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授課領域

作物育種方法、數量遺傳、育種試驗資料分析

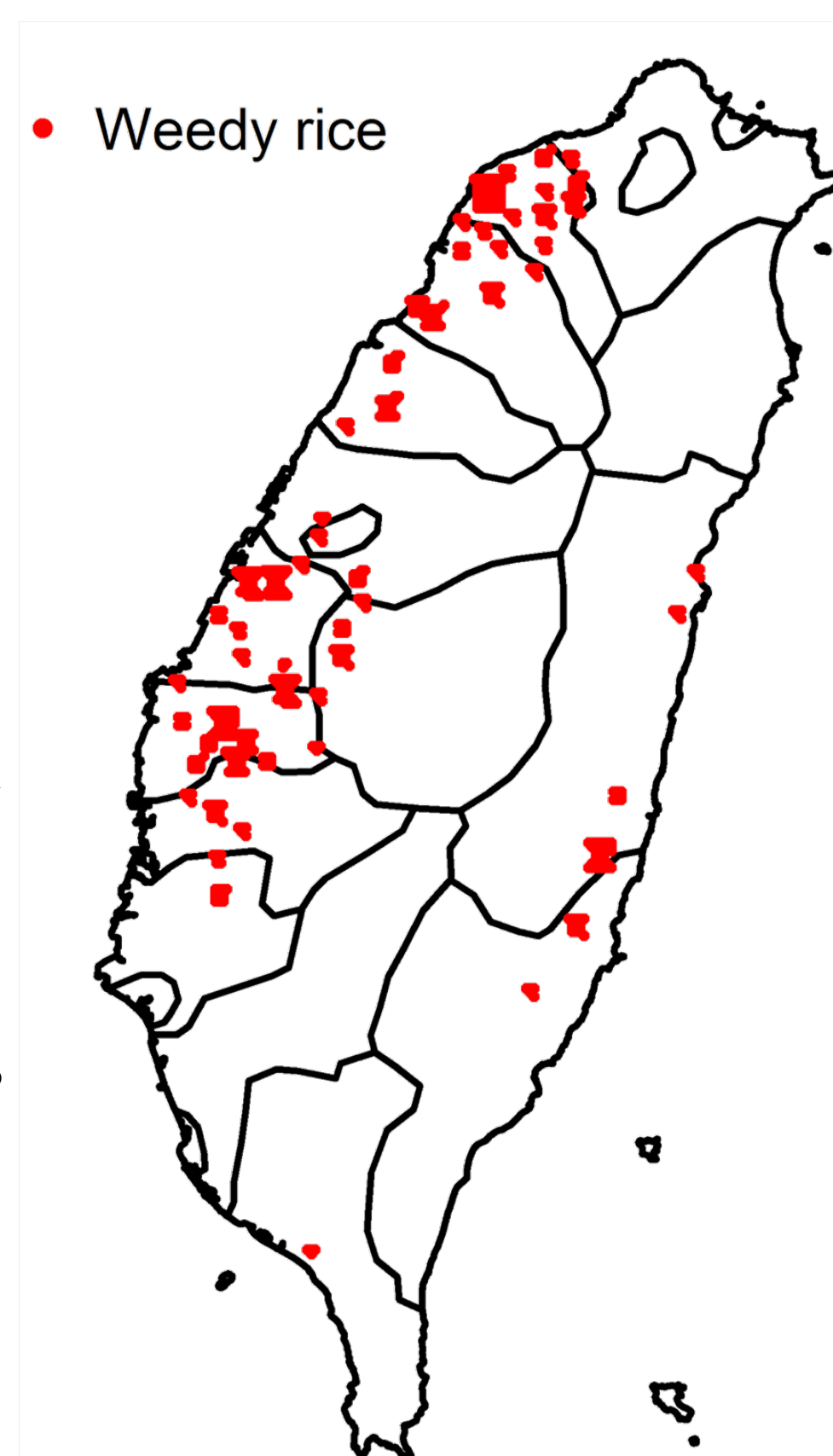
研究策略

普查全台稻種繁殖圃時，收集雜草型紅米糙米 (weedy red rice, WRR)後，先利用SSR標誌進行初步遺傳歧異度分析，再藉由次世代定序評估族群內雜草化遺傳區間，了解紅米族群與各類栽培品種的遺傳親緣關係，並納入各紅米樣品的地理資訊，並確定該類混雜的傳播模式與遺傳親緣，藉此擬定田間管理與防除技術。

試驗材料

試驗材料包含由2014年134個稻種繁殖圃所收集的552個紅米收集系 (TWR)，如Fig. 1，並同時自國家種原庫挑出57個1953年前秈型紅米地方品系 (INDL)、近代23個蓬萊稻 (粳稻, TEJ)、43個秈稻 (IND)、24個孟加拉型秈稻 (AUS)與12個美國雜草型紅米 (UWR)。

Fig. 1. Taiwan weedy rice accessions were collected 134 seed fields and plotted on Taiwan map.



研究方法

所有試驗材料發芽取樣後 (如Fig. 2)，均分析38個SSR基因座，利用主軸分析 (PCA) 確認台灣雜草型紅米與其他族群的親緣關係，再藉由遺傳地理分析了解台灣雜草型紅米的傳播模式，最終藉由雙切位次世代定序 (ddRAD)，在全基因組內3,127個定序區間中獲得5,927個SNP變異位點，再驗證次族群內之遺傳親緣關係與雜草化潛在遺傳區間。

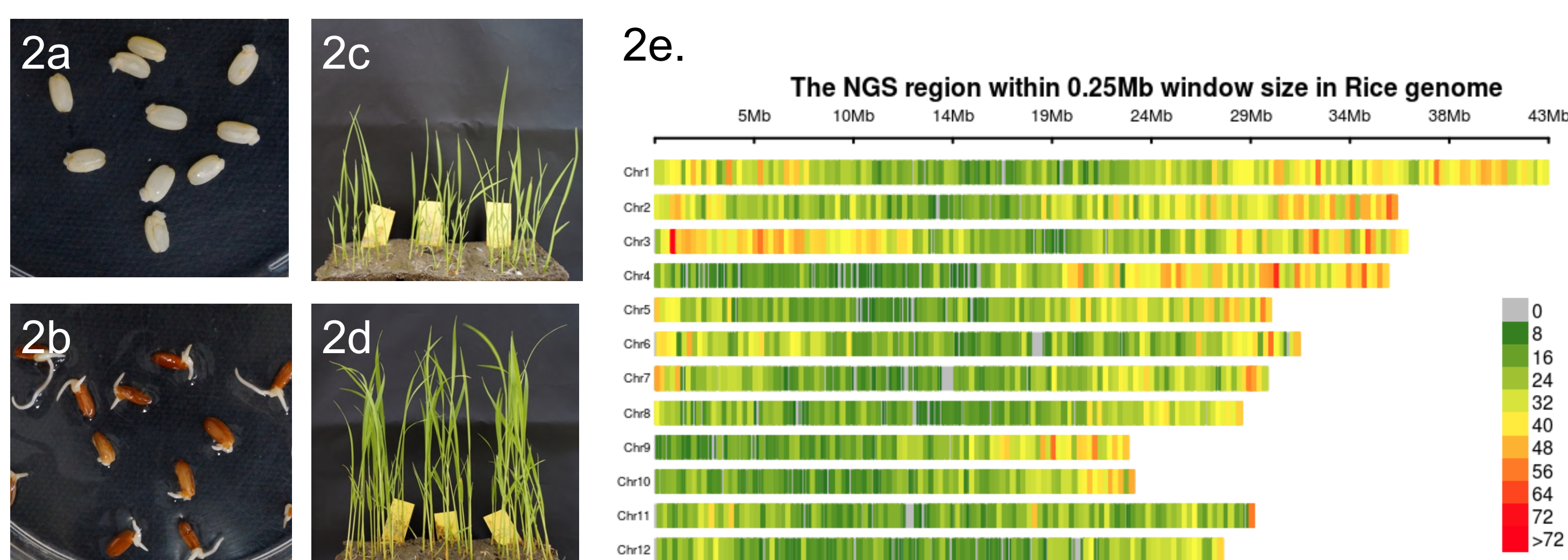


Fig. 2. The performance of weedy rice and cultivated rice on germination and seedling vigor. 2a. Cultivated rice; 2b. Weedy red rice; 2c. Cultivated seedling; 2d. Weedy red seedling; 2e. The NGS region within 0.25 Mb window size.

2020, Phylogenetic origin and dispersal pattern of Taiwan weedy rice. Pest Manag Sci 76: 1639–1651

2021, Survey of rice production practices and perception of weedy red rice in Taiwan. Weed Sci. 69:526-535

2021, Weedy Trait Genetics Using Rice 3K Database. Bot. Stud. 62:2

2022, Insights into the Genetic Spatial Structure of Nicaragua Weedy Rice and Control of Its Seed Spread. Pest Manag Sci 78: 3685–3696

2023, Dynamics of spatial and temporal population structure of Pyricularia oryzae in Taiwan. Pest Manag Sci 79: 4254–4263

2025, Morphological Diversity and Crop Mimicry Strategies of Weedy Rice Under the Transplanting Cultivation System. Agronomy, 15(4): 984

成果論文

重要結果

1) 遺傳親緣

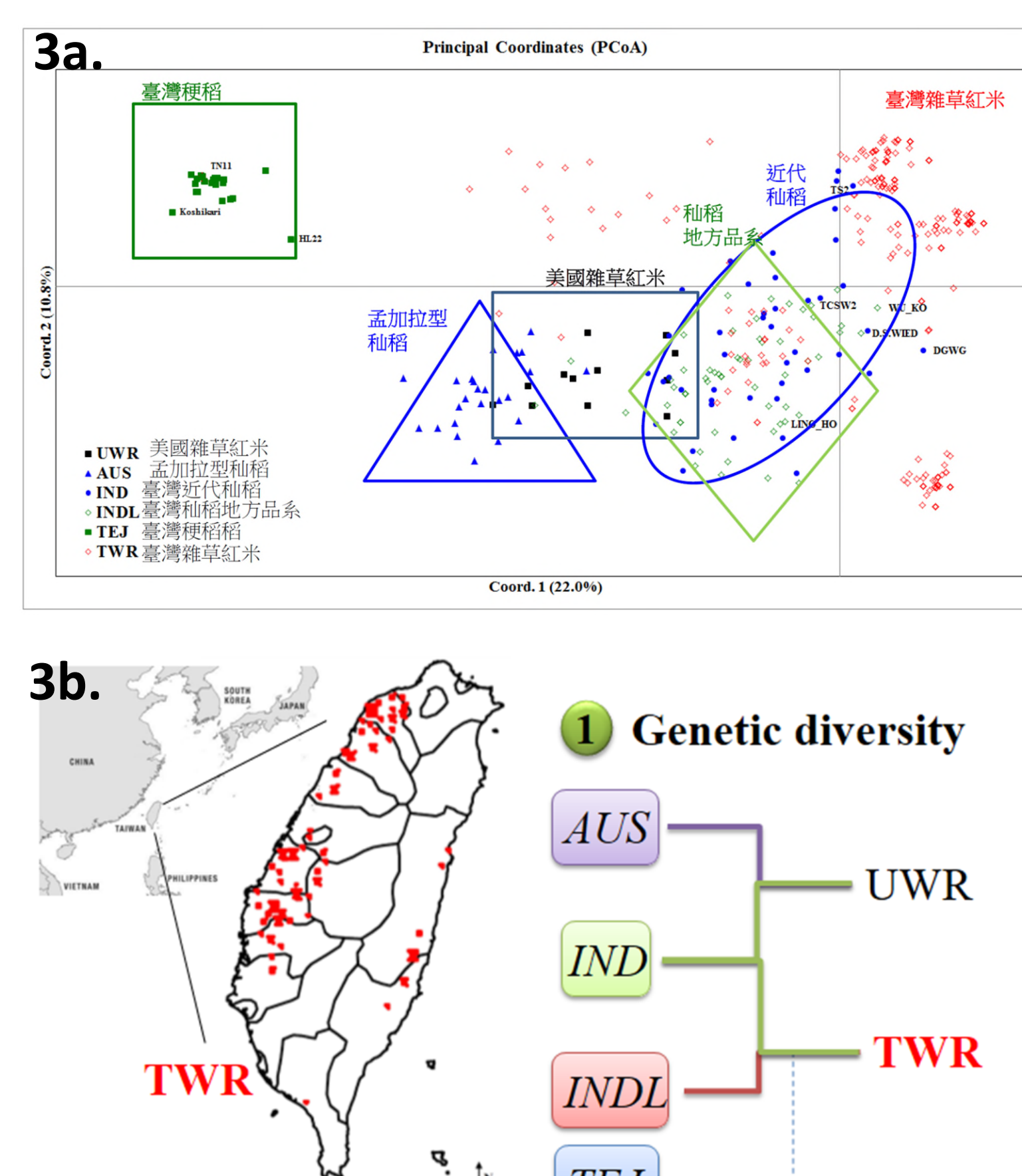


Fig. 3. The two-dimensional plot of the Principal Coordinate Analysis (PCoA) of SSR data showed the clustering of populations of cultivated rice and weedy rice (3a.). The illustration showed the distribution of Taiwan weedy rice and genetic origin of UWR and TWR (3b.).

2) 擴散模式

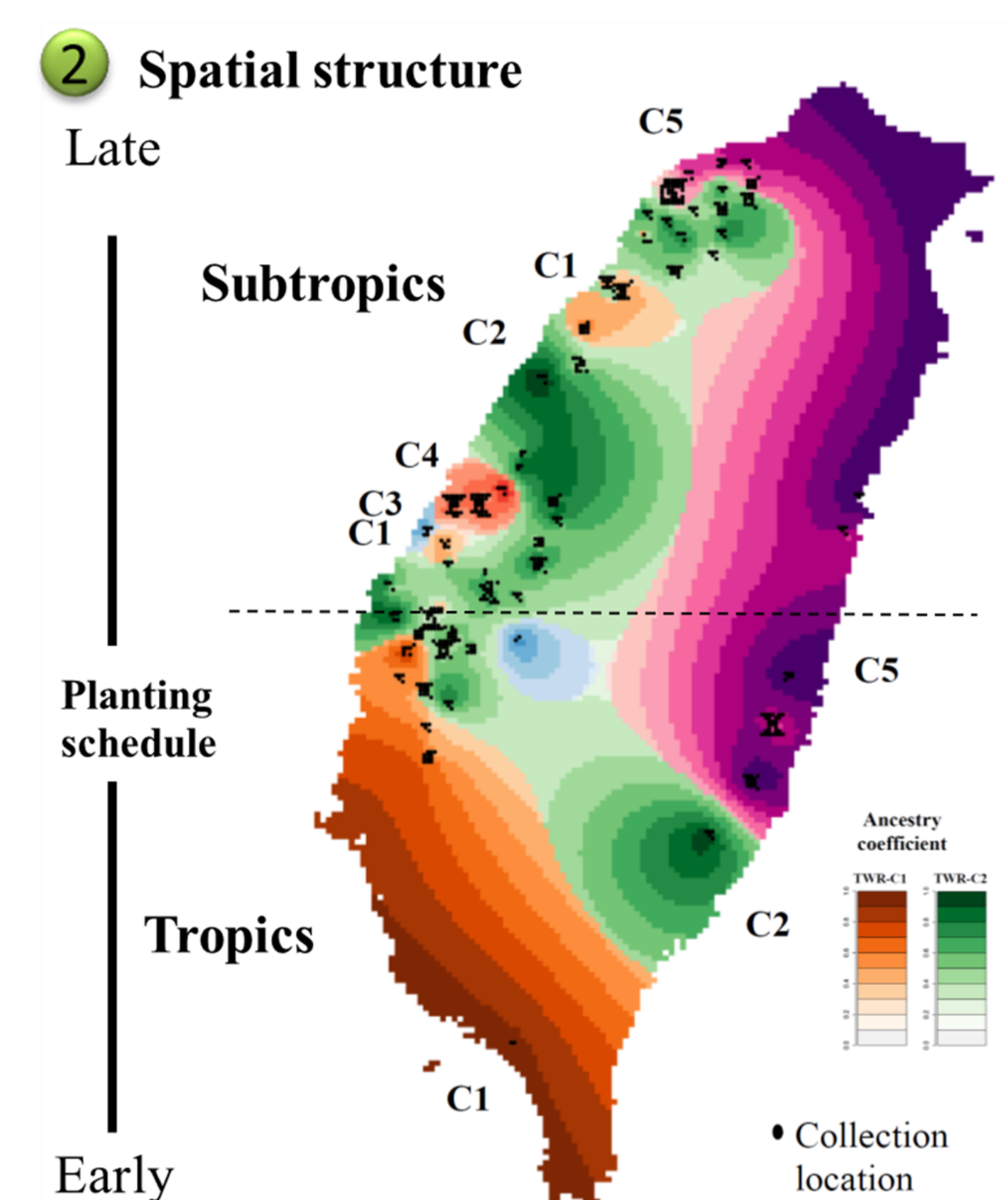


Fig. 4. Dispersal patterns of six Taiwan weedy rice clusters are displayed by the interpolated values of ancestry coefficients on the geographical map. Small black dots indicate the collection locations of Taiwan weedy red rice. The 6th geographic cluster contained few samples, which were from diverse origins. Thus, its color scheme is not represented on the graph.

3) 演化歷程

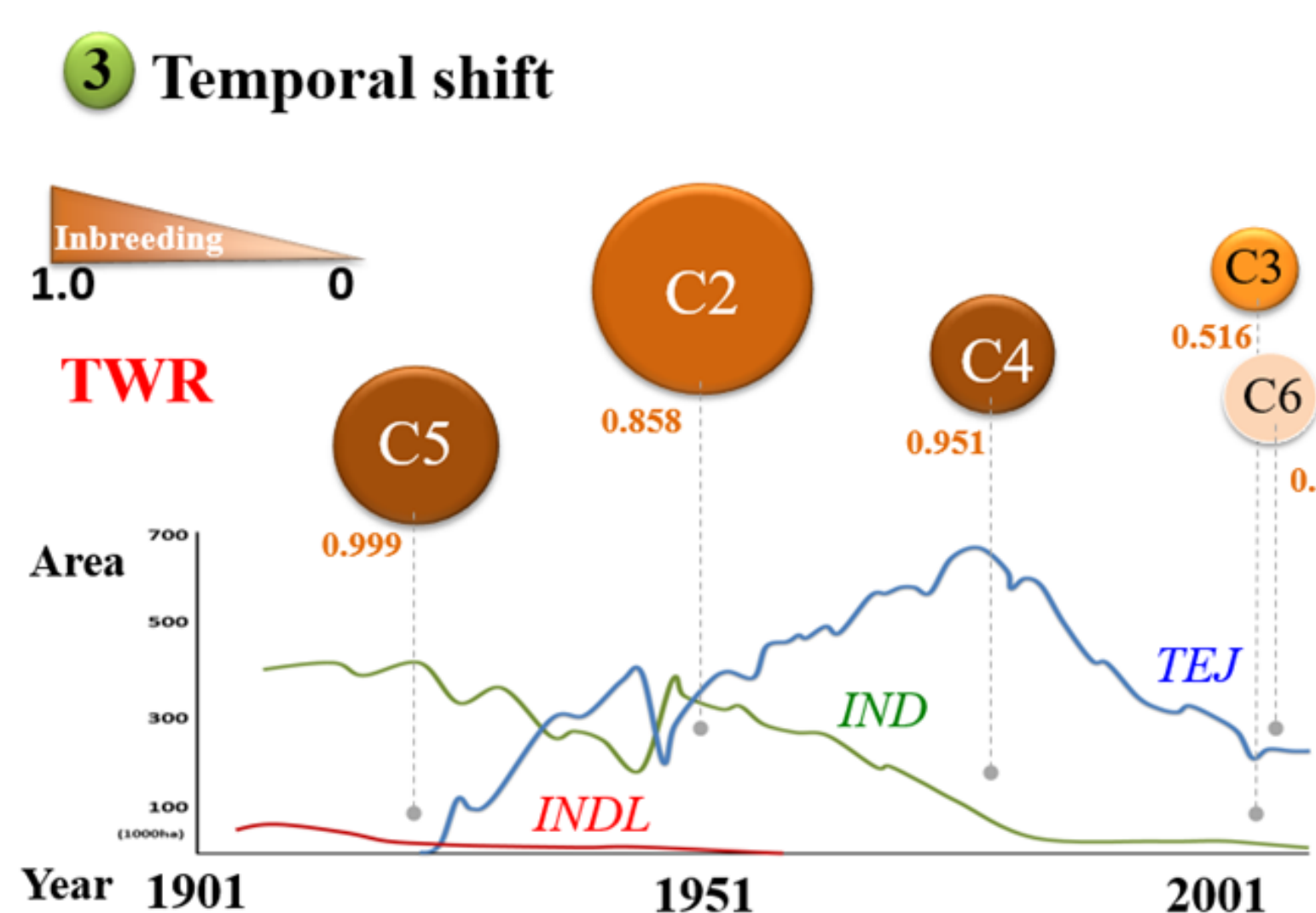


Fig. 5. The inbreeding coefficient of each Taiwan weedy rice cluster and the release year of inference variety. The three landraces is very popular before 1945 at Taiwan paddy field and the inbreeding coefficient of some clusters (C2, C4, C5) can be up to 1.

4) 適應特性

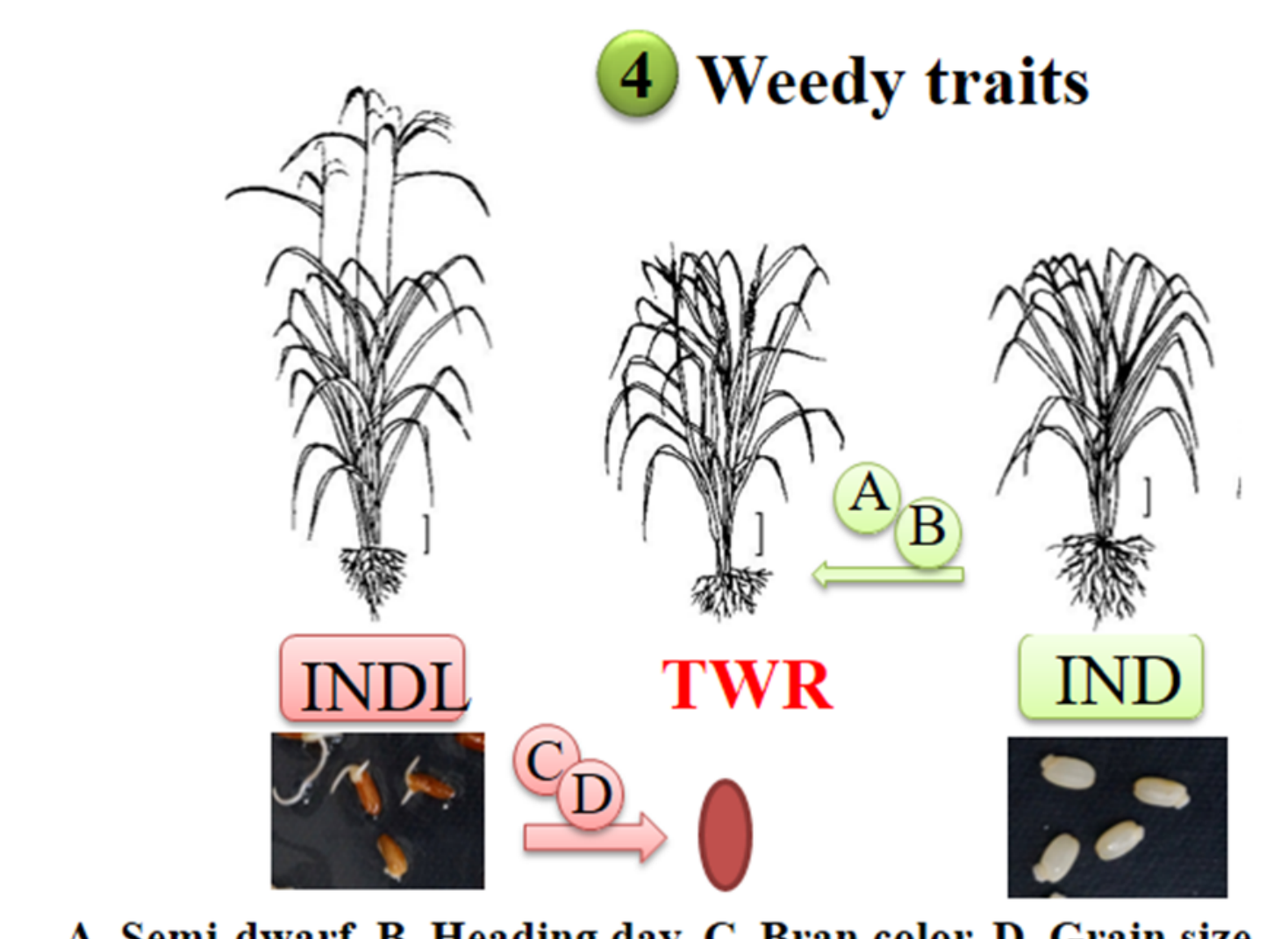


Fig. 6. Taiwan weedy rice possessed traits of semi-dwarf, early heading day, bran color and grain size, which derived from hybridization between old landraces (tall with red bran; commonly grown on Taiwan farms pre-twentieth century) and the indica cultivar (short with white bran; grown beginning mid-twentieth century).