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ETHNOBOTANICAL DOCUMENTATION OF PLANTS WITH INSECTICIDAL AND PESTICIDAL POTENTIAL IN SATPUDA REGION, NORTH MAHARASHTRA, INDIA

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ABSTRACT
The growing environmental and health risks associated with synthetic pesticides have created an urgent need for sustainable, eco-friendly alternatives. Ethnobotanical knowledge provides valuable insights into plant-based pest control strategies that have been developed through generations of empirical observation. This study documents ethnobotanically significant plant species used for insecticidal and pesticidal purposes in North Maharashtra, India. Field surveys conducted between 2022 and 2024 across the Jalgaon, Dhule and Nandurbar districts recorded 80 plant species belonging to 40 families. The dominant families were Fabaceae, Euphorbiaceae, Lamiaceae and Asteraceae. Leaves were the most commonly used plant part, followed by seeds, bark and roots. These plants serve as repellents, fumigants, larvicides and grain protectants. The findings demonstrate that traditional plant-based pest control practices represent an important resource for developing biodegradable and environmentally safe pesticides. Scientific validation, phytochemical characterization and formulation development are essential for integrating these plants into modern pest management systems.

KEYWORDS: *Ethnobotany, Botanical Pesticides, Indigenous Knowledge, Pest Management, Sustainable Agriculture, North Maharashtra*

INTRODUCTION

Plants have been a vital resource for medicine, agriculture, and pest control since ancient times. Archaeological and ethnobotanical evidence suggests that indigenous communities worldwide have utilized plant-based remedies for thousands of years [1]. In India, traditional knowledge systems such as Ayurveda and folk medicine document numerous plant species with pesticidal and medicinal properties [2].

Modern agriculture heavily relies on synthetic pesticides to enhance crop productivity and control insect pests. However, excessive use of these chemicals has led to environmental contamination, pesticide resistance, and adverse health effects in both humans and animals [3]. Persistent pesticide residues have been detected in soil, water, and agricultural products, posing serious ecological and public health concerns [4].

Botanical pesticides, derived from plants, offer a safer alternative due to their biodegradability, low toxicity to non-target organisms and reduced environmental persistence [5]. Plant-derived compounds such as alkaloids, terpenoids, flavonoids and phenolics exhibit insecticidal, repellent and growth-inhibitory effects against pests [6]. For example, neem-based products have shown effective pest control with minimal ecological impact [7].

Ethnobotanical documentation plays a crucial role in identifying plant species with pesticidal potential and in preserving traditional knowledge. Despite the rich biodiversity of North Maharashtra, there is limited scientific documentation regarding plant-based pest control practices in this region. Therefore, this study aims to document ethnobotanically important pesticidal plants and evaluate their potential role in sustainable pest management.

MATERIALS AND METHODS

1. Study Area

The study was conducted in the Satpuda region of North Maharashtra, including Jalgaon, Dhule and Nandurbar districts. This region is characterized by tropical dry deciduous vegetation, moderate rainfall and diverse tribal populations possessing rich ethnobotanical knowledge.

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Table 1. Description of Study Area

District	Latitude	Climate	Dominant Vegetation	Communities
Jalgaon	20.99°N	Semi-arid	Dry deciduous forest	Bhil, Pawra
Dhule	20.90°N	Tropical	Mixed forest	Bhil, Kokna
Nandurbar	21.37°N	Moderate rainfall	Dense forest	Tribal communities

2. Data Collection

Field surveys were conducted between 2022 and 2024 using structured questionnaires and personal interviews. Informants included farmers, tribal healers, and elderly villagers with knowledge of traditional pest control practices.

Information recorded included: Local plant name, Scientific name, Plant family, Plant part used, Method of preparation and Pest control application.

3. Plant Collection and Identification

Plant specimens were collected and processed using standard herbarium techniques [8]. Identification was confirmed using regional floras and botanical references [9,10]. Voucher specimens were preserved in the herbarium of the Department of Botany.

RESULTS

1. Diversity of Pesticidal Plants

A total of 80 plant species belonging to 40 families were documented.

Table 1: Plants used as insecticides/ Pesticides

Sr. No.	Botanical name	Family
1	*Acorus calamus* L.	Araceae
2	*Agave americana* L.	Agavaceae
3	*Ageratum conyzoides* L.	Asteraceae
4	*Albizia lebbeck* (L.) Bth.	Mimosaceae
5	*Albizia procera* (Roxb.) Bth.	Mimosaceae
6	*Alysicarpus bupleurifolius*(L.) DC.	Fabaceae
7	*Anacardium occidentale* L.	Anacardiaceae
8	*Anamirta cocculus* (L.) Wight & Arn	Minispermaceae
9	*Annona reticulata* L.	Annonaceae
10	*Annona squamosa* L.	Annonaceae
11	*Arisaema tortuosum* Schott.	Araceae
12	*Aristolochia bracteolata* Retz.	Aristolochiaceae
13	*Artemisia japonica* Thumb.	Asteraceae
14	*Artemisia nilagirica* (C.B.CI.) Pamp.	Asteraceae
15	*Azadirachta indica* A.Juss.	Miliaceae
16	*Bambusa arundinacea* (Retz.)Willd.	Poaceae
17	*Blumea eriantha* DC.	Asteraceae
18	*Boswellia serrata* Roxb. ex.Cotebr.	Burseraceae
19	*Brassica campestris* (L.) Clapham	Brassicaceae
20	*Butea monosperma* (Lam.) Taub.	Fabaceae
21	*Calotropis procera* (Ait.) R. Br.	Asclepiadaceae
22	*Cannabis sativa* L.	Cannabaceae
23	*Careya arborea* Roxb.	Lecythidaceae
24	*Carissa congesta* Wight.	Apocynaceae
25	*Cassia hirsuta.* L.	Caesalpiniaceae
26	*Cassytha filiformis* L.	Lauraceae

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27	*Catunaregam spinosa* (Thumb.) Tivveng	Rubiaceae
28	*Cinnamomum camphora* (L.) Nees & Ebern.	Lauraceae
29	*Citrus limon* L.Burn.f.	Rutaceae
30	*Cleistanthus collinus* (Roxb.) Bth. ex.Host.f.	Euphorbiaceae
31	*Commiphora wightii* (Arn.) Bhandari.	Burseraceae
32	*Corypha umbraculifera* L.	Arecaceae
33	*Croton roxburghii* Balakr.	Euphorbiaceae
34	*Cucumis melo* L.	Cucurbitaceae
35	*Cucumis sativus* L.	Cucurbitaceae
36	*Curcuma longa* L.	Zingiberaceae
37	*Cuscuta reflexa* Roxb.	Cuscutaceae
38	*Cymbopogan nardus* (L.) Rendle.	Gavatichaha
39	*Derris scandens* (Roxb.) Bth.	Fabaceae
40	*Derris trifoliate* Lour.	Fabaceae
41	*Dioscorea hispida* Dennst.	Dioscoreaceae
42	*Duranta erecta* L.	Verbenaceae
43	*Euphorbia antiquorum* L.	Euphorbiaceae
44	*Euphorbia dracunculoides* Lam.	Euphorbiaceae
45	*Euphorbia thymifolia.* L	Euphorbiaceae
46	*Fioria vitifolia* (L.) Mattei.	Malvaceae
47	*Gloriosa superba* L.	Liliaceae
48	*Haldina cordifolia* (Roxb.) Ridsd	Rubiaceae
49	*Hardwickia binata* Roxb.	Caesalpiniaceae
50	*Harpullia arborea* (Blanco) Radlk	Sapindaceae
51	*Holarrhena pubescens* (Buch-Ham) Wall.	Apocynaceae
52	*Hyptis suaveolens* (L.) Poit.	Lamiaceae
53	*Kalanchoe integra* (Medik)O. Kize.	Crassulaceae
54	*Lagenandra ovata* (L.) Thw.	Araceae
55	*Lavendula bipinnata* O. Ktze	Lamiaceae
56	*Lavendula lawii* Wight.	Lamiaceae
57	*Madhuca langifolia* (Koen.) Mac.	Sapotaceae
58	*Madhuka latifolia* (Roxb.) Chev.	Sapotaceae
59	*Melaleuca leucadendron* (L.) L.	Myrtaceae
60	*Melia azadarach* L.	Miliaceae
61	*Millettia extensa* (Bth.) Baker.	Fabaceae
62	*Mimosa pudica.* L	Mimosaceae
63	*Mundulea sericea* (Willd.) A. Chev.	Fabaceae
64	*Nigela sativa* (Roxb.) DC.	Ranunculaceae
65	*Ocimum americanum*. L	Lamiaceae
66	*Ocimum tenuiflorum* L.	Lamiaceae
67	*Ougeinia oojeinensis* (Roxb.) Hochr.	Fabaceae
68	*Peganum harmala.* L	Zygophyllaceae
69	*Pongamia pinnata* (L.) Pierre.	Fabaceae
70	*Ricinus communis* L.	Euphorbiaceae
71	*Ruta chalepensis* L.	Rutaceae
72	*Sarcostemma viminale* (L.) R.Br.	Asclepiadaceae

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73	*Stephania japonica* (Thumb)Miers	Minisparmaceae
74	*Strychnos nuxvomica.* L	Logamiaceae
75	*Tephrosia purpurea* (L.) Pers.	Fabaceae
76	*Trachylobium ammi.* (L.) Sprague	Apiaceae
77	*Trigonella foenum- graecum* L.	Fabaceae
78	*Vernonia anthelminticum* (L.) Wild.	Asteraceae
79	*Vitex negundo* L.	Verbenaceae
80	*Vitex trifolia* L.	Verbenaceae

Table 3. Dominant Plant Families and Number of Species

Family	Number of Species
Fabaceae	10
Euphorbiaceae	6
Lamiaceae	5
Asteraceae	5
Others	56

Fabaceae was the dominant family, followed by Euphorbiaceae and Lamiaceae.

2. Plant Parts Used

Leaves were the most commonly used plant part.

Table 4. Plant Parts Used in Pest Control

Plant Part	Percentage (%)
Leaves	42
Seeds	18
Bark	12
Roots	10
Whole plant	9
Others	8

3. Commonly Used Pesticidal Plants

Table 5. Selected Plant Species with Pesticidal Uses

Scientific Name	Family	Plant Part	Use
Azadirachta indica	Meliaceae	Leaves, seeds	Insecticide
Vitex negundo	Lamiaceae	Leaves	Mosquito repellent
Pongamia pinnata	Fabaceae	Seeds	Grain protectant
Ocimum tenuiflorum	Lamiaceae	Leaves	Insect repellent
Cymbopogon nardus	Poaceae	Leaves	Mosquito repellent

DISCUSSION

The current study confirms that indigenous communities in North Maharashtra have extensive knowledge of using plants for pest control. The prevalence of the Fabaceae and Lamiaceae families underscores their ecological and phytochemical significance in pest management.

Plants produce bioactive secondary metabolites, such as terpenoids, alkaloids and flavonoids, which serve as natural defense compounds against herbivores and insects [6]. These compounds exhibit insecticidal, repellent and growth-regulating properties. For example, neem (*Azadirachta indica*) is one of the most widely used botanical pesticides due to the presence of azadirachtin, which disrupts insect growth and feeding behavior [7]. Additionally, essential oil-producing plants, such as those from the *Ocimum* and *Cymbopogon* genera, demonstrate strong insect-repellent activity.

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Botanical pesticides offer several advantages over synthetic pesticides, including:

1. Biodegradability
2. Reduced environmental toxicity
3. Lower risk of resistance development
4. Safety to non-target organisms

These findings support previous studies that emphasize the importance of ethnobotanical knowledge in sustainable agriculture [5,11].

CONCLUSION

This ethnobotanical investigation documented 80 plant species utilized for pesticidal purposes in the Satpuda region of North Maharashtra. Traditional knowledge serves as a valuable resource for developing eco-friendly pest management solutions. Botanical pesticides present sustainable alternatives to synthetic chemicals due to their biodegradability, safety, and effectiveness. However, further research is needed to:

1. Validate pesticidal activity
2. Identify active compounds
3. Develop standardized formulations
4. Conduct safety and toxicity studies

Integrating ethnobotanical knowledge with modern scientific research can contribute significantly to sustainable agriculture and environmental conservation.

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