Asian J Biol Life Sci., 2026; 15(2):296-302.
https://ajbls.com

Review Article

Biogeography of Dragonflies and Damselflies across the World

Deepak Rawal*, Diksha Batra

Department of Zoology, Mohanlal Sukhadia University, Udaipur, Rajasthan, INDIA.

ABSTRACT

Odonate (dragonflies and damselflies) constitute an ancient lineage of predatory insects whose contemporary distribution reflects interactions among geological history, climatic conditions, freshwater availability, habitat heterogeneity, dispersal capacity and evolutionary diversification. Approximately 6,400 extant species are distributed across all continents except Antarctica, with the greatest richness occurring in tropical regions. Nevertheless, odonate diversity does not follow a simple latitudinal pattern. Regional richness and endemism are influenced by water-energy availability, topography, river-basin history, forest cover, hydroperiod, elevation, island area and isolation, and the dispersal characteristics of individual lineages. The aquatic larval and terrestrial-aerial adult stages of odonates produce a distinctive dual-realm biogeography: successful colonization requires both suitable freshwater breeding habitats and terrestrial landscapes through which adults can forage, mature and disperse. Molecular phylogenies indicate that the principal odonate lineages originated deep in geological time, while many family-level radiations were shaped by the fragmentation of Pangaea and Gondwana, continental isolation and subsequent long-distance dispersal. Tropical regions such as the Neotropics, Afrotropics, Oriental Region, Sundaland, Wallacea and New Guinea contain high lineage diversity and numerous range-restricted species. Oceanic islands generally support fewer species than comparable continental areas but frequently harbour evolutionarily distinctive endemic radiations, including *Megalagrion* in Hawaii and *Nesobasis* and *Melanesobasis* in the Pacific. By contrast, highly dispersive dragonflies such as *Pantala flavescens* maintain almost cosmopolitan distributions through continental and transoceanic migration. Climate change, habitat modification, pollution, river regulation and deforestation are now reorganizing odonate distributions. Poleward and elevational range shifts are increasingly recorded, particularly in Europe, while tropical forest-stream and montane specialists may experience range contraction. This review synthesizes the historical, ecological and evolutionary processes underlying global odonate biogeography and identifies priorities for improving geographical databases, tropical inventories, phylogeographic sampling and conservation planning.

Keywords: *Anisoptera*, Dispersal, Endemism, Island Biogeography, Species Richness, *Zygoptera*.

Correspondence:
Deepak Rawal
Department of Zoology, Mohanlal Sukhadia University, Udaipur, Rajasthan, INDIA.
Email: deepakrawal26@mlsu.ac.in

Received: 03-04-2026;
Revised: 15-06-2026;
Accepted: 22-07-2026.

INTRODUCTION

The insect order *Odonata* comprises dragonflies, suborder *Anisoptera*, and damselflies, suborder *Zygoptera*, together with the relict family *Epiophlebiidae*, traditionally placed in *Anisozygoptera*. Odonates are among the oldest extant lineages of winged insects and possess a fossil history extending into the Palaeozoic. Modern estimates recognize approximately 6,400 species distributed throughout the world except Antarctica, although species totals continue to change as previously unknown species are described and molecular studies revise taxonomic boundaries (Dijkstra *et al*., 2013; Bybee *et al*., 2021; Newton *et al*., 2026). Their antiquity, strong association with freshwater, variable dispersal ability and nearly global distribution make odonates valuable organisms for studying historical and ecological biogeography. Odonates have a complex life cycle that links aquatic and terrestrial ecosystems. Eggs and larvae occur in rivers, streams, lakes, ponds, marshes, peatlands, phytotelmata and temporary pools, whereas adults forage and disperse through terrestrial and aerial environments. Their distributions therefore depend on the geographical arrangement of both aquatic breeding sites and surrounding terrestrial habitats. A freshwater body may possess suitable water quality and vegetation but remain unoccupied when it is isolated beyond the dispersal capacity of a species. Conversely, a highly mobile adult may cross extensive terrestrial or marine barriers but fail to establish where appropriate larval habitats are absent. This dual dependency distinguishes odonate biogeography from that of strictly aquatic or terrestrial organisms (Corbet, 1999; Kalkman *et al*., 2008; May, 2019).

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Manuscript TECHNOMEDIA

DOI: 10.5530/ajbls.20260207

Publishing Partner : Manuscript Technomedia. [www.mstechnomedia.com]

The contemporary distributions of odonates have been shaped by processes operating over multiple spatial and temporal scales. At geological scales, plate tectonics, continental fragmentation, mountain formation and changing drainage systems separated ancestral populations and generated opportunities for vicariant speciation. At regional scales, climatic stability, river-basin connectivity, topography and habitat heterogeneity influenced diversification and persistence. At ecological scales, hydroperiod, water temperature, vegetation, flow velocity, predation, salinity and disturbance determine which species can occupy individual freshwater habitats. Adult body size, wing morphology, flight behaviour and thermal physiology further influence the ability of species to cross barriers and colonize new regions (Corbet and May, 2008; Bybee *et al*., 2016; Newton *et al*., 2026). Early knowledge of odonate distributions was assembled through regional monographs and museum collections. Important foundations included Fraser's work on the *Odonata* of the Indian subcontinent, Lieftinck's studies of Southeast Asian and Indo-Australian faunas, and later regional syntheses for the Neotropics, Africa, North America, Europe and Australasia (Fraser, 1933-1936; Lieftinck, 1954; Garrison *et al*., 2006, 2010; Paulson, 2009; Dijkstra and Clausnitzer, 2014; Boudot and Kalkman, 2015). Modern distribution databases, molecular phylogenies, ecological niche models, remote sensing and citizen-science records now permit global analyses that were previously impossible. However, recording remains geographically uneven, with much denser information from Europe and North America than from tropical Africa, South America, Southeast Asia and many Pacific islands (Hassall, 2012; Sandall *et al*., 2022; Alves-Martins *et al*., 2024). The review is based on global phylogenetic studies, regional checklists and atlases, island-biogeographic analyses, migration studies, distribution models and conservation assessments.

RESULTS AND DISCUSSION

The evolutionary history of *Odonata* extends far deeper than the history of most modern insect orders. Fossil and molecular evidence places the divergence of the odonate lineage in the late Palaeozoic, while recent phylogenomic estimates place the crown diversification of living *Odonata* approximately 290-325 million years ago. Many divergences among modern families occurred during the Jurassic and Cretaceous, when continental fragmentation repeatedly separated terrestrial and freshwater biotas (Bybee *et al*., 2008; Kohli *et al*., 2021; Newton *et al*., 2026). These ancient divergences explain why several odonate families exhibit strongly disjunct distributions that cannot be interpreted solely through recent dispersal. Earlier phylogenetic studies produced competing hypotheses concerning the relationships among major odonate lineages. Molecular analyses gradually clarified the monophyly and internal relationships of *Zygoptera* and *Anisoptera*, although several deep nodes remained uncertain (Dumont *et al*., 2010; Dijkstra *et al*., 2014; Ware *et al*., 2007). Target-enrichment, transcriptomic and phylogenomic studies have since increased taxonomic and genomic coverage, revealing both ancient lineage separation and episodes of ancestral introgression (Bybee *et al*., 2021; Suvorov *et al*., 2022). Consequently, modern odonate biogeography should not be interpreted as a simple branching history. Hybridization and gene flow between ancestral lineages may have contributed to discordance between mitochondrial, nuclear and morphological phylogenies. Continental breakup created barriers but did not eliminate dispersal. The distributions of some old families contain signatures compatible with Gondwanan vicariance, whereas younger radiations reflect over-water dispersal, continental interchange and ecological expansion. Geological events influencing odonate diversification include the fragmentation of Gondwana, separation of Africa and South America, isolation of India and its later collision with Eurasia, development of Southeast Asian Island arcs, uplift of major mountain systems and repeated sea-level fluctuations.

Damselfly families containing weak-flying forest-stream species often preserve stronger geographical structure than highly mobile dragonfly families. *Platystictidae*, for example, is concentrated in tropical forests of Asia, Australasia, Africa and the Neotropics, with many narrowly distributed species. Its distribution has been interpreted through a combination of ancient vicariance, regional isolation and limited dispersal across unsuitable habitats (van Tol, 2009). In contrast, many *Libellulidae* occupy broad continental ranges and have repeatedly colonized islands because their strong flight, thermoregulatory capacity and use of open-water habitats facilitate dispersal. A recent phylogenomic reconstruction suggested that the common ancestor of living *Odonata* was behaviourally closer to an active flyer than to a sedentary percher. Multiple independent transitions subsequently occurred between flight strategies. These behavioural changes were associated with wing morphology and probably altered the geographical expansion of different lineages (Newton *et al*., 2026). Strong-flying lineages could cross drainage divides and marine barriers, whereas lineages adapted to shaded forest interiors frequently became isolated within individual mountain ranges, catchments or islands. The superfamily *Coenagrionoidea* provides a detailed example of how historical origin and ecological opportunity combine to generate contemporary diversity. Phylogenetic analyses indicate a tropical origin approximately 105 million years ago, followed by global dispersal and repeated biome transitions. The persistence of ancestral tropical climatic preferences contributed to greater tropical richness through time-for-speciation and tropical niche-conservatism mechanisms. Nevertheless, shifts into temperate environments allowed several lineages to expand northward and southward, reducing the steepness of the latitudinal diversity gradient during the late Cenozoic (Willink *et al*., 2024).

Odonate richness generally increases from high latitudes toward the tropics. Tropical South America, Central Africa and Southeast

Asia support the greatest concentrations of species, whereas polar and highly arid regions support few or none. This pattern reflects the combined effects of temperature, precipitation, primary productivity, freshwater availability, climatic stability and evolutionary history rather than latitude itself (Kalkman *et al*., 2008; Keil *et al*., 2008; Cordero-Rivera, 2025). Warm conditions extend adult flight seasons, accelerate larval development and permit a greater variety of reproductive strategies. High precipitation and topographic complexity generate diverse aquatic environments, including torrential streams, shaded forest creeks, floodplain lakes, swamps, temporary pools and phytotelmata. Long-term climatic stability may additionally allow lineages with narrow ecological tolerances to persist and diversify. Tropical regions have therefore functioned simultaneously as museums preserving ancient lineages and as cradles generating new species.

Water-energy availability provides a strong broad-scale explanation for richness. European and North African odonate diversity is related to temperature and water availability, although the relative influence of these variables changes geographically. In cooler regions, energy may limit larval growth and adult activity, whereas in dry regions, precipitation and freshwater availability become more important (Keil *et al*., 2008). Similar interactions operate globally, but their effects are modified by topographic heterogeneity, evolutionary history and regional species pools. The tropical richness gradient is not uniform between suborders. Many *Anisoptera* tolerate open, warm and seasonally variable habitats and possess broad distributions. Numerous tropical *Zygoptera*, particularly forest-associated families, are restricted to humid streams and exhibit small geographical ranges. Consequently, tropical regions contain both widespread generalists and exceptionally localized specialists. The apparent number of species within a grid cell may therefore conceal substantial variation in range size, phylogenetic diversity and conservation significance.

A recent analysis of hundreds of continental and island regions confirmed strong effects of latitude and insularity on odonate richness. Islands generally supported fewer species than continental regions, while island richness increased with area and decreased with geographical isolation. Nevertheless, individual islands departed substantially from the general pattern because of differences in geological age, elevation, habitat diversity and opportunities for *in situ* diversification (Cordero-Rivera, 2025). Global richness maps must be interpreted cautiously because recording effort is highly uneven. Areas with active odonatological societies, accessible roads and long histories of biological recording appear more completely sampled than remote tropical forests, conflict-affected regions and sparsely inhabited islands. Analyses that account for sampling completeness can produce different relationships between climate and richness from analyses based on raw occurrence totals. In some tropical areas, low observed richness may represent insufficient sampling rather than true biological impoverishment (Sandall *et al*., 2022; Alves-Martins *et al*., 2024). Taxonomic uncertainty adds another source of geographical bias. Tropical species complexes frequently contain cryptic species, while historical museum specimens may have been identified under broadly defined names. Molecular analyses often reveal deep genetic differentiation among island, mountain or river-basin populations. Consequently, current richness estimates are probably conservative in several tropical regions.

Island odonate communities are governed by the balance among colonization, extinction and *in situ* speciation. Large islands generally support more species because they contain more freshwater habitats, greater elevational variation and larger populations. Isolation reduces immigration, particularly for weak-flying forest species. Habitat diversity and geological age determine whether colonists merely persist or diversify into endemic radiations. Oceanic islands act as strong ecological filters. Species breeding in temporary ponds or small stagnant waters are more likely to establish than specialists requiring extensive rivers or highly specific stream conditions. Strong-flying libellulids are therefore disproportionately represented on remote islands. Damselflies can nevertheless colonize oceans, as demonstrated by the Hawaiian and Fijian radiations, but successful events are comparatively infrequent. Species richness is normally lower on islands than in continental regions of similar latitude. Nevertheless, islands may contain disproportionate evolutionary uniqueness because endemic species represent long-isolated branches of the odonate phylogeny. Conservation assessments based only on species number may consequently undervalue islands with small but distinctive faunas (Cordero-Rivera, 2025). Sea-level fluctuations strongly affected continental-shelf islands. During glacial low stands, land bridges connected parts of Sundaland and facilitated dispersal. Rising seas subsequently fragmented populations and promoted differentiation. In contrast, islands within Wallacea and the remote Pacific required over-water dispersal even at the lowest sea levels. Insular species are vulnerable because their entire ranges may be confined to one island, mountain or catchment. Deforestation, invasive fish, water abstraction, pollution and severe storms can therefore affect a large proportion of their global populations simultaneously. Climate warming creates an additional threat for montane island species, which may be unable to shift to cooler elevations once mountain summits are reached.

Biogeographic regionalization of the world's odonate fauna

Afrotropical Region

The Afrotropical Region includes sub-Saharan Africa, Madagascar and neighbouring Indian Ocean islands. Its fauna contains both widespread savanna dragonflies and highly localized forest-stream damselflies. Major centres of richness and endemism include the

Congo Basin, Guinean forests, East African highlands, Ethiopian highlands, Albertine Rift, Eastern Arc Mountains, Madagascar and the Cape region of southern Africa.

Tropical forest streams support numerous members of *Platycnemididae, Chlorocyphidae, Calopterygidae* and other damselfly groups. Many depend on shaded, oxygen-rich running water and are sensitive to sedimentation and canopy removal. In contrast, libellulid dragonflies frequently dominate open ponds, wetlands and seasonal savannas. Their strong dispersal permits rapid colonization after seasonal rainfall and enables wide African distributions. Africa's mountain blocks function as biogeographic islands. Cool, moist headwaters separated by hot or arid lowlands contain range-restricted taxa, especially species of *Gynacantha, Gomphidia, Notogomphus, Gomphus, Chlorocypha* and related genera. Climatic oscillations repeatedly altered forest connectivity, causing cycles of range expansion, isolation and secondary contact. The Eastern Arc and Albertine Rift are especially important because long-term environmental stability allowed persistence of ancient forest lineages. Madagascar has a distinctive fauna generated by prolonged isolation, habitat diversity and occasional colonization from Africa or Asia. The island contains endemic genera and species associated with rainforest streams, highlands and wetlands. The Comoros, Mascarenes, Seychelles and other western Indian Ocean islands support fewer species but provide evidence for repeated long-distance dispersal. Regional syntheses have greatly improved identification and mapping, although central African forests remain incompletely surveyed (Samways, 2008; Dijkstra and Clausnitzer, 2014).

Neotropical Region

The Neotropics extend from Mexico and the Caribbean through Central America and South America. They contain extraordinarily high odonate diversity, reflecting extensive tropical forests, large river systems, climatic gradients and complex geological history. Important centres include Amazonia, the Guiana Shield, Atlantic Forest, Central American highlands, northern Andes, Chocó, Cerrado and southeastern Brazilian mountain systems. Neotropical odonate communities contain diverse representatives of *Coenagrionidae, Gomphidae, Libellulidae, Calopterygidae, Heteragrionidae, Polythoridae, Pseudostigmatidae* and other predominantly tropical groups. Forest-interior damselflies frequently possess very small ranges, whereas many open-habitat libellulids occur across multiple countries. Taxonomic inventories and identification guides have revealed substantial regional diversity, but large portions of Amazonia and the Guiana Shield remain poorly sampled (Garrison *et al*., 2006, 2010; Paulson, 2004). The Andes have strongly influenced Neotropical biogeography by creating elevational climatic belts, isolating drainage basins and generating rain-shadow effects. Uplift promoted vicariant diversification and provided cool habitats into which tropical lineages could expand. Andean valleys and isolated massifs contain endemic species adapted to montane streams and wetlands. At lower elevations, major rivers may function either as dispersal pathways or barriers, depending on habitat requirements and adult flight behaviour. The banner-wing damselflies, family *Polythoridae*, illustrate the complexity of Neotropical historical biogeography. Molecular evidence indicates a history involving Andean uplift, movement between geographical regions, river-basin isolation and repeated diversification within tropical forests. Their present distributions cannot be explained by a single vicariant event but instead reflect changing landscapes and multiple episodes of dispersal (Sánchez-Herrera *et al*., 2020). The Amazon Basin supports immense habitat diversity, but local odonate assemblages are not evenly distributed. Large turbid rivers, blackwater systems, clearwater streams, temporary pools, forest swamps and phytotelmata support different communities. Deforestation often replaces forest specialists with widespread heliophilic species, producing local increases in conspicuous dragonflies while reducing regional endemism and phylogenetic distinctiveness. Thus, species richness alone may underestimate biogeographic homogenization.

Oriental Region, Sundaland and Wallacea

The Oriental Region includes the Indian subcontinent, southern China, mainland Southeast Asia and much of the Sunda Shelf. It is one of the world's major odonate-diversity centres. The Himalaya, Western Ghats, northeastern India, Indo-Burma, southern China, Malay Peninsula, Borneo, Sumatra and the Philippines contain especially rich assemblages. The Indian fauna combines Oriental, Palaearctic and endemic elements. The Himalaya forms both a barrier and a transition zone: tropical lineages occur along warm foothills and valleys, whereas temperate species occupy high-elevation wetlands. Peninsular India contains widespread seasonal-wetland species together with endemic forest-stream taxa concentrated in the Western Ghats. Fraser's classical volumes established the taxonomic foundation for the region, while modern state and landscape inventories continue to extend known ranges (Fraser, 1933-1936; Tiple *et al*., 2015). Sri Lanka supports a high proportion of endemic damselflies associated with the island's wet-zone forests and central highlands. Geographic isolation, climatic zonation and stream specialization have promoted differentiation, while dry-zone wetlands contain more widespread South Asian species. Continuing inventories demonstrate that even comparatively well-studied landscapes retain distributional gaps (Wijesooriya *et al*., 2022). Sundaland includes the Malay Peninsula, Borneo, Sumatra, Java and nearby islands that were periodically connected during Pleistocene low sea levels. Repeated cycles of land connection and isolation influenced dispersal and population divergence. Forest-stream damselflies display high island and mountain endemism, whereas many pond-breeding dragonflies occur throughout the Sunda Shelf. Borneo is especially rich because of its large area, extensive rainforest, mountain systems and dense stream networks.

Wallacea, situated between the Sunda and Sahul shelves, comprises islands that were never completely connected to either mainland Asia or Australia. Its odonate fauna therefore reflects over-water colonization, island isolation and *in situ* speciation. The region contains sharp faunal turnover among Sulawesi, the Moluccas and the Lesser Sunda Islands. Across Sundaland and Wallacea, hundreds of species are restricted to the broader region and many occur on only one island, demonstrating how geological fragmentation promotes endemism. The boundary between Palaearctic and Oriental faunas is not a fixed line. Analyses of dragonfly distributions indicate a broad transition zone influenced by elevation, monsoon climate and east-west differences in continentality. Some tropical species penetrate northward along warm river valleys, while temperate species extend southward through highlands (Heiser and Schmitt, 2013).

Australasian and Pacific regions

New Guinea and surrounding islands form one of the least completely documented but most distinctive odonate regions. Mountain uplift, deep river valleys, rainforest continuity and isolation among ranges have generated exceptional endemism. Many damselflies are confined to individual mountain systems or islands. New Guinea also represents a zone of interchange between Asian-derived and Australian lineages. Australia contains a mixture of ancient endemic lineages and widespread Indo-Pacific colonists. The humid eastern margin, tropical north and southwestern region support distinctive assemblages, while aridity limits diversity across much of the interior. Permanent springs, monsoonal rivers and isolated wetlands provide refugia in otherwise dry landscapes. New Caledonia and New Zealand contain smaller but biogeographically important faunas, including ancient and highly isolated lineages. Pacific islands generally contain few species because of their isolation and limited freshwater habitats. However, successful colonists may diversify extensively after arriving. Habitat opportunities include streams, waterfalls, marshes, tree holes and water retained in plant structures. Adaptive shifts into unusual larval habitats can reduce competition and promote ecological speciation. The Hawaiian genus *Megalagrion* represents a classic island radiation. Its ancestors crossed a vast marine barrier, after which descendants diversified into species occupying streams, seepages, waterfalls and terrestrial or semi-terrestrial larval habitats. Molecular evidence indicates repeated ecological transitions and inter-island dispersal within the archipelago (Jordan *et al*., 2003). Fiji supports major radiations of *Nesobasis* and *Melanesobasis*. Most species have restricted distributions, and several are confined to particular islands, catchments or elevations. Their evolutionary history reflects island isolation, ecological differentiation and occasional movement among islands (Beatty *et al*., 2017). Recent investigation of *Melanesobasis* in Vanuatu has added evidence for ancient geographical separation among Melanesian island groups rather than exclusively recent stepping-stone dispersal (Saxton *et al*., 2025).

Nearctic Region

The Nearctic Region has lower species richness than tropical America but is comparatively well documented. Its fauna includes temperate specialists, widespread Holarctic species and Neotropical elements extending northward through Mexico and the southern United States. Richness is highest in the warm, humid southeastern United States, where dense river networks and diverse wetlands support many gomphids, coenagrionids and libellulids (Abbott *et al*., 2022; Paulson, 2009). Northern North America was extensively glaciated during the Pleistocene. Much of its modern fauna therefore originated through postglacial recolonization from southern refugia. Highly dispersive species expanded rapidly, while poor dispersers retained stronger genetic structure. The orientation of mountain ranges and drainage networks influenced recolonization routes. The southwestern deserts contain fewer species overall but support specialized assemblages around springs, desert rivers and canyon systems. The Grand Canyon region forms a transition between Nearctic and Neotropical faunas. Elevation, river corridors and climatic gradients allow northern and southern elements to occur within a relatively restricted geographical area (Stevens and Bailowitz, 2009). Species-distribution modelling has demonstrated that occurrence records for North American *Odonata* contain substantial false absences caused by unequal survey effort. Models can identify environmentally suitable but under-recorded regions, although predictions require field validation (Hassall, 2012).

Palaearctic Region

The Palaearctic fauna extends from Europe and North Africa across northern Asia to Japan. Species richness is lower than in tropical regions, but the fauna is well studied and provides some of the clearest evidence for postglacial expansion and climate-driven redistribution. Southern European peninsulas, North Africa, Anatolia, the Caucasus and parts of Central and East Asia served as refugia during Pleistocene glaciations. Populations expanded northward during warmer periods, producing contact zones and genetic gradients. Mediterranean mountain systems retained localized species and genetically differentiated populations, while northern Europe was colonized mainly by cold-tolerant and mobile taxa. European atlases and Red Lists provide unusually detailed distributional information (Riservato *et al*., 2009; Kalkman *et al*., 2010; Boudot and Kalkman, 2015). These data show that warming has enabled several southern species to expand northward, while habitat restoration and improved water quality have assisted some riverine species. Nevertheless, Mediterranean and boreal specialists face increasing climatic and hydrological stress. Calopterygid damselflies in the Iberian Peninsula demonstrate the influence of climatic belts

and historical isolation. Their distributions correspond to combinations of temperature, precipitation, river characteristics and geographical barriers, while contact zones provide evidence of past range shifts (Outomuro *et al*., 2010).

CONCLUSION

The global biogeography of odonates is the outcome of interactions among ancient evolutionary history, geological change, freshwater geography, climate, ecological specialization and dispersal. Deep divergences among major lineages reflect Palaeozoic and Mesozoic events, whereas present-day distributions also record recent colonization, migration, postglacial expansion and anthropogenic environmental change. Species richness generally increases toward tropical latitudes, but latitude alone does not explain odonate diversity. Water-energy availability, climatic stability, habitat heterogeneity, topography, river-basin configuration and regional evolutionary history determine the size and composition of faunas. Tropical forests and mountains contain many localized damselflies, while open wetlands support mobile dragonflies with broad ranges. Islands clearly demonstrate the contrasting outcomes of dispersal limitation and evolutionary diversification. Remote islands normally contain fewer species than continental areas, yet successful colonization can generate endemic radiations of exceptional evolutionary importance. At the opposite extreme, migratory dragonflies such as *Pantala flavescens* connect continents and cross oceans by exploiting seasonal winds and temporary freshwater habitats.

Climate change and land-use transformation are now reorganizing these historical patterns. Warm-adapted species are expanding poleward and upward, while cold-water, montane, forest-stream and island specialists face contraction. Changes in geographical richness may be accompanied by losses of endemism, ecological functions and evolutionary history. Future progress requires geographically balanced sampling, improved taxonomy, integrated freshwater and terrestrial environmental data, genomic phylogeography and long-term monitoring. Conservation planning must protect not only individual breeding sites but entire freshwater-terrestrial landscapes, dispersal corridors, elevational gradients and climatic refugia. Odonates provide an unusually informative model for understanding how ancient evolutionary history and modern environmental change interact to structure freshwater biodiversity.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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Cite this article: Rawal D, Batra D. Biogeography of Dragonflies and Damselflies across the World. Asian J Biol Life Sci. 2026;15(2):296-302.