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ADDITIONS TO FLORA OF PAKISTAN: FIVE NEW RECORDS IN THE GENERA *LEPIDIUM*, *SHANGWUA* AND *SOLANUM* FROM SWAT, MALAKAND, DIR AND CHITRAL DISTRICTS

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Abstract

Lepidium bonariense L., *L. campestre* (L.) W.T. Aiton, *Shangwua masarica* (Lipsky) Yu J. Wang & Raab-Struabe, *Solanum nitidibaccatum* Bitter and *S. sisymbriifolium* Lamarck are newly recorded from Pakistan. Illustrations and a distribution map of the newly recorded species are provided.

Key words: *Lepidium bonariense*, *Lepdium. campestre*, *Shangwua masarica*, *Solanum nitidibaccatum*, *Solanum sisymbriifolium*, Khyber Pakhtunkhwa, Invasive plants.

Introduction

An increasing number of new plant records including alien invasive species have been reported from Pakistan over last couple of decades (Qaiser & Abid, 2002; Marwat *et al.*, 2009; Ajaib & Khan, 2010; Khan *et al.*, 2010; Ajaib & Khan, 2012; Qureshi *et al.*, 2014; Qureshi & Raana, 2014; Islam *et al.*, 2016; Ali *et al.*, 2017; Mujahid & Shabbir, 2017; Hameed *et al*., 2019; Hussain *et al.*, 2019; Bahadur *et al.*, 2020; Ishaq *et al.*, 2020; Sultan *et al*., 2022; Rashid & Sultan, 2023) including the most hazardous invasive species like *Parthenium hysterophorus* (Arshad *et al.*, 2006) that have serious ecological consequences and cause significant economic losses.

The present study reports the occurrence of *Lepidium bonariense* L., *L. campestre* (L.) W.T. Aiton, *Shangwua masarica* (Lipsky) Yu J. Wang & Raab-Struabe, *Solanum nitidibaccatum* Bitter and *S. sisymbriifolium* Lamarck in Pakistan. These plants have not been documented in Stewart's annotated catalogue of the vascular plants of W. Pakistan and Kashmir (1972) or the account of the families Brassicaceae (Jafri, 1973), Asteraceae: tribe Cardueae (Ghafoor, 2019) and Solanaceae (Nasir, 1985) in the Flora of Pakistan, therefore represent new records for the country. *Lepidium bonariense, L. campestre, Solanum nitidibaccatum* and *S. sisymbriifolium* are known to have become naturalized/invasive or adventive in other parts of the world.

Genus *Lepidum* was previously represented by nine species in Pakistan (Jafri, 1973), including one introduced species – *L. virginicium*. With the addition of *Lepidium bonariense* and *L. campestre*, *Lepidium* is represented by 11 species in Pakistan. Genus *Shangwua* was only represented by *Shangwua jacea* (Klotzsch) Yu J. Wang & Raab-Struabe in Pakistan (Ghafoor, 2019; Wang *et al*., 2013), with the addition of *S. masarica*, *Shangwua* is now represented by two species. Genus *Solanum* was previously represented by 16 species in Pakistan (Nasir, 1985; Ishaq *et al*., 2020), including two introduced/invasive species viz., *S. elaeagnifolium* Cav.and *S. rostrtaum* Dunal. With the addition of *S. nitidibaccatum* and *S. sisymbriifolium*, *Solanum* is now represented by 18 species in Pakistan.

Lepidium bonariense, *L. campestre* were determined by Dr. Ihsan Al-Shehbaz (Missouri Botanical Garden) and *Solanum nitidibaccatum* and *S. sisymbriifolium* were determined by Dr. Sandra Knapp (British Museum of Natural History).

Morphological descriptions and geographic distribution

Lepidium bonariense L.

Figs. 1, 7

Annual herbs, 25–28 cm, stem ribbed, sparsely hairy with curved, retrorse hairs, leaves 1-2 pinnatisect, 2–2.8 × 0.9–1.5 cm, sparsely hairy along the midrib and margins, leaf segments 5–8 × 1 mm, upper leaves linear, racemes 2–5.5 cm, flowers c. 1 mm long, flowering pedicel adaxially hairy, 2–2.5 mm, sepals 0.5 × 0.25 mm, apically ± pilose, petals reduced, subulate, 0.3 mm, stamens 2, filament c. 1 mm, anther 0.25 mm, style obsolete, stigma capitate, silicula notched, glabrous, reticulate, c. 3.5 × 3 m, broadly elliptic, suborbicular, apically winged, seed 1.6 × 1 mm, obovate, flattened, narrowly winged.

Specimens examined: Pakistan, Khyber Pakhtunkhwa, Upper Dir district, Sahib Abad, Jogha Banj, 3 June, 2023, *Amir Sultan, Amjad Khan* & *Mahrine Rashid*, No. AMA-16, (RAW 102784).

Lepidium bonariense is native to Bolivia to SE. & S. Brazil and S. South America and has spread to parts of Europe, Africa and Yemen, Japan, Australia, New Zealand (POWO, 2023).

Lepidium campestre (L.) W.T. Aiton
Figs. 2, 7

Annual herbs, 20–33 cm, stem hirsute with upto 0.3 mm long spreading hairs, radical leaves long petiolate, petiole 4.6 cm, lamina 3.2 × 0.9 cm, lanceolate, cauline leaves 0.9–3.7 × 0.3–0.8 cm, oblong, denticulate, auriculate-sagittate, racemes 2.3-6.2 cm, pedicel 5–6 mm, densely hirsute, flower c. 2 mm long, sepals 1.2 × 0.8–0.9 mm, oblong, white margined, petals 1.5 × 0.5 mm, claw 1 mm, stamens 6, filament 1.2–1.5 mm, anther 0.3 mm, ovary 1.5 mm, style 0.5 mm, stigma capitate, silicula notched, papillate, 4.5 × 2.5–3 mm, elliptic, winged, wing up to 1.5 mm broad, seed 1.8 × 1 mm, flattened, narrowly winged.

Specimens examined: Pakistan, Khyber Pakhtunkhwa, Upper Dir district, Lowari, 5 June, 2023, *Amir Sultan, Amjad Khan* & *Mahrine Rashid*, No. AMA-16, (RAW 102785).

Lepidium campestre is native to Russia, SW Asia and Europe and is introduced elsewhere (Zhou *et al*., 2001).

Shangwua masarica (Lipsky)
Yu J. Wang & Raab-Struabe
Figs. 3, 4, 7

Plants up to 35 cm, stem greyish-brown to brown, ribbed, with spreading glandular hair, leaves 1.5 – 7 × 0.5 – 3 cm, short-petiolate, petioles narrowly winged, upper cauline leaves sessile or subsessile, elliptic, acute-aristate, denticulate, abaxial surface white lanate with yellow sessile glands and few stipitate glands, adaxial surface green with stipitate glands, capitula (including florets) 1.9 – 2.7 × 1.5 – 2.5 cm, phyllaries 4-5 seriate, coriaceous, outer phyllaries ovate, 6 – 10 × 4.5 mm, inner oblong, lanceolate, 12 – 16 × 2 – 3 mm, arachnoid hairy at the apices, acuminate, greenish-yellow with dark brown margins, palea linear, 18 × 0.5 mm, floret c. 23 mm, pappus cream, up to 15 mm, corolla 15 mm, corolla tube c. 8 mm, lobes 2.2 × 0.5 mm, linear, anthers caudate, 6.5 mm long, filaments 3 – 3.5 mm, immature cypsela 5 – 5.5 × 0.8 – 1.5 mm.

Specimens examined: Pakistan, Khyber Pakhtunkhwa, Swat district, Kalam, Osh Nala, 25 September, 2023, *Amir Sultan, Amjad Khan* & *Roohul Amin* (RAW 102928); Osh Nala, 26 July, 2023, *Roohul Amin* (RAW 102916); **Chitral district, Laspur,** Rezhun, 18 August, 2024, *Ghulam Qadir*, No. 3067, (RAW 103299).

According to Flora of the USSR (Bobrov *et al*., 1962) *Shangwua masarica* (as *Saussurea masarica*) occurs along borders of glaciers and stony slopes and was considered endemic to Tajikistan, however, it was noted that it is a typical species of Himalayan alliance.

Solanum nitidibaccatum Bitter
Figs. 5, 7

Annual herbs, plants up to 30 cm, all plant parts with an indumentum of spreading septate glandular hair, stem green, striate, leaves 1.6 – 6.3 × 0.9 – 2.2 cm, ovate to rhomboidal, entire to undulate, petiole 0.6 – 2.2 cm, winged apically. Inflorescence 3 – 9 flowered, peduncle 0.3 – 1.5 cm, pedicel 3 mm, calyx 4.5 mm, lobes, c. 1.25 × 1.0 mm, ovate, obtuse, corolla 4.5 mm, corolla tube 2.5 mm, lobes ovate c. 2 × 1.5 mm, with a dense tuft of hair at the apex on abaxial surface, free part of filament 1 mm, anther 2 × 0.5 mm, yellow, ovary 0.75 mm in diameter, style c. 3 mm, pubescent in the lower half, stigma capitate, fruit 7 – 8 mm in diameter, globose, brownish-green, fruiting pedicel c. 6 mm, fruiting calyx accrescent c. 9.5 mm, seeds 2.25 × 2 mm.

Specimens examined: Pakistan, Khyber Pakhtunkhwa, Swat district, Kalam, Osh, 25 September, 2023, *Amjad Khan, Amir Sultan* & *Roohul Amin* (RAW 102932); Gabral, 30 August, 2023, *Amir Sultan, Amjad Khan, Raees Khan & Tahir Iqbal* (RAW 102931); **Chitral district**, Shah Saleem, 3 September, 2024, *Amir Sultan & Amjad Khan* (RAW 103323).

Solanum nitidibaccatum has an amphitropical distribution in temperate South America and temperate western North America, including northern Baja California (Knapp *et al*., 2019) and is adventive in parts of North America, Europe, Australia and New Zealand (POWO, 2023). In the Gabral area of Swat *S. nitidibaccatum* has spread as a weed in cultivated areas.

Solanum sisymbriifolium Lamarck
Figs. 6, 7

Perennial erect or procumbent herbs, stem prickly, prickles 1 – 20 × 0.25 – 3 mm, yellow to yellowish brown, with a few stipitate red-coloured glands, stem indumentum of short, aseptate, eglandular and long septate, glandular hair. Leaves 10.5–13 × 5–7 cm, bipinnatisect, with an indumentum of stellate and simple hair, petioles 2 – 3 cm. Inflorescence 4 – 6 flowered axillary raceme, pedicel 0.7–1.4 cm, fruiting pedicel 1–1.2 cm, calyx c. 5.5 cm, with up to 1.5 mm long hairs and small prickles, persistent and accrescent in fruiting to c. 8 – 1.6 cm, lobes c. 4.5 mm, ovate, acuminate, corolla bluish-white, abaxially stellate hairy, tube 2 – 5 mm, lobes 5 – 9 mm, ovate, acute, filament 1.5 – 2.5 mm, free part of filament 0.5 – 1.5 mm, anther 6 – 7 mm, style 12 mm, stigma 1 mm, fruit red, globose, 0.9 – 1.8 cm, seeds c. 3 mm.

Specimens examined: Pakistan, Khyber Pakhtunkhwa, Malakand district, Batkhela, 17 October, 2019, *Sayed Afzal Shah* (RAW 101367); **Lower Dir district,** Bandagai, Shagokas, 3 June, 2023, *Amir Sultan, Amjad Khan & Mahrine Rashid*, No. AMA-06 (RAW 102757).

Solanum sisymbriifolium is native to South America but is widely adventive and somewhat invasive and has been recorded in tropical Asia in Bangladesh, China and throughout India (Aubriot & Knapp, 2022).

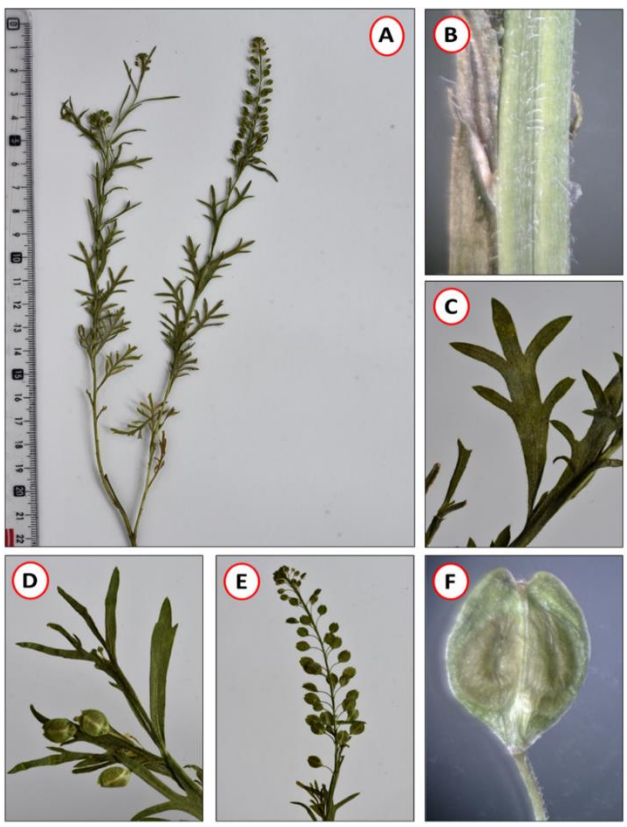

Fig. 1. *Lepidium bonariense* L., (A) Habit, (B) Stem indumentum, (C) Cauline leaf, (D) Upper cauline leaves, (E) Raceme, (F) Fruit (silicula).

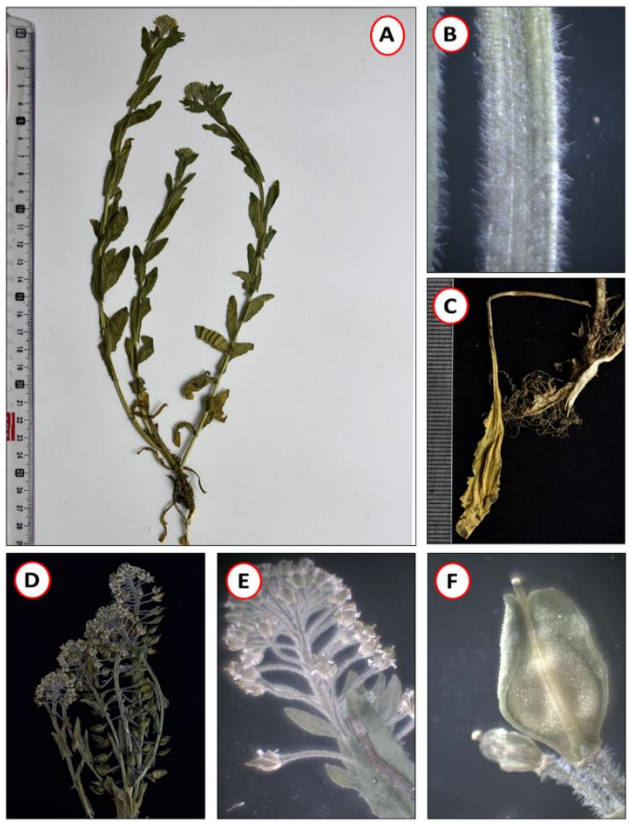

Fig. 2. *Lepidium campestre* (L.) W.T. Aiton, (A) Habit, (B) Stem indumentum, (C) Basal leaf, (D) Flowering and fruiting racemes, (E) Flowering raceme, (F) Fruit (silicula).

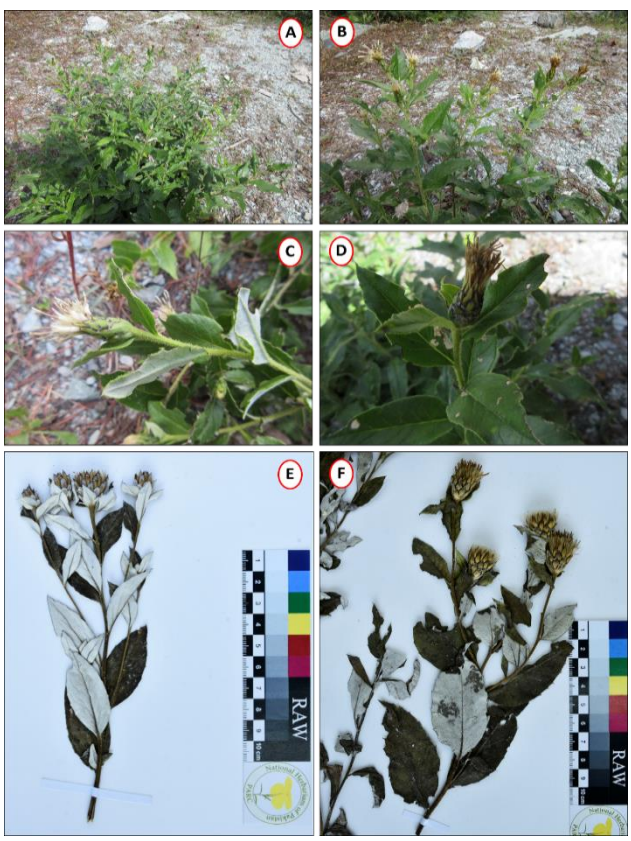

Fig. 3. *Shangwua masarica* (Lipsky) Yu J.Wang & Raab-Straube, (A-B) Habit, (C-D) Capitulum, (E-F) Herbarium specimens at National Herbarium of Pakistan (RAW 102916; 102928).

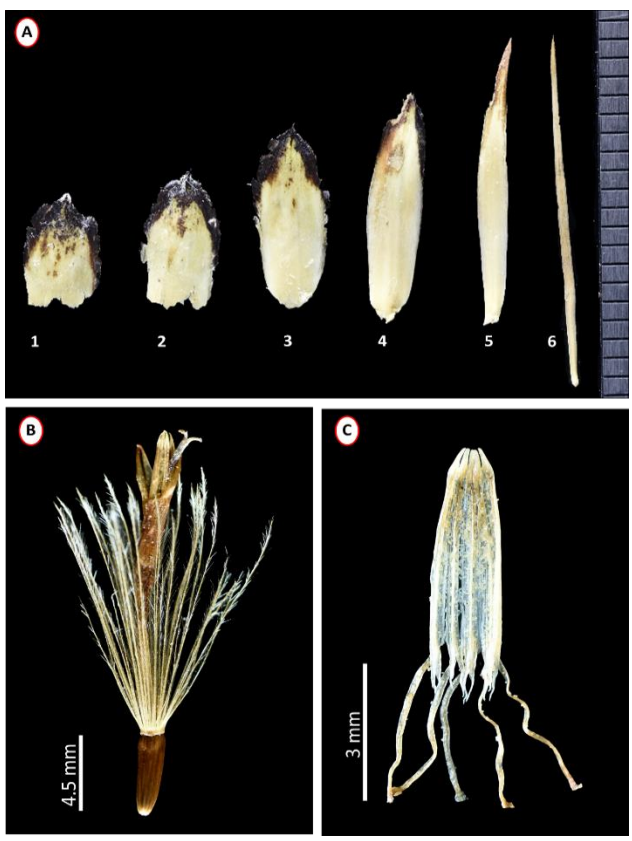

Fig. 4. *Shangwua masarica* (Lipsky) Yu J. Wang & Raab-Straube, (A) 1 – 5 Phyllaries, 6 Palea, (B) Floret, (C) Anthers.

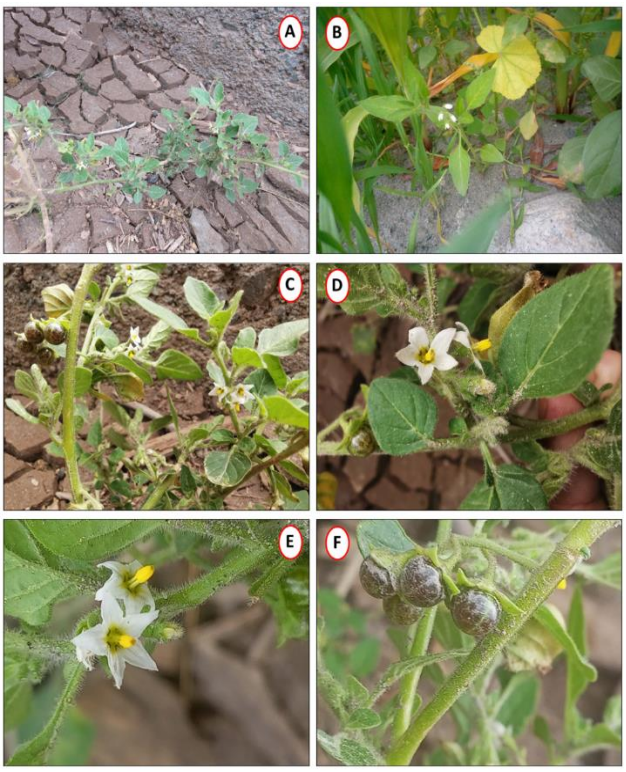

Fig. 5. *Solanum nitidibaccatum* Bitter, (A - B) Habit, (C) Flowering and fruiting branches, (D - E) Flower, (F) Fruits (berries).

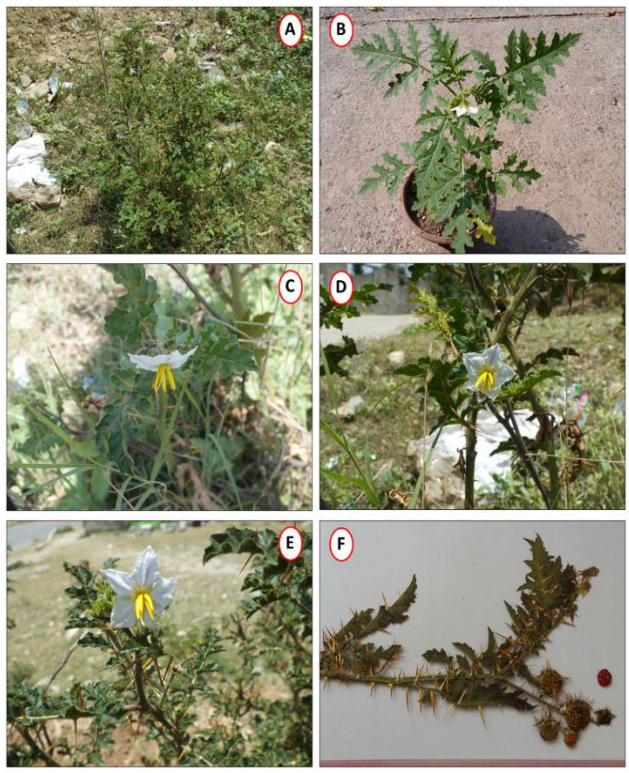

Fig. 6. *Solanum sisymbriifolium* Lam., (A-B) Habit, (C-E) Flower, (F) Fruiting branch.

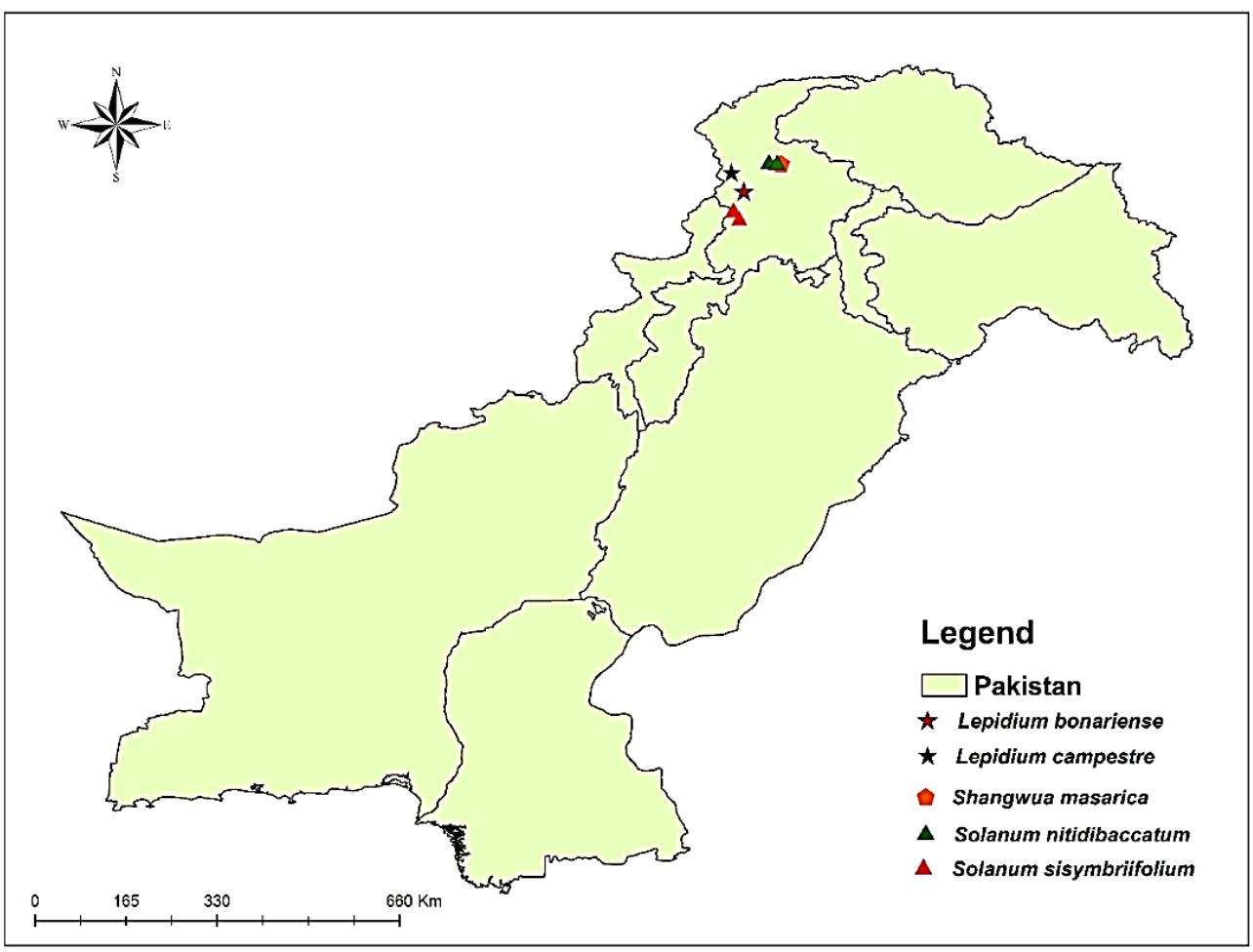

Fig. 7. Distribution of *Lepidium bonariense*, *L. campestre*, *Shangwua masarica*, *Solanum nitidibaccatum* and *S. sisymbriifolium* in Pakistan.

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