BIOLOGY OF WEEDS AND INVASIVE PLANTS (PBT-804) Credit hours 3(3-0)

Educational Objectives:

1. Introduction weeds and invasive plants, Effects on ecosystem, Evolution of weeds and invasive plants, Genomics of plant invasions and genetic variation of the invasive species, Interactions with other plant species in communities, Ecophysiology of individual species and, at the molecular level, Shared genetic, physiological and biochemical characteristics, Occurrence of plant invasions and how they continue, Methods of detection, containment control and management of weeds, Using weeds and invasive plants for genetic manipulations.

Course Outcomes:

2. Students who take this course will be able to translate weed biology and understand their economic effects both in term of yield loss in crops and eco-environmental dynamics.

3. **Course Contents:**

a. Introduction
   (1) The definition of a weed
   (2) Weeds and human nature
   (3) Weedy traits
   (4) The origins of weeds
   (5) World origins and centers of agriculture, crop domestication and cultivation
   (6) World crop-weed species groups

b. The evolution of weed populations
   (1) Evolution, natural selection and weedy adaptation
   (2) Formation of the local weed population (deme).
   (3) Opportunity and the formation of the local deme
   (4) The structure of local weedy opportunity

(5) Habitat heterogeneity and dynamics

(6) Limiting resources and pervasive conditions in local opportunity

(7) The nature of plant invasions of local opportunity

c. Weed life history

(1) Introduction

(2) Plant life history classification systems

(3) The ecological demography of plant population life history dynamics

(4) Evolutionary, trait-based, weed life history population dynamics

d. Reproductive adaptation

(1) Flowering, anthesis, fertilization and birth

(2) Embryo adaptation: embryogenesis and dormancy induction

(3) Propagule adaptation: post-abscission fecundity

(4) Propagule dispersal in space and time

(5) Dispersal in space

(6) Dispersal in time: formation of seed pools in the soil

(7) Propagule germination and recruitment

(8) Germination micro-sites and safe sites

(9) Patterns of seedling emergence

e. Adaptation in local plant communities

(1) Introduction

(2) Weed-crop communities as complex adaptive systems

(3) Neighbor interactions in local plant communities

(4) Adaptation to neighbors in the community

(5) Patterns of neighbor interactions

(6) Interference interactions between neighbors: Competition, Amensalism, Antagonism

(7) Facilitative interactions between neighbors: Mutualism, Commensalism

(8) Strategic roles and traits of interference with neighbors:

(9) Strategic roles and traits of facilitation with neighbors

(10) Space, neighborhoods and plant density

(11) Plant density and productivity per unit area.

(12) Plant density and plant size

(13) Plant density and plant form

f. Weed community structure and dynamics

(1) Weed communities

(2) Weed community structure

(3) The origins of weeds: wild-crop-weed plant complexes

(4) Biogeographical population genetic structure

(5) Genotype structuring: species association for weedy colonization

g. Species-groups

(1) Polyploid species clusters

(2) Aggregate species

(3) Genotype structuring: pre-adaptive colonizing archetypes

(4) Generalist-specialist genotypes

(5) Genetic-reproductive colonizing types

h. Exploiting opportunity: weed community dynamics

(1) Ecological roles-guilds-trades in weed-crop plant communities

(2) Guild structure and community organization

(3) Parameters of weed species ecological role and niche

(4) Trait guild: relative seedling/bud emergence order

(5) Weed population shifts

(6) Plant community ecological succession

i. Weed community biodiversity

(1) Scales of weedy biodiversity

(2) Biodiversity encountered by interacting neighbors

(3) Weed community biodiversity: complexity, stability and equilibrium

j. Herbicides

(1) Systems Approaches for weed and invasive plant management

(2) Cycles of land use, expansion, and intensification

(3) Novel ecosystems

Recommended Books:

1. **Ecology of Weeds and Invasive Plants: Relationship to agriculture and natural resource management** (3rd Edition). By Radosevich et al. John Wiley and Sons, Hoboken, New Jersey, 2007.
2. **Invasive plant species of the world: a reference guide to environmental weeds** By Weber. CABI Publishing, 2003.
3. **Ecology and Control of Introduced Plants.** By Myers and Bazely. Cambridge: Cambridge University Press, 2003.
4. **Invasive Plants: Ecological and Agricultural Aspects** by Inderjit, S. Steven (ed.) Simpson Books, 2005.
5. **Invasive Plants of Range and Wildlands and Their Environmental, Economic, and Societal Impacts**. By Duncan et al. (eds.) Weed Science Society of America, 2005.
6. **Plant Invaders: The Threat to Natural Ecosystems.** By Cronk et al. London: Chapman and Hall, 1995.