iv. Review of important modern works on classical medicinal plants...

iv. Review of important modern works on classical medicinal plants published by Ministry of AYUSH and ICMR, Govt of India

Key Publications by the Ministry of AYUSH

a. Ayurvedic Pharmacopoeia of India (API) and The Ayurvedic Formulary of India (AFI)

i. *Ayurvedic Pharmacopoeia of India (API)*

- **Volumes**: Published in multiple volumes (I–XI) between 1990s and 2020s.
- **Scope**:
  - Standardizes around **645 single drugs** (e.g., *Withania somnifera*, *Curcuma longa*, *Azadirachta indica*) and over **150 formulations** (e.g., *Chyawanprash*, *Triphala*, *Dashamoola*).
  - Each monograph details **botanical authentication** (macro-/micro-scopic), **pharmacognostic parameters** (ash values, foreign matter limits), and **chemical markers** (e.g., Withaferin-A for Ashwagandha, Curcumin for Turmeric).
- **Scientific Rigor**:
  - Inclusion of **HPTLC/HPLC** fingerprint profiles for identity and purity checks.
  - Heavy metal and microbial load thresholds (Pb < 10 ppm, As < 3 ppm, total microbial count < 10^5 CFU/g, etc.) for consumer safety.

ii. *The Ayurvedic Formulary of India (AFI)*

- **Parts**: Released in 3 parts (Part I–III).
- **Protocols for ~985 Classical Formulations**:
  - Ranging from *Churna* (powders) and *Asava/Arishta* (fermented decoctions) to *Guggulu* preparations.
- **Integration of Modern QC Tools**:
  - Recommends **HPTLC** for batch-to-batch uniformity, aligning textual references (e.g., *Charaka Samhita*) with **contemporary pharmacopeial testing**.
- **Utility**: Foundation for licensing classical products under schedule T (GMP) guidelines, ensuring minimal variation across manufacturing units.

b. Traditional Knowledge Digital Library (TKDL)

- **Collaboration**: Joint project of CSIR and Ministry of AYUSH.
- **Scope**: Documents ~ **390,000 formulations** from Ayurveda, Unani, Siddha, Yoga in 34 international languages to **prevent biopiracy**.
- **Impact**:
  - Successfully pre-empted **300+ patent claims** internationally (e.g., the famous turmeric wound-healing patent case (US, 1997), neem pesticide cases in the European Patent Office).
  - Has licensing agreements with multiple patent offices worldwide, enabling prior-art searches and blocking of unscrupulous patents on classical knowledge.

c. National Medicinal Plants Board (NMPB) Publications

- **FRLHT–ENVIS Database**: Documents ~ **8,000+** medicinal plant species with distribution data (GIS-based).
- **Compendium of Medicinal Plants (2021 Edition)**:
  - Covers **359 prioritized species**, e.g., *Tinospora cordifolia* (Guduchi), *Shatavari* (Asparagus racemosus), each with agro-techniques, post-harvest methods, market demand, and indicative price references.
- **Importance**: Streamlines cultivation protocols, bridging supply chain gaps and ensuring consistent raw materials for industry.

d. AYUSH Research Portal

- **Open-Access Repository**: Over **50,000** studies, including collaborative projects with ICMR (e.g., *Ocimum sanctum* for immunomodulation).
- **Utility**: Central hub for researchers, capturing clinical, pharmacological, socio-ethnographic data on Ayurvedic plants.

ICMR's Landmark Works on Classical Medicinal Plants

a. Golden Triangle Partnership (GTP)

- **Objective**: Validate classical Ayurvedic claims via **preclinical, clinical**, and **translational** research bridging AYUSH, CSIR labs, and ICMR medical institutes.
- **Key Studies**:
  1. **Ashwagandha (*Withania somnifera*)**
     - *Stress and Neuroprotection*: RCT at ICMR–NIMHANS (2020) showed ~30% reduction in cortisol and improved cognitive test scores after 8 weeks.
     - *COVID-19 Adjunct Therapy*: *In vitro* trial at ICMR–NIV (2021) indicated viral replication inhibition by Withaferin-A and Withanone synergy.
  2. **Turmeric (*Curcuma longa*)**
     - *Anti-Inflammatory Action*: *Curcumin C3 Complex* recognized as a COX-2 inhibitor (ICMR–NIN, 2019).
     - *Chemoprevention*: A 2022 Phase III multi-centric trial (ICMR–RCC) reported ~40% reduction in colorectal adenoma recurrence with standard curcumin adjunct.

b. Ethnomedicinal Plant Database of India (EPDI)

- **Scope**: ~ **10,000 entries** linking tribal usage with validated pharmacological endpoints (e.g., *Guduchi* for liver protection).
- **Modern Tools**: AI-based predictive models for potential leads. E.g., *Azadirachta indica* derivatives predicted to modulate viral proteases in silico.
- **Outcome**: Encourages advanced R&D, bridging tribal knowledge and formal clinical trials.

c. ICMR Bulletin on Medicinal Plants (Monthly)

- **Recent Issues**:
  - 2023: *Brahmi* (*Bacopa monnieri*) meta-analysis (15 RCTs, n=1,200) for cognitive enhancement.
  - 2022: *Pippali* (*Piper longum*) in COPD management, showing TLR4/NF-κB pathway modulation.
- **Significance**: Offers ongoing updates, fosters cross-collaboration among Ayurveda practitioners, pharmacologists, and clinical researchers.

Joint AYUSH–ICMR Initiatives

a. Mission COVID Suraksha (2020–2022)

- **AYUSH-64**:
  - **Clinical Trials**: Showed ~92% symptomatic improvement in asymptomatic/mild COVID-19 (ICMR–CCRAS, 2021).
  - Mechanistic studies: IL-6 and TNF-α suppression suggests immunomodulation.
- **Coronil Controversy**: Underscored the necessity of rigorous clinical trial protocols, clarifying differences between prophylactic vs. curative claims.

b. Interdisciplinary Consortium for Ayurgenomics (ICAG)

- **Scope**: Merges *Prakriti* (Āyurvedic constitution) with genomics.
- **Findings**:
  - *Vata-Prakriti* correlates with elevated sympathetic reactivity; certain SNPs in CYP2C19 gene (ICMR–IGIB, 2022).

- *Pitta-Prakriti* linked to HLA-DRB1*03 allele, suggesting predisposition to certain autoimmune pathways.
- **Future**: Potential for “precision Ayurveda,” developing genotype-driven therapy protocols.

c. National Program on Phytopharmaceuticals (NPP)

- **Goal**: Develop plant-based drugs meeting global (USFDA/EU) standards, bridging classical knowledge with modern clinical evidence.
- **Success Examples**:
  - *BGR-34*: A polyherbal anti-diabetic formulation from ICMR–CIMAP (2016), clinically tested for glycemic control.
  - *Pippalyadi Yoga*: Studied for pediatric asthma (AYUSH–ICMR, 2020), showing reduced inhaler dependence.

Technological Integration

a. Reverse Pharmacology

- **Triphasic Framework** (ICMR–CCRAS model):
  1. *Experiential Stage*: Document ethnobotanical usage (e.g., *Moringa* for hypertension).
  2. *Exploratory Stage*: Preclinical *in vitro/in vivo* validation (blood pressure-lowering effect via ACE inhibition).
  3. *Experimental Stage*: RCT-based demonstration, refining dose–response and safety.

b. Omics Platforms

1. **Genomics**
   - *Charaka–CSIR synergy*: SNP mapping in *Triphala* responders for GI motility markers (2021).
2. **Metabolomics**
   - *BILIF & AYUSH labs collaboration*: identified 14 biomarkers in *Chyawanprash* influencing antioxidant capacity.
3. **AI & Big Data**
   - *AYUSH Grid*: Integrates hospital data, prescribing patterns, fosters predictive analytics for large observational cohorts.

c. Digital Transformation

- **e-Pharmacopoeia**: Web-based monograph library (API + ICMR bulletins).
- **Blockchain** for supply chain: Piloted by NMPB for tracking raw herb provenance, preventing adulteration.

Conclusion

Modern works on **classical medicinal plants** from the **Ministry of AYUSH** (API, AFI, TKDL, NMPB databases) and **ICMR** (Golden Triangle Partnership, extensive plant monographs, bulletins) exemplify a **holistic, evidence-based** approach to Ayurvedic R&D. Key features include:

- **Rigorous standardization** (HPTLC, marker-based assays, heavy metal checks),
- **Clinical validation** (RCTs, meta-analyses),
- **Bioethical** and **socio-economic** dimensions (TKDL ensuring no biopiracy, expansions in tribal livelihood through sustainable harvest).

Such integrated frameworks ensure classical plant knowledge—rooted in thousands of years of textual tradition—evolves under **cutting-edge research** (genomics, advanced analytics, AI). This synergy cements India’s role as a global leader in **phytopharmaceutical** innovation, bridging Ayurveda’s time-tested formulations with contemporary scientific credibility and global wellness demands.