordia gharaf*	Boraginacea	Trees	Shelwat, Gondani	Ripe & Unripe Fruits
24	*Curcuma longa*	Zingiberaceae	Herbs	Halad	Rhizome
25	*Cymbopogon nardus*	Poaceae	Herbs	Gawatichaha	Leaves
26	*Dendrocalamus strictus*	Poaceae	Shrubs	Bamboo	Young stem
27	*Dioscorea alata*	Dioscoreaceae	Climbers	Matalu	Tubers
28	*Dioscorea bulbifera*	Dioscoreaceae	Climbers	Matalu	Tubers
29	*Diospyros melanoxylon*	Ebenaceae	Trees	Tendu patta	Ripe fruits
30	*Embilca officinalis*	Euphorbiaceae	Trees	Awala	Ripe & Unripe Fruits
31	*Ficus racemosa*	Moraceae	Trees	Umber	Ripe fruits
32	*Grewia asiatica*	Tiliaceae	Shrubs	Phaalsa	Ripe fruits
33	*Holarrhena pubescens*	Apocynaceae	Trees	Pandharakuda	Flowers
34	*Lantana camara*	Verbenaceae	Shrubs	Ghaneri	Ripe fruits
35	*Limonia acidissima*	Rutaceae	Trees	Kawath	Ripe fruits
36	*Lygodium flexuosum*	Polypodiaceae	Herbs	Jatashankar	Leaves

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37	*Madhuca longifolia*	Sapotaceae	Trees	Mahua	Ripe Fruits, Flower
38	*Mallotus philippensis*	Euphorbiaceae	Trees	Shendi	Ripe fruits
39	*Mangifera indica*	Anacardiaceae	Trees	Aam	Ripe & Unripe Fruits
40	*Marsilea quadrifolia*	Marsileaceae	Herbs	Marsiliea sp.	Leaves
41	*Maytenus senegalensis*	Celastraceae	Shrubs	Bharati	Young inflorescences
42	*Momordica dioica*	Cucurbitacae	Climbers	Katwel	Unripe fruits
43	*Moringa oleifera*	Moringaceae	Trees	Shevaga	Unripe fruits
44	*Musa paradisiaca*	Musaceae	Shrub	Kela	Ripe fruits
45	*Nymphaea pubescens*	Nymphaeceae	Herbs	Kamal	Ripe Fruits, Flower, Rhizome
46	*Ocimum tenuiflorum*	Lamiaceae	Herbs	Tulas	Leaves
47	*Olax psittacorum*	Olacacea	Shrubs	Hartfari	Young leaves
48	*Oroxylum indicum*	Bignoniaceae	Trees	Tetu	Flower & Unripe fruit
49	*Phoenix sylvestris*	Palmae	Trees	Sindi	Ripe fruits
50	*Pithecellobium dulce*	Mimosaceae	Trees	Chichbili	Ripe fruits
51	*Semecarpus anacardium*	Anacardiaceae	Trees	Bhelau, Bibba	Ripe fruits
52	*Syzygium cumini*	Myrtaceae	Trees	Jambhul	Ripe fruits
53	*Tamarindus indica*	Caesalpiniaceae	Trees	Chinch	Ripe & Unripe Fruits
54	*Terminalia bellerica*	Combretaceae	Trees	Behada	Seeds
55	Termitomyces sp.	Trichlomataceae		Bhombodi	Fruting body
56	*Theriophonum indicum*	Araceae	Herbs	Undirkani	Leaves
57	*Trapa natans*	Trapaceae	Herbs	Shingada	Ripe fruits
58	*Ziziphus caracutta*	Rhamnaceae	Shrubs	Katbor	Ripe fruits
59	*Ziziphus mauritiana*	Rhamnaceae	Shrubs	Ber	Ripe fruits
60	*Ziziphus oenoplea*	Rhamnaceae	Shrubs	Aeroni	Ripe fruits
61	*Morus alba*	Moraceae	Shrub	-	Ripe fruits
62	*Portulaca oleracea*	Portulacaceae	Herbs	-	Above ground parts
63	*Bombax ceiba*	Bombaceae	Trees	Katesavar	Tubers
64	*Cajamus scarabaeoides*	Fabaceae	Climbers	Rantur	Young pods and seed
65	*Allmania nodiflora*	Amaranthaceae	Herbs	Dhan Bhaji, Mal Kukkur	Leaf
66	*Alternanthera paronychioides*	Amaranthaceae	Herbs	Patur Bhaji	Leaf
67	*Antidesma acidum*	Euphorbiaceae	Shrubs	Surpela	Unripe & ripe fruit
68	*Argyreia nervosa*	Convolvulaceae	Climbers	Baswrael, Widhara	Leaf
69	*Borassus flabellifer*	Arecaceae	Trees	Taad	Ripe Fruits
70	*Bridelia retusa*	Euphorbiaceae	Trees	Kasai, Kassi	Ripe Fruits
71	*Centella asiatica*	Apiaceae	Herbs	Bramhi	Leaf
72	*Cheilocostus speciosus*	Costaceae	Herb	Dukar kanda	Corm
73	*Chenopodium album*	Chenopodiaceae	Herb	Batwa	Leaf
74	*Chlorophytum sp.*	Liliaceae	Herb	Lodanga bhaji	Leaf, Root
75	*Corchorus capsularis*	Tiliaceae	Herbs	Fotakani	Leaf
76	*Dioscorea pentaphylla*	Dioscoreaceae	Climber	Padmati	Bulb
77	*Glinus oppositifolius*	Molluginaceae	Herbs	Kadubhaji	Leaf
78	*Holoptelea integrifolia*	Ulmaceae	Tree	Yensadad	Seeds
79	*Merremia hederacea*	Convolvulaceae	Climber	Diwati	Seeds
80	*Oxalis corniculata*	Oxalidaceae	Herbs	Chihoda Bhaji	Leaf
81	*Pergularia daemia*	Asclepiadaceae	Climber	Utaran, Hacher	Ripe fruits

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82	*Phoenix acaulis*	Arecaceae	Shrub	Bhui Shindi	Underground Petiole
83	*Scripus grossus*	Cyperaceae	Herb	Kachar Kaandaa	Root
84	*Smilax zeylanica*	Smilacaceae	Climber	Sherdire	Tendril
85	*Tamilnadia uliginosa*	Rubiaceae	Tree	Kala Fendra	Fruit

Table 2. An analysis of the wild plant parts used regarding the number of species

Sr. No.	Plant parts use	Number of species in concern
Vegetative plant Parts (Underground)		
1	Roots	1
2	Rhizome	2
3	Tubers	3
4	Root	2
5	Bulb	1
6	Corn	1
7	Underground petiole	1
Vegetative plant parts (Aerial)		
1	Leaves	16
2	Young leaves	3
3	Leafy shoot	6
4	Above ground part	1
5	Young stem	1
6	Tendril	1
Reproductive plant parts		
1	Flower	6
2	Unriped fruits	11
3	Ripe fruits	30
4	Fruiting body	2
5	Young inflorescences	1
6	Young pod & Seeds	1

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