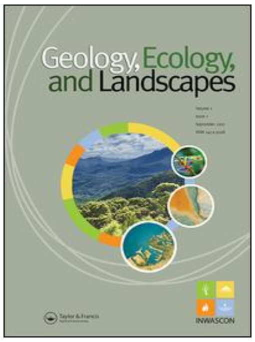

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REVIEW ARTICLE

Distribution of phytoliths in plants: a review

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ABSTRACT
Phytoliths are ergastic siliceous substances present abundantly within intercellular spaces as well as inside the cells of numerous plants. Being made up of silica, they are nondegradable and hence found preserved as microfossils in various substrata. This property of phytoliths extends its significance in the field of paleobotany, geology, and archaeology. Soil analysis for eking out phytoliths has been often exercised for reconstructing paleophytogeography of extinct grasslands. Plants accumulate silica and convert them into crystals when their concentration reaches certain maxima. Deciphering the types of phytoliths at historically rich sites, we can predict the culture of ancient farming. Finding such peerless opulence of phytoliths in paleobotany, the present review was designed to compile the data of phytoliths in various plants. The data compiled in this review will help researchers tracing the link between phytoliths and its source plant at the target sites.

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KEYWORDS
Phytoliths; Pteridaceae; dry ashing method

Introduction

Silica is important for the growth and development of the plants (Agarie, Agata, Uchida, Kubota, & Kaufman, 1996). It is absorbed through roots in the form of monosilicic acid through the water conducting tissue, i.e., xylem (Blackman and Parry, 1968). Many plant species deposit silica in their intercellular or extracellular location in the cells. These silica bodies are called phytoliths. They are found deposited in both over and between leaf veins, culms, and in epidermis of inflorescence and rarely in seeds (Zsuzsa et al., 2014). Phytolith has been used for various types of mineral deposition that may be siliceous and calcareous particles that show a great difference in their structure and taxonomic attributes (Shakoor & Bhat, 2014).These have been extracted from many different plant organs such as leaves, stems, inflorescence, seeds, and roots. Current knowledge suggests that phytoliths are restricted to the vascular plants, with high production levels and common family-specific forms occurring in the pteridophytes (tree ferns and horsetails), basal angiosperms (magnolias), and monocotyledons (particularly the grasses and sedges), eudicots. These are inorganic and thus resistant to the forces of decay that cause the destruction of other types of plant materials, and they survive in a well-preserved state over long periods of time. These have been found to be advantageous for the growth and development of many plants (Matoh et al., 1986). It also helps the plants to overcome various biotic and abiotic stresses (Epstein, 1999; Ma and Yamaji, 2006).The existence of phytoliths in the plant tissues has structural and protective role against fungi, insects, and herbivores (Shakoor et al., 2014). Silica bodies are abundant and morphologically distinct as well as more durable in soil for 1000 years even after the death and decay of the plants (Piperno & Pearsall, 1998). The structural hierarchy and durability of this element in the form of phytoliths in different parts of the plant (Chauhan, Tripathi, Kumar, & Kumar, 2011) as well as in the soil has proven the possibilities to solve the archaeological problems and to identify the crop plants which were grown in our past (Twiss 1987). The archeological and paleoecological significance of phytoliths has researched under the various names that are opal phytoliths, silica phytoliths, silica cells, plant opal, biogenic opal, or simply phtyoliths (Albert et al., 2001). Phytoliths are present in various shape and sizes depending upon the location of its deposition and the age of the plant. Plant does not use the silica for any of its metabolic processes and deposit them as silica gel. As the concentration of silica gel increases, it gradually crystallizes into a solid silt-sized particle. When plant dies, the phytoliths are released into the soil (Shakoor & Bhat, 2014). Numerous angiosperms, gymnosperms, and pteridophytes produce large quantity of phytoliths. Among the pteridophytes species of Equisetaceae, there are heavy silicon accumulators which use them as nutrient (Chen et al., 1969). Silica may get deposited in any of the cells of dermal,

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ground, and the vascular tissues. Hyper-accumulation of silicon in plants helps them for growing under biotic and abiotic stresses like heavy metal, drought, salinity, and pathogens (Ma and Yamaji, 2006). Among recent advances in plant identification, phytoliths have got substantive importance in the identification of different taxa at various levels of hierarchy. Many taxa in family Poaceae are characterized by the phytoliths with specific morphological characteristics; hence, they extend their significance in taxonomic as well. When the plants die, phytoliths are released from the plant tissues, and released phytoliths from the plant tissues become the microfossil of that plant. These microfossils are formed in different plant parts, depending on the taxa and most commonly within epidermal cells of aerial structures but also sometimes within wood, mesophyll, and roots. Silica deposition can be actively controlled by plants through physiological mechanisms and in relation to specific cells and passive potentially leading to silicification of a more variable range of cells and areas of plant tissue. Areas of epidermal tissue can become silicified, and these conjoined phytoliths are commonly referred to as silica skeletons (Ryanet 2014). Production of silica in the bark is greater than the wood; phytoliths in wood have long since been recorded in the frame of wood anatomical research (Collura & Neumann, 2017). However, many plant species do not produce phytoliths but an important factor for understanding phytolith production is that patterns of solid silicon accumulation, together with the placement of the hardened deposits in specific tissues and cells of plants, are quite similar in plant species and their most closely related taxa regardless of the environmental conditions of growth (Shakoor & Bhat, 2014). The initial interest in phytolith type was focused on their diagnostic potential in plant taxonomy and phytoliths were observed *in situ*. Study of phytoliths morphotype in grasses and modern plants can be used for the identification of botanical remains in fossil records (Esteban et al., 2016). However, the physiological role of silicon in vascular plants is still an open subject; silicon may act as an essential or a beneficial element depending on the species. So, the phytolith analysis can be a valuable tool in the study of the vegetation history (Carnelli, Theurillat, & Madella, 2004). The present review was designed to show the distribution of different phytolith types present in various plant species.

Collection of data

The data of phytoliths were collected from 21 research articles from 1978 to 2017 and presented in Table 1. Figure 1 showed the number of families in which phytolith analysis has been reported and from the analyzed data it was found that Pteridaceae (156 plant species) followed by Poaceae (140 plant species) and Fabaceae (29 plant species) showed maximum number of plant species in which phytolith analysis has been done. The various methodological approaches adapted by researchers for the phytolith analysis were shown in Figure 2. From the data, it was found that dry ashing method was followed by wet oxidation method, and wet ashing methods are mainly applied for the digestion of samples to carry out the phytolith analysis.

Future directions

It has been more than 150 years since the phytolith research began in Germany which interpreted the shape of silica bodies formed in plants (Piperno, 1988, 2006; Struve, 1835). Since then substantive phytolith research has been progressed in various field of science. The archaeologists used phytolith to predict early human agritarian contributions to understand human past. The extensive research is required to understand the isotopic depositions of phytoliths (Hart, 2016). Phytolith analysis of top soil helps in reconstructing paleological environments of various proxies (Wu et al., 2018). However, lack of standard procedures is the major stumbling block to exploit full potential of phytolith research in wider areas pertaining to development of reliable models in archeological studies (Zurro, García-Granero, Lancelotti, & Madella, 2016). There is compelling necessity of describing additional geographical areas for available phytolith diversity (Zurro et al., 2016). Phytolith carbon sequestration presents mainly to the carbon cycle, and hence it is important to integrate plant-soil silica cycling in biogeochemical cycling of carbon. Studies with terrestrial biogeochemical cycles should pursue more clearly about the plant-soil silica-carbon modeling to drive the biogeochemical carbon sequestration (Song, Liu, Strömberg, Yang, & Zhang, 2017). Sequestration of carbon in phytoliths is considered as stable carbon sink process in terrestrial ecosystems to reduce the impact of

Table 1. Distribution of phytoliths in different plant species.

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
Angiosperms	Arecaceae	Wet oxidation technique	*Sabal minor*	Leaf stem fruit	Spherical, eliptical, hat, conical shaped	Piperno(2006)
	Arecaceae	Wet oxidation technique	*Sabal etonia*	Leaf stem fruit	Spherical, eliptical, hat, conical shaped	Piperno (2006)
	Arecaceae	Wet oxidation technique	*Serenoa repens*	Leaf stem fruit	Spherical, eliptical, hat, conical shaped	Piperno (2006)
	Cyperaceae	Wet oxidation method	*Carex curvula*	Leaf fruit seed	Hat shaped, mesophyll	Piperno (2006)
	Cyperaceae	Wet oxidation method	*Cyperus polystachyos*	Leaf fruit seed	Hat shaped, mesophyll	Piperno (2006)
	Cyperaceae	Wet oxidation method	*Schoenus nigricans*	Leaf fruit seed	Hat shaped, mesophyll	Piperno (2006)
	Liliaceae	Wet oxidation technique	*Yucca aloifolia*	Leaf root stem	Rondel saddle	Thorne & Kishino (2002)
	Marantaceae	Wet oxidation technique	*Maranta arundinacea*	Seed fruit	Conical, spherical, nodulose	Piperno (2006)
	Poaceae	Wet oxidation technique	*Andropogon scoparius*	Leaf	Polylobate, rondel, elongate	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Cenchrus longispinus*	Leaf	Polylobate, rondel, elongate	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Festuca scarbriculims*	Leaf	Polylobate, rondel, elongate	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Nardus stricta*	Leaf	Polylobate, rondel, elongate	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Andropogon glomeratus*	Leaf	Dumbell	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Andropogon ternarius*	Leaf	Dumbell two-horned tower	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Anthaenatia rufa*	Leaf	Dumbell cross	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Aristida desmantha*	Leaf	Dumbell rondel two-horned	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Arundinaria longifolia*	Leaf	Long saddle short saddle two-horned spool	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Arundinaria gigantea*	Leaf	Long saddle short saddle two-horned	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Avena sativa* L	Leaf	Rondel	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Cenchrus incertus*	Leaf	Dumbell cross two-horned	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Chasmanthium laxum*	Leaf	Dumbell cross two-horned	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Chasmanthium ornithorhynchum*	Leaf	Dumbell rondel cross	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Ctenium aromaticum*	Leaf	Dumbbell flat tower two-horned	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Dactyloctenium aegyptium*	Leaf	Short saddle	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Distichlis spicata*	Leaf	Short saddle two-horned tower spool	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Eragrostis oxylepis*	Leaf	Short saddle two-horned	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Eragrostis cilianensis*	Leaf	Short saddle two-horned	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Erianthus strictus*	Leaf	Dumbbell spool	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Eustachys petraea*	Leaf	Shorty saddle two-horned	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Leersia oryzoides*	Leaf	Dumbbell two-horned tower	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Panicum amarum*	Leaf	Dumbbell spool	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Panicum dichotomiflorum*	Leaf	Dumbbell cross two-horned tower	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Panicum hemitomon*	Leaf	Dumbbell cross	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Panicum verrucosum*	Leaf	Dumbbell	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Panicum virgatum*	Leaf	Dumbbell two-horned	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Phragmites australis*	Leaf	Short saddle flat tower	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Poa annua*	Leaf	Rondel flat tower	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Saccharum officinarum*	Leaf	Dumbbell	Korolûk (2010)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Poaceae	Wet oxidation technique	*Setaria* sp.	Leaf	Dumbbell	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Sorghastrum nutans*	Leaf	Dumbbell cross two-horned	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Sorghum halepense*	Leaf	Dumbbell cross	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Sorghum halepense*	Leaf	Dumbbell cross	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Spartina alterniflora*	Leaf	Short saddle flat tower	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Spartina patens*	Leaf	Short saddle dumbbell	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Sporobolus virginicus*	Leaf	Flat tower two-horned tower spool	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Uniola paniculata*	Leaf	Flat two-horned tower spool	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Zizaniopsis miliacea*	Leaf	Dumbbell two-horned tower	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Oryza sativa*	Inflorescence	Polylobate, rondel, elongate	Korolûk (2010)
	Poaceae	Wet oxidation technique	*Zea mays*	Corn leaf husk tassel	Bilobate, rondel, saddle, irregular, elongate	Korolûk (2010)
	Poaceae	Ultrasound water bath & wet oxidation technique	*Calamagrostis villosa*	Leaf culm	Bilobate, rondel, saddle, irregular, elongate	Carneli et al. (2001)
	Poaceae	Ultrasound water bath & wet oxidation technique	*Festuca halleri*	Leaf culm	Bilobate, rondel, saddle, irregular, elongate	Carnelli et al. (2001)
	Poaceae	Ultrasound water bath & wet oxidation technique	*Festuca puccinelli*	Leaf culm	Bilobate, rondel, saddle, irregular, elongate	Carnelli et al. (2001)
	Poaceae	Ultrasound water bath & wet oxidation technique	*Festuca scabriculmis*	Leaf culm	Bilobate, rondel, saddle, irregular, elongate	Carnelli et al. (2001)
	Poaceae	Ultrasound water bath & wet oxidation technique	*Poa alpina*	Leaf	Bilobate, rondel, saddle, irregular	Carnelli et al. (2001)
	Poaceae	Ultrasound water bath & wet oxidation technique	*Nardus stricta*	Leaf	Bilobate, rondel, saddle, irregular, elongate	Carnelli et al. (2001)
	Poaceae	Wet oxidation technique	*Sorghum vulgare*	Leaf	Rondel, saddle, irregular, elongate	Korolûk (2010)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Bambusa* sp.	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Li et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*B. rutila*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*B. multiplex*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*B. multiplex cv. Changye*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*B. multiplex raeuschel*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*B. alphonsekarri*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*B. glaucescens*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*H. tranguillans.shiroshima*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Sh. kumasasa*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried &Walkley–Black type digest technique	*Sh. chinensis nakai*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Sh. chinensis nakai cv. Jimao*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*S. yashadake f. kimmei*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*S. yashadake makino*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*S. yashadake f. ogon*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys prominens*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys vivax*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys heterocycla taokiang*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys heterocycla*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys incarnata*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys bambusoides*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys bambusoides. cv. huayehuagan*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys bambusoides.castillonis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys Nigra*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys aureosulcata*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys aureosulcata*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys.aureosulcata.spectabilis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys.sulphurea.viridis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys.sulphurea viridisulcata*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys sulphurea*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys houzeauana*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys ventricosa*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys ventricosa cv huangganlucao*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried &Walkley–Black type digest technique	*Phyllostachys ventricosa cv. Luganhuangcao*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys ventricosa cv. huangjin*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys arcana.luteosulcata*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys propinqua*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys vivax.aureocaulis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys heterocycla.gracilis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys nigra.henonis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachysdulcis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachysparvifolia*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys violascens cv. Xiye*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys nviolascens cv. jianye*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys violascens cv. viridisulcata*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys sulphurea*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys houzeauana*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys Ventricosa*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys ventricosa cv huangganlucao*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys ventricosa cv. Luganhuangcao*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys ventricosa cv. huangjin*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys arcana.luteosulcata*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys propinqua*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys vivax.aureocaulis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys heterocycla.gracilis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys nigra.henonis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys edulcis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys parvifolia*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried &Walkley–Black type digest technique	*Phyllostachy violascens*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachy sviolascens*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachy viridisulcata*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachy flavistriatus*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachy panggan*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachy anhuiensis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachy lavivaginis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachy violascens*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys bambussoides*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys aureosulcata*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Phyllostachys*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*I. acutiligulata*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Indosasasinica*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Sasaellatootsik*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Sasaellaauricoma*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Chimonobambusaquadrangularis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Pleioblastuskongosanensis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Pleioblastus hisauchii*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Pleioblastussimony*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Pleioblastusinearis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Pleioblastusangustifoliu*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Pseudosasaamabilis*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Pseudosasajaponica*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Pseudosasa tsutsumiana*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Acidosasagigantean*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried &Walkley–Black type digest technique	*Oligostachyum*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Oligostachyumubricum*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Sasaargenteostriata*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Sasapygmaea*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Sasaauricoma*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Indosasadecoruss*	Leaf	Rondel, saddle, irregular, elongate, bilobalt, flat	Beilei et al. (2014)
	Poaceae	Oven-dried & Walkley–Black type digest technique	*Bromus inermis*	Leaf	Polylobate, elongate, plate, rondel, bilobate	Beilei et al. (2014)
	Musaceae	Rapid microwave digestion technique	*Musa paradisiaca*	Leaf	Irregular shape	Lentfer et al. (2002)
	Heliconiaceae	Rapid microwave digestion technique	*Heliconia* spp.	Seed leaf	Irregular shape	Lentfer et al. (2002)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Restionaceae	Dry ash technique	*Restio triticeus*	Stem	Parallelepipedal elongate, angulate, scorbiculat	Novello et al. (2017)
	Orchidaceae	Rapid microwave digestion technique	*Orchid* spp.	Leaf	Conical	Lentfer et al. (2002)
	Aceraceae	Wet oxidation technique	*Acer sacchrum, Acer negundo*	Leaf	Lanceolate, spherical, elliptical	Piperno (2006)
	Asteraceae	Wet oxidation technique	*Helianthus annuus*	Leaf	Tracheid, mesophyll	Piperno (2006)
	Asteraceae	Sonication & dried technique	*Aspilia mosambicensis*	Leaf	Cylindroid Scrobiculate	Mercader, Bennett, Esselmont, Simpson, & Walde (2009)
	Asteraceae	Sonication & dried technique	*Brachylaena*spp.	Stem leaf	Tracheid, mesophyll cylindroid scrobiculate	Mercader et al. (2009)
	Asteraceae	Sonication & dried technique	*Pleiotaxis* spp.	Leaf	Cylindroid scrobiculate	Mercader et al. (2009)
	Asteraceae	Sonication & dried technique	*Aspilia* spp.	Leaf	Tracheid, mesophyll cylindroid scrobiculate	Mercader et al. (2009)
	Asteraceae	Sonication & dried technique	*Vernonia amygdalina*	Leaf stem	Tracheid, mesophyll, cylindroid scrobiculate	Mercader et al. (2009)
	Anacardiaceae	Dry and wet ashing technique	*Lannea fruticosa*	Wood	Elongate, scalariform, elongate, vesicular, blocky, irregular tabular, irregular	Collura & Neumann (2017)
	Anacardiaceae	Dry and wet ashing technique	*Lannea acida*	Wood	Elongate, scalariform, elongate, vesicular, blocky, irregular tabular, irregular	Collura & Neumann (2017)
	Sapotaceae	Dry and wet ashing technique	*Vitellaria paradoxa*	Wood	Elongate, scalariform, elongate, vesicular, blocky, irregular tabular, irregular	Collura & Neumann (2017)
	Betulaceae	Wet oxidation technique	*Carpinus Carolina, Ostrya virginlana*	Leaf	Lanceolate spherical eliptical	Piperno (2006)
	Cucurbitaceae	Wet oxidation technique	*Cucurbita pepo*	Fruit seed	Lanceolate, spherical eliptical	Piperno (2006)
	Dilleniaceae	Wet oxidation technique	*Curatella americana,Tetracera volubilis*	Leaf wood	Eliptical lanceolate, spherical	Piperno (2006)
	Ericaceae	Wet oxidation technique	*Rhododendrum ferrugineum, Vaccinium myritillus*	Leaf	Lanceolate, spherical eliptical	Piperno (2006)
	Ericaceae	Wet oxidation technique	*Euclea crispa*	Leaf	Lanceolate, spherical eliptical	Mercader et al. (2009)
			*Diospyros*spp.	Leaf	Lanceolate, spherical eliptical	Mercader et al. (2009)
	Proteaceae	Dry ash technique	*Leucadendron salignum*	Leaf	Rondel, trapeziform, cubic/rectangular	Novello et al. (2017)
	Proteaceae	Dry ash technique	*Leucadendron spissifolium*	Leaf	Rondel, trapeziform, cubic/rectangular	Novello et al. (2017)
	Proteaceae	Dry ash technique	*Leucospermum cuneifolia*	Leaf	Rondel, trapeziform, cubic/rectangular	Novello et al. (2017)
	Proteaceae	Dry ash technique	*Protea neriifolia*	Leaf	Rondel, trapeziform, cubic/rectangular	Novello et al. (2017)
	Proteaceae	Dry ash technique	*Protea tena*	Leaf	Rondel, trapeziform, cubic/rectangular	Novello et al. (2017)
	Vitaceae	Dry ash technique	*Rhoicissus tomentosa*	Leaf	Rondel, trapeziform, cubic/rectangular	Novello et al. (2017)
	Euphorbiaceae	Wet oxidation technique	*Manihot esculenta*	Leaf fruit seed	Lanceolate, spherical eliptical	Piperno (2006)
						Piperno (2006)
	Fagaceae	Wet oxidation technique	*Quercus macrocarpa, Quercus faevis*	Leaf	Lanceolate, spherical eliptical	Piperno (2006)
	Juglandaceae	Wet oxidation technique	*Carya ovate, Juglans nigra*	Leaf	Lanceolate, spherical eliptical	Piperno (2006)
	Moraceae		*Morus rubra*	Leaf bark	Hook shaped	Geiset et al. (1973)
	Rubiaceae		*Coffea arbica*	Leaf wood	Rondel	Thorn (2008)
	Fabeaceae	Sonication & dried technique	*Albizia anthelmintica*	Leaf stem	Block with lacunose/slightly scrobiculate texture	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Lonchocarpus capassa*	Leaf	Blocky cavate	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Dolichos kilimandscharicus*	Leaf	Blocky corniculate	Mercader et al. (2009)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Fabeaceae	Sonication & dried technique	*Lonchocarpus capassa*	Stem	Blocky hairy	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Sphenostylis* spp.	Leaf	Cylindroid	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Piliostigma thonningii*	Leaf	Cylindroid bulbous	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Afzelia quanzensis*	Leaf	Epidermal laminate	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Pterocarpus angolensis*	Stem	Globular echinate large	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Afzelia quanzensis*	Leaf	Globular psilate large	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Pterocarpus angolensis*	Stem	Globulose bisected	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Sphenostylis* spp.	Stem	Lenticular concave/ convex	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Cajanus cajan*	Leaf	Tabular crenate	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Dolichos kilimandscharicus*	Stem	Tabular scrobiculate	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Elephantorrhiza goetzei*	Leaf	Tabular thick lacunate	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Pterocarpus angolensis*	Leaf	Tabular thick lacunate	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Pterocarpus tinctorius*	Leaf	Tabular thick sinuate	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Albizia gummifera*	Leaf	Tabular trapezoid	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Brachystegia* spp	Stem	Tabular trapezoid	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Dalbergiella nyasae*	Stem	Tabular trapezoid	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Acacia tortilis*	Leaf	Tabular trapezoid	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Acacia schweinfurthii*	Leaf	Tabular trapezoid	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Pterocarpus tinctorius*	Stem	Tabular trapezoid	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Acacia* spp	Leaf	Tabular thick lacunate	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Brachystegia* spp	Leaf	Tabular thick lacunate	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Aeschynomene* spp	Leaf	Tabular trapezoid	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Securidaca Longipedunculata*	Stem	Tabular trapezoid	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Erythrophleum suaveolens*	Leaf	Tabular thick lacunate	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Brachystegia* spp	Leaf	Tabular thick lacunate	Mercader et al. (2009)
	Fabeaceae	Sonication & dried technique	*Brachystegia boehmii*	Stem	Tabular thick lacunate	Mercader et al. (2009)
	Rosaceae	Sonication & dried technique	*Ficus* spp.	Leaf	Cylindroid scrobiculate	Mercader et al. (2009)
	Rosaceae	Sonication & dried technique	*Parinari* spp	Leaf stem	Globular facetate	Mercader et al. (2009)
	Rosaceae	Sonication & dried technique	*Pouzolzia mixta*	LeafStem	Cylindroid scrobiculate	Mercader et al. (2009)
	Rosaceae	Sonication & dried technique	*Ensete ventricosum*	Stem	Globular facetate	Mercader et al. (2009)
	Rosaceae	Sonication & dried technique	*Ziziphus mucronata*	Stem	Cylindroid scrobiculate	Mercader et al. (2009)
	Celastraceae	Dry ash technique	*Pterocelastrus tricuspidatus*	Leaf	Parallelepipedal elongate, angulate, scorbiculat	Novello et al. (2017)
	Ulmaceae	Wet oxidation technique	*Celtis occidentalis, Ulmus americana*	Fruit seed bark	Sinuate spherical	Thorn (2008)
Gymnosperms	Pinaceae	Wet oxidation technique	*Abies balsamea*	Needle foliage, wood	Flat spiny granulated	Piperno (2006)
	Pinaceae	Wet oxidation technique	*Abies frasera*	Needle foliage, wood	Flat spiny granulated	Klein and Geis (1978)
	Pinaceae	Wet oxidation technique	*Abies grandis*	Needle foliage, wood	Flat spiny granulated	Piperno (2006)
	Pinaceae	Wet oxidation technique	*Pinus strobus*	Needle foliage, wood	Flat spiny granulated	Piperno(2006)
	Pinaceae	Wet oxidation technique	*Podocarpus neriifollia*	Needle foliage, wood	Flat spiny granulated	Piperno(2006)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Pinaceae	Ultrasonic bath technique	*Carex lanceolata*	Needle foliage, wood	Flat spiny granulated	Yang, Wu, Liu, Chen, and Zhou (2018)
	Pinaceae	Ultrasonic bath technique	*Artemisia eriopoda*	Needle foliage, wood	Flat spiny granulated	Yang et al. (2018)
	Pinaceae	Ultrasonic bath technique	*Lespedeza bicolor*	Needle foliage, wood	Flat spiny granulated	Yang et al. (2018)
	Pinaceae	Ultrasonic bath technique	*Pinus tabulaeformis*	Needle foliage, wood	Flat spiny granulated	Yang et al. (2018)
	Taxaceae	Dry ashing technique	*Taxus baccata,Taxus cuspidate*	Needle,wood	Flat spniy granulated	Carnelli et al. (2004)
	Taxodiaceae	Wet oxidation technique	*Taxodium distichium*	Needle wood	Flat spiny granulated	Piperno (2006)
	Araucariaceae	Dry ashing technique	*Araucaria araucana*	Needle, foliage Wood	Flat spiny granulated	Blinnikov (2005)
	Cupressaceae	Dry ashing technique	*Juniperus communis,Juniperus nana*	Needle wood	Flat spiny granulated	Klein and Geis (1978)
	Pinaceae	Dry ashing technique	*Picea jezoensis*	Wood needle	Bilobate short cell	Yang et al. (2018)
		Dry ashing technique	*Abies nephrolepis*	Wood needle	Saddle rondel rectangle dentate	Yang et al. (2018)
	Pinaceae	Dry ashing technique	*Pinus koraiensi*	Wood needle	Saddle rondel rectangle dentate	Yang et al. (2018)
	Pinaceae	Dry ashing technique	*Larix olgensis*	Wood needle	Saddle rondel rectangle dentate	Yang et al. (2018)
	Pinaceae	Dry ashing technique	*Rosa marretii*	Wood needle	Saddle rondel rectangle dentate	Yang et al. (2018)
	Pinaceae	Dry ashing technique	*Solidago virgaurea*	Wood needle	Saddle rondel rectangle dentate	Yang et al. (2018)
	Pinaceae	Dry ashing technique	*Calamagrostis angustifolia*	Wood needle	Saddle rondel rectangle dentate	Yang et al. (2018)
	Pinaceae	Dry ashing technique	*Beckmannia syzigachne*	Wood needle	Saddle rondel rectangle dentate	Yang et al. (2018)
	Pinaceae	Dry ashing technique	*Arthraxon hispidus*	Wood needle	Saddle rondel rectangle dentate	Yang et al. (2018)
	Epacridaceae	Low-temperature acid extraction technique	*Dracophyllum scoparium*	Leaf wood	Rondel	Thorn (2008)
	Scrophulariaceae	Dry ashing technique	*Hebe elliptica*	Leaf	Saddle rondel rectangle dentate	Yang et al. (2018)
	Rosaceae	Low-temperature acid extraction (Jones & Milne 1966)	*Acaena anserinifolia*	Leaf	Conical elongated trapezoid globular	Thorn (2008)
	Boraginaceae	Low-temperature acid extraction (Jones & Milne 1966)	*Myosotis capitata*	Leaf	Conical elongated trapezoid globular	Thorn (2008)
Pteridophytes	Equisetaceae	Hot bath & acid treatment technique	*Equisetum*	Stem leaf	Elongate echinate, cylindrical polylobate, acicular, papillate, stomata, stomata	Stromberg et al. (2002)
	Lycopodiaceae	Dry ashing technique	*Lycopodium clavatum*	Whole plant	Smooth or granular plates with projecting margins	Chauhan et al. (2011)
	Lycopodiaceae	Wet oxidation technique	*L. japonicum Thunb*	Aerial branch	Smooth or granular plates with projecting margins	Mazumdar (2011)
	Lycopodiaceae	Wet oxidation technique	*Palhinhaea cernua*	Aerial	Smooth or granular plates with projecting margins	Mazumdar (2011)
	Lycopodiaceae	Wet oxidation technique	*Huperzia selago*	Aerial	Smooth or granular plates with projecting margins	Mazumdar (2011)
	Selaginellaceae	Wet oxidation technique	*Selaginella bryopteris*	Whole plant	Elongated epidermal bodies with small cone like projections	Mazumdar (2011)
	Selaginellaceae	Wet oxidation technique	*Selaginella inaequalifolia*	Aerial shoot	Elongated epidermal bodies with small cone like projections	Mazumdar (2011)
	Selaginellaceae	Wet oxidation technique	*Selaginella involvens*	Leaf	Elongated epidermal bodies with small cone like projections	Mazumdar (2011)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Selaginellaceae	Wet oxidation technique	*Selaginella monospora*	Aerial shoot	Elongated epidermal bodies with small cone like pro-Elongated epidermal bodies with small cone like projections jections	Mazumdar (2011)
	Selaginellaceae	Wet oxidation technique	*Selaginella pentagona*	Aerial shoot	Elongated epidermal bodies with small cone like projections	Mazumdar (2011)
	Selaginellaceae	Wet oxidation technique	*Selaginella plana*	Aerial shoot	Elongated epidermal bodies with small cone like projections	Mazumdar (2011)
	Selaginellaceae	Wet oxidation technique	*Selaginella tenera*	Aerial shoot	Elongated epidermal bodies with small cone like projections	Mazumdar (2011)
	Selaginellaceae	Wet oxidation technique	*Selaginella chrysocaulos*	Aerial shoot	Elongated epidermal bodies with small cone like projections	Mazumdar (2011)
	Selaginellaceae	Wet oxidation technique	*Selaginella velutina*	Leaf	Elongated epidermal bodies with small cone like projections	Piperno (2006)
	Isoetaceae	Wet oxidation technique	*Isöetes coromandelina*	Leaf	Epidermal cells like angular, polyhedral bodies	Mazumdar (2011)
			Isöetes weberi	Leaf	Epidermal cells like angular, polyhedral bodies	Iriarte & Paz (2009)
	Ophioglossaceae	Wet oxidation technique	*Botrychium virginianum*	Leaf, spike	Epidermal cells like angular, polyhedral bodies	Mazumdar (2011)
		Wet oxidation technique	*Helminthostachys zeylanica*	Leaf	Epidermal cells like angular, polyhedral bodies	Mazumdar (2011)
		Wet oxidation technique	*Ophioglossum reticulatum*	Leaf	Epidermal cells like angular, polyhedral bodies	Mazumdar (2011)
	Marattiaceae	Wet oxidation technique	*Angiopteris evecta*	Leaf	Epidermal cells like angular, polyhedral bodies	Mazumdar (2011)
	Hymenophyllaceae	Wet oxidation technique	*Hymenophyllum* sp.	Leaf	Epidermal cells like angular, polyhedral bodies	Piperno (2006)
	Hymenophyllaceae	Wet oxidation technique	*Trichomanes* sp.	Leaf	Epidermal cells like angular, polyhedral bodies	Mazumdar (2011)
	Gleicheniaceae	Wet oxidation technique	*Dicranopteris linearis*	Leaf	Epidermal cells like angular, polyhedral bodies	Mazumdar (2011)
		Wet oxidation technique	*Gleichenia gigantean*	Leaf	Epidermal cells like angular, polyhedral bodies	Mazumdar (2011)
	Gleicheniaceae	Wet oxidation technique	*Gleichenia microphylla*	Leaf	Epidermal cells like angular, polyhedral bodies	Mazumdar (2011)
	Lygodiaceae	Dry ashing technique	*Lygodium flexuosum*	Whole plant	Smooth or granular plates with projecting margins	Chauhan et al. (2011)
	Marsileaceae		*Marsilea ancylopoda*	Leaf		Iriarte and Paz (2009)
	Cyatheaceae	Dry ashing technique	*Cyathea gigentea*	Whole plant	Smooth or granular plates with projecting margins	Chauhan et al. (2011)
	Cyatheaceae	Wet oxidation technique	*Cyathea spinulosa*	Leaf	Epidermal cells like angular, polyhedral bodies	Mazumdar (2011)
	Lindsaeaceae	Wet oxidation technique	*Lindsaea odorata*	Leaf	Epidermal cells like angular, polyhedral bodies	Mazumdar (2011)
	Lindsaeaceae	Wet oxidation technique	*Sphenomeris chinensis*	Leaf	Epidermal cells like angular, polyhedral bodies	Mazumdar (2011)
	Dennstaedtiaceae	Wet oxidation technique	*Hypolepis punctate*	Leaf	Epidermal cells like angular, polyhedral bodies	Mazumdar (2011)
	Pteridaceae	Wet ashing technique	*Acrostichum danaeifolium*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Actiniopteris australis*	Whole plant	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Chauhan et al. (2011)
	Pteridaceae	Wet ashing technique	*Adiantopsis radiate*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Pteridaceae	Wet ashing technique	*Adiantum abscissum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum adiantoides*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum andicola*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum argutum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum cajennense*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum capillus-junonis*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum capillus-veneris*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum caryotideum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum caudatum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum concinnum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum cordatum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum delicatulum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum dolosum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum formosum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum fructuosum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum glaucescens*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum hispidulum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum humile*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum incertum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum intermedium*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum jordanii*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Pteridaceae	Wet ashing technique	*Adiantum kaulfusii*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum kendalii*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue(2009)
	Pteridaceae	Wet ashing technique	*Adiantum krameri*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum latifolium*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum leprieurii*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum lucidum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum lunulatum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum macrophyllum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum malesianum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum mcvaughii*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum multisorum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum oaxacanum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum obliquum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum paraense*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum patens*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum peruvianum*	Whole plant	Elliptical shape, tapered ends and undulate sides	Chauhan et al. (2011),
	Pteridaceae	Wet ashing technique	*Adiantum petiolatum*	Leaf	Elliptical shape, tapered ends and undulate sides	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum phillippense*	Whole plant	Elliptical shape, tapered ends and undulate sides	Chauhan et al. (2011),
	Pteridaceae	Wet ashing technique	*Adiantum phyllitidis*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum platyphyllum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Pteridaceae	Wet ashing technique	*Adiantum poeppigianum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum poiretii*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum polyphyllum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum pulverulentum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum pyramidale*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum raddianum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum reniforme*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum scalare*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum seemanii*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum serratodentatum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum tenerum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum terminatum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum tetraphyllum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum tomentosum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Pteridaceae	Wet ashing technique	*Adiantum trapeziforme*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum trichochlaenum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum tricholepis*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum venustum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum villosissimum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum villosum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum vogellii*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Adiantum wilsonii*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Afropteris repens*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Aleuritopteris argentea*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Aleuritopteris aurantiacea*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Aleuritopteris farinosa*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Ananthacorus angustifolius*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Anetium citrifolium*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Pteridaceae	Wet ashing technique	*Anogramma leptophylla*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Anopteris hexagona*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Antrophyum boryanum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Antrophyum callifolium*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Antrophyum latifolium*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Antrophyum lineatum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Antrophyum mannianum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Antrophyum minersum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Antrophyum plantagineum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Antrophyum reticulatum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Antryophum brasilianum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Antryophym obovatum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Argyrochosma limitanea*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Aspidotis californica*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Pteridaceae	Wet ashing technique	*Aspidotis densa*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Astrolepis sinuate*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Austrogramme decipiens*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Bommeria hispida*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Ceratopteris pteridoides*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Ceratopteris richardii*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Cheilanthes alabamensis*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Cheilanthes albomarginata*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Cheilanthes angustifolia*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Cheilanthes angustifolia*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Cheilanthes decomposita*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Cheilanthes eatonii*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Cryptogramma cripsa*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Doryopteris ludens*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Pteridaceae	Wet ashing technique	*Doryopteris sagittifolia*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Eriosorus hispidulus*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Haplopteris anguste-elongata*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Haplopteris elongate*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Haplopteris ensiformis*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Haplopteris ensiformis*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Haplopteris forestiana*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Haplopteris forestiana*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Hecistopteris pumila*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Hemionitis arifolia*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Hemionitis rufa*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Jamesonia verticalis*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Llavea cordifolia*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Mildella intramarginalis*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Pteridaceae	Wet ashing technique	*Monogramma graminea*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Monogramma paradoxa*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Neurocalis praestantissima*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Onychium japonicum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Onychium siliculosum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Pentagramma triangularis*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Pityrogramma austroamericana*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Pityrogramma calomelanos*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Pityrogramma ebenea*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Pityrogramma trifoliata*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Platyzoma microphyllum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Polytaenium cajenense*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Polytaenium chlorosporum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Polytaenium guayanense*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Pteridaceae	Wet ashing technique	*Polytaenium lanceolatum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Polytaenium lineatum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Polytaenium urbanii*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Pteris arborea*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobe blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed d	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Pteris argyraea*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Pteris mulitifida*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Pteris propinqua*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Pteris quadriaurita*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Pteris ryukyuensis*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Pteris tremula*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Pteris vittata*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Chauhan et al. (2011)
	Pteridaceae	Wet ashing technique	*Pterozonium brevifrons*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Radiovittaria gardneriana*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Radiovittaria minima*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Pteridaceae	Wet ashing technique	*Radiovittaria remota*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Scoliosorus ensiformis*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Vittaria amboinensis*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
	Pteridaceae	Wet oxidation technique	*Vittaria carcina*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
	Pteridaceae	Wet oxidation technique	*Vittaria elongate*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
	Pteridaceae	Wet ashing technique	*Vittaria flavicosta*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Vittaria graminifolia*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet oxidation technique	*Vittaria himalayensis*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
	Pteridaceae	Wet ashing technique	*Vittaria isoetifolia*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet ashing technique	*Vittaria lineata*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Sundue (2009)
	Pteridaceae	Wet oxidation technique	*Vittaria sikkimensis*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
	Pteridaceae	Wet oxidation technique	*Vittaria zosterifolia*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
	Pteridaceae	Wet oxidation technique	*Athyrium nigripes*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
	Pteridaceae	Wet oxidation technique	*Diplazium esculentum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)

(*Continued*)

Table 1. (Continued).

Plant taxa	Family	Techniques used	Plant	Plant parts	Phytolith type	Reference
	Thelypteridaceae	Wet oxidation technique	*Ampelopteris prolifera*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
	Thelypteridaceae	Wet oxidation technique	*Christella dentate*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
	Thelypteridaceae	Wet oxidation technique	*Cyclosorus interruptus*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
	Thelypteridaceae	Wet oxidation technique	*Pronephrium nudatum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
	Thelypteridaceae	Wet oxidation technique	*Pseudocyclosorus tylodes*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
	Thelypteridaceae	Wet oxidation technique	*Pseudophegopteris pyrrhorhachis*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
	Blechnaceae	Wet oxidation technique	*Blechnum orientale*	Leaf	Elongated epidermal plates with smooth surface and lobed margins	Mazumdar (2011)
	Dryopteridaceae	Wet oxidation technique	*Leucostegia immerse*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
	Dryopteridaceae	Wet oxidation technique	*Peranema cyatheoides*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
		Wet oxidation technique	*Polystichum squarrosum*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
	Oleandraceae	Wet oxidation technique	*Oleandra wallichi*	Leaf	Blunt ends and sides that are smooth, denticulate sparsely denticulate or shallowly lobed	Mazumdar (2011)
	Polypodiaceae	Wet oxidation technique	*Arthromeris wallichiana*	Leaf	Elongated flat base and a surface with two undulating ridges parallel to each other	Mazumdar (2011)
	Polypodiaceae	Dry ashing technique	*Drynaria quercifolia*	Leaf	Elongated flat base and a surface with two undulating ridges parallel to each other	Chauhan et al. (2011)
	Polypodiaceae	Wet oxidation technique	*Phymatopteris griffithiana*	Leaf	Elongated flat base and a surface with two undulating ridges parallel to each other	Mazumdar (2011)
	Zygophyllaceae	Dry ash technique	*Creosote*	Leaf wood	Globular echinate cubic parallelepipedal	Morgan-Edel, Boston, Spilde, & Reynolds (2015)
	Moraceae	Dry ash technique	*Mulberry*	Leaf twig	Stomata crenulated tissue cubic	Morgan-Edel et al. (2015)

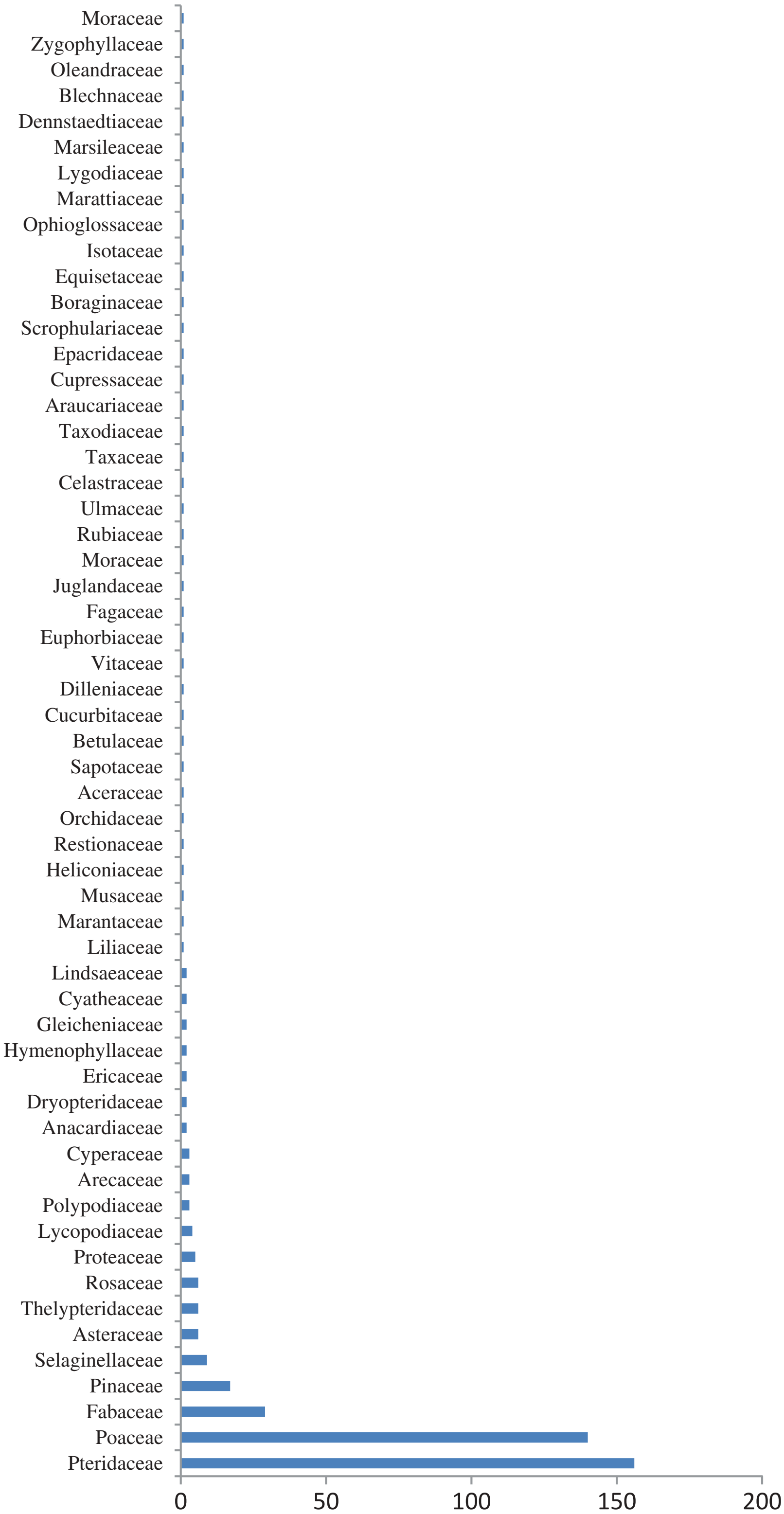

Figure 1. Families in which phytolith analysis have been reported.

climate change. However, modifications with addition of basalt powder indicate good method to enhance the biogeochemical carbon sequestration in crops and may be an effective method to reduce the global warming indirectly (Guo et al., 2015).

Conclusions

The present review attempts to compile the data of phytoliths in various plants analyzed by various researchers from time to time. It will help the workers of scientific community in tracing the relationship

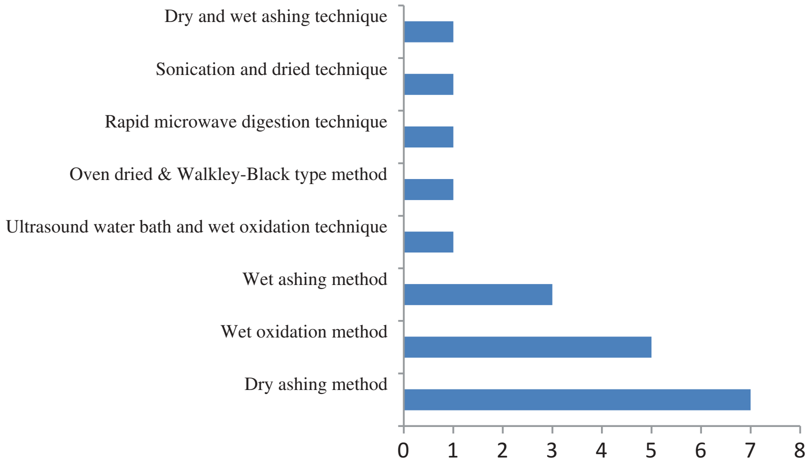

Figure 2. Methodology used by researchers for sample preparation.

between phytoliths and its source plant at the target sites. It was observed that maximum plants eked for phytolith distribution belonged to family Pteridaceae followed by Poaceae family. The most common method used for the digestion of samples for phytoliths preparation is dry ashing method followed by wet oxidation method. The most common type of phytolith reported was blunt ends with smooth followed by rondel and elliptical type of phytoliths.

Disclosure statement

No potential conflict of interest was reported by the authors.

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