

On the species of *Kamthisaccites* Srivastava & Jha 1986 and *Goubinispota* Tiwari & Rana 1981 from the Triassic Succession of India

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ABSTRACT

Vijaya & Tripathi A 2008. On the species of *Kamthisaccites* Srivastava & Jha 1986 and *Goubinispota* Tiwari & Rana 1981 from the Triassic Succession of India. Palaeobotanist 57(3) : 399-406.

Two new species, viz. *Kamthisaccites ringus* and *Goubinispota triassica* are described herein from the late Early Triassic strata and their range in Indian Peninsula and spatial distribution in Gondwanaland has been discussed.

Key-words—Morphotaxonomy, Palynostratigraphy, Late Permian, Triassic, India.

भारत के ट्राइऐसिक अनुक्रम से प्राप्त कामथीसैकाइट्स श्रीवास्तव व झा 1986 तथा गौबिनीस्पोरा तिवारी व राणा 1981 की प्रजातियों के बारे में

विजया एवं अर्चना त्रिपाठी

सारांश

अंतिम प्रारंभिक ट्राइऐसिक पट्टीदार से प्राप्त दो नवीन प्रजातियाँ अर्थात् कामथीसैकाइट्स रिंगस एवं गौबिनीस्पोरा ट्राइऐसिका और भारतीय प्रायद्वीप में उनकी सीमा तथा गोंडवाना भूमि में उनके स्थानीय वितरण की चर्चा की गई है।

मुख्य शब्द - आकारवर्गीकरणविज्ञान, परागाणुस्तरक्रमविज्ञान, अंतिम पर्मियन, ट्राइऐसिक, भारत।

INTRODUCTION

THE two monosaccate pollen taxa—*Kamthisaccites* Srivastava and Jha 1986, and *Goubinispota* Tiwari and Rana 1981, dealt herein were first described from the end Permian and Middle Triassic strata, respectively on Indian Peninsula. While working on the Triassic palynoflora, variation in morphological features of these two genera were observed and consequently two new species – *Kamthisaccites ringus* sp. nov. and *Goubinispota triassica* sp. nov. have been identified here. These species have their stratigraphic significance in Triassic palynostratigraphy. The newly

instituted species are described from the bore core material, given in Fig. 1.

SYSTEMATICS

Genus—*Kamthisaccites* Srivastava & Jha 1986
(Pl. 1.1-2, 6-9)

Type Species—*Kamthisaccites kamthiensis* Srivastava & Jha 1986.

Repository—BSIP Museum.

Locality—Borehole GJ-6, depth 258.00 m, Bhopalpalli area, Godavari Graben, A.P., India.

Age & Horizon—Kamthi Formation, Late Permian (now Early Triassic).

Generic Diagnosis (elaborated)—Monosaccate pollen, subcircular to circular; central body distinct, thin to thick, 3 to 6 taeniae on proximal face; exine intramicroreticulate; saccus attachment equatorial proximally, subequatorial on distal face, which may be associated with folds forming a ring; saccus intrareticulation fine to medium, radially oriented.

Kamthisaccites kamthiensis Srivastava & Jha 1986
(Pl. 1.1, 2)

Holotype—Srivastava & Jha, 1986; pl. 1.1; size 135.00 x 152.50 µm; BSIP Sl. No. 9480.

Repository—BSIP Museum.

Locality—Borehole GJ-6, depth 258.00 m, Bhopalpalli area, Godavari Graben, A.P., India.

Age & Horizon—Kamthi Formation, Late Permian (now Early Triassic).

Diagnosis—Size 81-180 µm; central body 65-140 µm; exine finely intramicroreticulate, bearing 3 taeniae widely separated on proximal face. Proximal attachment of saccus to central body equatorial, distally subequatorial with overlap ¼ body radius.

Occurrence—Barakar Formation, Late Permian, Rajmahal Basin (Tripathi & Ray, 2005); Parsora Formation, Late Triassic, Son Valley (Tripathi *et al.*, 2005); Barakar Formation, Late Permian; Supra-Barakar Formation, Early Triassic, Mahanadi Basin (Tripathi, 1996); Kamthi Formation, Late Permian (now Early Triassic), Godavari Graben (Srivastava & Jha, 1986, 1990, 1995).

Kamthisaccites ringus sp. nov.
(Pl. 1.6-9)

Holotype—Pl. 1.6; size 54 x 65 µm; central body 34.5 x 36.5 µm; BSIP Sl. No. 13336.

Locality—Borehole SSM - 2, depth 462.60 m; Singrauli Coalfield, Son Valley, M.P., India.

Age & Horizon—Parsora Formation, Early and Late Triassic.

Isotype—Pl. 1.8; size 66.5 x 47 µm; central body 34 x 48.5 µm; BSIP Sl. No. 13334.

Locality—Borehole SSM-2, depth 476.85 m, Singrauli Coalfield, Son Valley, India.

Age & Horizon—Parsora Formation, Early to Late Triassic.

Diagnosis—Size 47-63.5 x 65-78.5 µm. Central body distinct, moderately thick, 34-46.5 x 36.5-51 µm, subcircular to circular. Exine intramicroreticulate, 3-6 taeniae, complete to incomplete on proximal face, taeniae 2-8 µm wide. Saccus 12-23 µm wide encircling equatorially on proximal face, distally subequatorial associated with circular fold in the form of 2-5 µm wide ring.

Comparison—*Kamthisaccites ringus* sp. nov., differs from *K. kamthiensis* Srivastava & Jha (1986) in having smaller size, more numbers of taeniae and a circular fold along saccus-body attachment on distal face.

Remarks—Specimens illustrated in Tripathi *et al.* 2005 (Pl. IV, Figs 4, 8) from the Parsora Formation, Late Triassic, Son Valley; are placed here in *K. ringus* sp. nov.

Occurrence—Panchet Formation, late Early Triassic to Middle Triassic, Damodar Basin (Borehole RAD-11, PGD-9; Fig. 1); Parsora Formation, Early and Late Triassic, Son Valley, (Borehole SSM-2; Table-1).

Derivation of Name—On the basis of presence of circular fold around the central body on distal face.

Genus—*Goubinispora* Tiwari & Rana 1981
(Pl. 1.3-5, 10-12)

Type Species—*Goubinispora indica* Tiwari & Rana 1981

Repository—BSIP Museum.

Locality—Borehole RD-1, sample no. 4, depth 532.48 m, Raniganj Coalfield, Damodar Basin, India.

Horizon & Age—Mahadeva Formation, Middle Triassic.

Stratigraphic status		Sample Details	References
PANCHET FORMATION	Lower and Middle Triassic	Damodar Basin, West Bengal	Tiwari, 1979 Singh, 1984
		Borehole RD-1, depth 532.48 m, Raniganj Coalfield Borehole RAD-11, depth 449.00 m, 459.00 m, 400.00 m, Raniganj Coalfield Borehole PGD-9, depth 403.50 m, Panagarh area, Raniganj Coalfield	
PARSORA FORMATION	Lower and Upper Triassic	South Rewa Basin, Chhattisgarh Borehole SSM-2, depth 152.56 m, 261.75 m, 462.60 m, 476.85 m, Singrauli Coalfield	Tripathi <i>et al.</i> , 2005

Fig. 1—Details of investigated samples.

Age / Area →	HIMALAYA	RAJMAHAL	DAMODAR	SATPURA	SON VALLEY	MAHANADI	WARDHA-GODAVARI	KRISHNA-GODAVARI	RAJASTHAN
	1	2	3	4	5	6	7	8	9
TRIASSIC	LATE	↑ ◆*			↑ ? *◆@**				◆
	MIDDLE	*◆	? *◆@**					◆*?	
PERMIAN	EARLY		? @*◆**	*◆	*◆	◆**	**	*	
	END PERMIAN		◆	*◆	◆	◆**	**		

Index: ** = *Kamthisaccites kamthiensis*, @ = *K. ringus*, ◆ = *Goubinispora indica*, * = *G. morondavensis*, ? = *G. triassica*

1 Singh T *et al.*, 1995; Tiwari *et al.*, 1984; Vijaya *et al.*, 1988; 2 Tripathi A, 2000; Tripathi A & Ray A, 2005; Tripathi A *et al.*, 1990; Vijaya, 2004; 3 Tiwari RS, 1979; Tiwari RS, 1980, 1981, 1984; Vijaya & Bhattacharji, 2003; 4 Kumar P, 1995, 1996, 2000, 2002; 5 Ram-Awatar, 2001, 2003; Ram-Awatar & Datta A, 2005; Tiwari RS & Ram-Awatar, 1990, 1992; Tripathi A *et al.*, 2005; Vijaya & Sinha S, 2005; 6 Tripathi A, 1996, 2000; 7 Srivastava Suresh C & Bhattacharyya AP, 1996; Srivastava Suresh C & Jha N, 1990, 1995; 8 Prasad B, 1997; Prasad B & Jain AK, 1994; Prasad B *et al.*, 1995; 9 Misra CM *et al.*, 1996.

Fig. 2—Stratigraphic occurrence of species of *Kamthisaccites* Srivastava & Jha 1986 and *Goubinispora* Tiwari & Rana 1981 through Latest Permian to Late Triassic succession on Indian Peninsula. At end Permian level, vertical placement of two symbols, * and ◆ are in order of the FADs of *K. kamthiensis* Srivastava & Jha 1986 and *G. indica* Tiwari & Rana 1981. Above this level, symbols are arranged horizontally to show occurrences at the same level; vertical arrow indicates range of occurrence.

Generic Diagnosis (elaborated)—Radial to bilaterally symmetrical, girdling monosaccate pollen; central body circular to oval, distinct to indistinct; on one side having faint and indeterminate to clearly marked striations, on other side bearing “islands” and “strips” of partly separated exoexine—structurally comparable to saccus; sometimes a circular rim present around central body, consists of either single or five folds overlapping each other at ends. Saccus intrareticulate, mostly uneven in width, incipiently to markedly polylobed, usually equatorially attached at striate-side and variously encroaching the body subequatorially on the other side.

Goubinispora indica Tiwari & Rana 1981
(Pl. 1.3)

Synonymy—*Densipollenites* sp., Jain 1968; pl. 2, fig. 34
Accinctisporites circumdatus Jain 1968; pl. 2, fig. 38
Dacrycarpites sp., Jain 1968; pl. 8, fig. 116
Crustaesporites sp., Hankel 1991; pl. 3, fig. 2
Monosaccate indeterminate Hankel 1993; pl. 3, fig. 1
Holotype—Tiwari & Rana 1981; pl. 4, fig. 58; size 144.5 x 192.5 µm; BSIP Sl. No. 5632.

Repository—BSIP Museum.

Locality—Borehole RD-1, depth 532.48 m, Raniganj Coalfield, Damodar Basin, India.

Age & Horizon—Mahadeva Formation, Middle Triassic.

Diagnosis—Size 90-198 µm; central body 45-130 µm, thin, usually distinct, sometimes indistinct, proximally bearing 12-22 simple, rarely forked striations, distinct, or not well-defined yet determined only at places, distally islands or elongated strips of exo-exine 18-36 µm wide, bearing intramicroreticulate structure. Saccus fully developed equatorially, distinctly lobed, pendant distally and encroaching in the form of lobes, subequatorially on distal region, reaching 10-35 µm inside the body equator but never covering the same entirely; intrareticulation of saccus coarse, muri 1-2 µm thick, meshes 5-12 µm wide, polygonal with mostly wavy muri.

Remarks—This species is characterized by coarse reticulation of the saccus having wavy muri binding polygonal, big meshes. Besides, the lobing in most of the specimens is very distinct and the distal encroachment of saccus is through lobes.

Occurrence—Dubrajpur Formation, Early and Late Triassic; Rajmahal Basin (Tripathi & Ray, 2005); Panchet

Age Area	Gondwana Countries						Other Countries	
	India	Antarctica	S. America	Africa	Madagascar	Australia	China	Middle East
		1	2	3	4	5	6	7
T R I LATE	◆*?		*?				◆	
A S MIDDLE	◆*?		◆*?		*◆			
I C EARLY	◆*?	*		? ◆	◆	◆*		◆

1 Lindström S & McLoughlin S, 2007; 2 Jain RK, 1968; Zavattieri AM & Volkheimer W, 1992; Zavattieri *et al.*, 2003; 3 Hankel O, 1991; 4 Goubin N, 1965; Hankel O, 1993; 5 de Jersey NJ, 1970; 6 & 7 Vijaya & Tiwari RS, 1990.

Fig. 3—Record of *Goubinispora* species in Gondwana countries, China and Middle East (For Indian references see Fig. 2).

Formation, Early to Middle Triassic; Damodar Basin (Tiwari & Rana, 1980, 1981; Singh, 1984); Pachmarhi Formation, Early Triassic; Satpura Basin (Kumar, 1995, 1996); Pali Formation, Latest Permian; Son Valley (Ram-Awatar & Dutta, 2005); Parsora Formation, Early and Late Triassic; Son Valley (Tripathi *et al.*, 2005); Supra-Barakar Formation, Mahanadi Basin (Tripathi, 1996).

Goubinispora morondavensis (Goubin) Tiwari & Rana 1981
(Pl. 1.4)

Synonymy—*Striomonosaccites morondavensis* Goubin 1965

Holotype—Goubin 1965; pl. 1, fig. 5.

Locality—LD I, 1960 m, Morondava Basin, Madagascar.
Horizon & Age—Middle Triassic.

Diagnosis—Size 107-170 µm, central body thin, distinct, 50-95 µm, bearing faint to distinct 10-20 striations. At distal polar region, islands of exoexine irregular, in between them the body exine finely intramicroreticulate. Saccus irregular in width, lobing at outline incipient, distally finely intra reticulate, meshes 1-2 µm wide, muri 1 µm thick, straight.

Remarks—*G. indica* Tiwari & Rana 1981, the type species, differs from *G. morondavensis* (Goubin) Tiwari & Rana 1981 in having coarse reticulation of saccus with broader meshes and thicker wavy muri. Besides, in the latter the lobing of saccus is also not perfect and complete, i.e. incipient.

PLATE 1

(All Figs. x 500; except Figs. 1-4, x 450)

- 1.2., 6.-9. *Kamthisaccites* Srivastava & Jha 1986.
1. *Kamthisaccites kamthiensis* Srivastava & Jha 1986, (Holotype) BSIP Sl. No. 9480, 2- Specimen from borehole SSM-2, depth 261.75 m, Singrauli Coalfield, BSIP Sl. No. 13335.
6. *Kamthisaccites ringus* sp. nov. Holotype, Borehole SSM-2, depth 462.60 m, Singrauli Coalfield, BSIP Sl. No. 13336. 7- *Kamthisaccites ringus* sp. nov., specimen, Borehole RAD-11, depth 459.00 m, Raniganj Coalfield, BSIP Sl. No. 13326. 8- Isotype from Borehole SSM-2, depth 476.85 m, Singrauli Coalfield, BSIP Sl. No. 13334. 9- Specimen from Borehole PGD-9, depth 403.60 m, Raniganj Coalfield, BSIP Sl. No. 13330.
- 3.-5., 10.-12. *Goubinispora* Tiwari & Rana 1981.
3. *Goubinispora indica* Tiwari & Rana 1981 (Holotype) BSIP Sl. No. 5632.
4. *Goubinispora morondavensis* (Goubin) Tiwari & Rana 1981; PGD-9, Depth 403.50 m, Panagarh area, Raniganj Coalfield, BSIP Sl. No.13332.
- 5., 10.-12. *Goubinispora triassica* sp. nov. showing presence of folds along distal saccus attachment in the form of a ring.
5. Specimen, showing continuous ring, from Borehole PGD-9, depth 403.50 m, Panagarh area, Raniganj Coalfield, BSIP Sl. No. 13328;
10. Holotype, Borehole PGD-9, depth 403.50 m, Panagarh area, Raniganj Coalfield, showing lobed saccus and folds arranged in a ring, BSIP Sl. No. 13329.
11. Specimen from Borehole PGD-9, depth 403.50 m, Panagarh area, Raniganj Coalfield, BSIP Sl. No. 13331.
12. Isotype, Borehole PGD-9, Depth 403.50 m, Panagarh area, Raniganj Coalfield, showing lobed saccus and folds arranged in a ring, BSIP Sl. No. 13332.

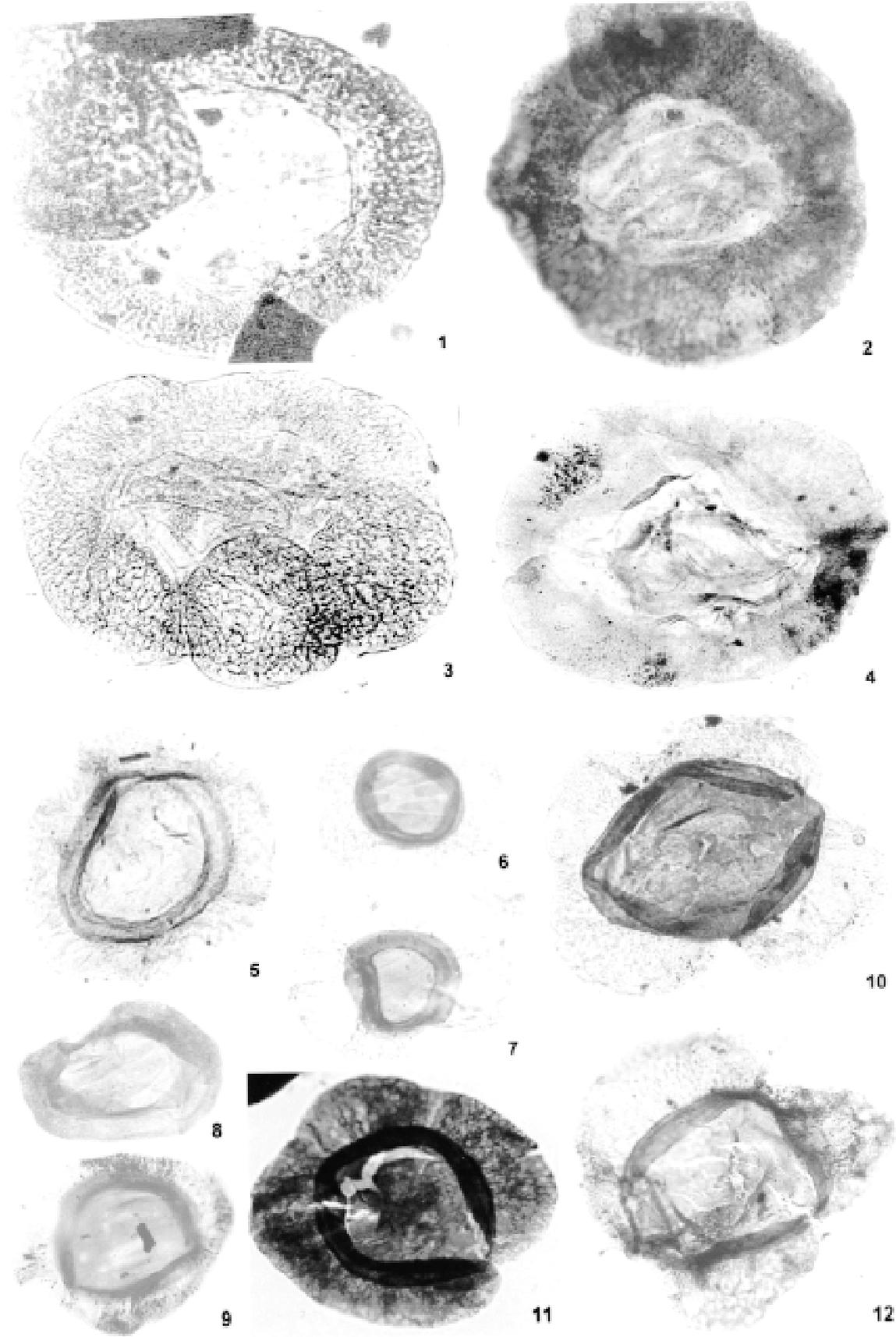


PLATE 1

Occurrence—Dubrajpur Formation, Late Triassic; Rajmahal Basin (Tripathi & Ray, 2005); Panchet Formation, Early to Middle Triassic; Damodar Basin (Tiwari & Rana, 1980, 1981; Singh, 1984); Pachmarhi Formation, Early Triassic; Satpura Basin (Kumar, 1995); Parsora Formation, Early and Late Triassic; Son Valley (Tripathi *et al.*, 2005).

Goubinispora triassica sp. nov.
(Pl. 1.5, 10-12)

Synonymy—*Goubinispora morondavensis* Tiwari & Rana 1980; pl. 3, figs 56-59.

Plicatipollenites sp. Hankel 1991; pl. 5, fig. 3

Goubinispora morondavensis Prasad 1997; pl. 5, fig. 5

Goubinispora sp. cf. *G. indica* Prasad 1997; pl. 5, fig. 12
cf. *Goubinispora* sp. Zavattieri *et al.* 2003

Holotype—Pl. 1, Fig. 10; size 95 x 114 µm; central body 64 x 84 µm, BSIP Sl. No. 13329.

Repository—BSIP Museum.

Locality—Borehole PGD-9, depth 403.50 m, Raniganj Coalfield, Damodar Basin, India.

Age & Horizon—Panchet Formation, Early Triassic.

Isotype—Pl. 1, Fig. 12; Size 105 x 106 µm; central body 58 x 71.5 µm; BSIP Sl. No. 13332.

Locality—Borehole PGD-9, depth 403.50 m, Panagarh area, Raniganj Coalfield, Damodar Basin, India.

Age & Horizon—Panchet Formation, Early Triassic.

Diagnosis—Size 66.5-123.5 x 72.5-115 µm; central body 45.5-72 x 57.5-90.5 µm, thin to thick, yellowish to dark brown; one circular fold, or 3-5 folds arranged in a ring, over-lapping each other at connecting ends, on distal face at central body-saccus attachment, folds measuring 2-12 µm wide; saccus 20-55 µm wide.

Comparison—*G. triassica* sp. nov. differs from *G. indica* Tiwari & Rana (1981) and *G. morondavensis* (Goubin) Tiwari & Rana (1981) in having distinct fold around central body-saccus attachment on distal face.

Remarks—Specimens with polylobed saccus have 3-5 folds at the zone of saccus attachment on distal face arranged in circular manner (Pl. 1.10, 12), in some specimens single continuous fold (Pl. 1.5, 11) is observed.

Derivation of Name—The name is derived from the occurrence of this species in Triassic succession.

Occurrence—Panchet Formation, latest Early to Middle Triassic; Damodar Basin (Tiwari & Rana, 1980, 1981); Parsora Formation, Early and Late Triassic; Son Valley (Tripathi *et al.*, 2005).

STRATIGRAPHIC DISTRIBUTION

Recent data accrued on palynostratigraphy in—Himalaya, Rajmahal, Damodar, Satpura, Son Valley basins and Godavari Graben, have revealed the occurrence of two taxa—

Kamthisaccites Srivastava & Jha 1986 (represented by two species) and *Goubinispora* Tiwari & Rana 1981 (represented by three species), at different levels in the Late Permian and Triassic succession (Fig. 2). Among these, *Kamthisaccites kamthiensis* Srivastava & Jha 1986, instituted from the Kamthi Formation, Late Permian (now Early Triassic) in Godavari Graben, has also been observed at the level of end-Permian and basalmost Triassic in the Rajmahal, Damodar and Mahanadi basins. Further, the presence of this species is noted at the closing phase of Early Triassic and Middle Triassic in the Raniganj Coalfield, Damodar Basin; and Late Triassic of Singrauli Coalfield, Son Valley. Moreover, *K. ringus* sp. nov., instituted from the Parsora Formation, Late Triassic shows its First Appearance at the closing phase of Panchet Formation (Early Triassic), Raniganj Coalfield, Damodar Basin; and continued up to Middle Triassic in Damodar Basin (Fig. 2).

Genus *Kamthisaccites* was reported to have a very short interval, the occurrence of which was specified in the latest Permian on Indian peninsula. However, the present investigation has revealed presence of *Kamthisaccites kamthiensis* throughout the Triassic succession, whereas *K. ringus* sp. nov., ranges in the uppermost Early Triassic to Late Triassic in Damodar Basin and Son Valley on Indian peninsula (Fig. 2).

The genus *Goubinispora* Tiwari & Rana (1981) was reported for the first time in India from the Mahadeva Formation, Middle Triassic in Raniganj Coalfield, Damodar Basin. The first appearance of *Goubinispora* is marked by *G. indica* Tiwari and Rana (1981) at the Late Permian level in Damodar, Son Valley and Mahanadi basins (Tiwari & Vijaya, 1994). Further up, this species is noted from the Late Triassic in Rajmahal, Son Valley and Rajasthan (Fig. 2). The species *G. morondavensis* (Goubin) Tiwari & Rana (1981) is observed in the Early Triassic palynoflora of Damodar, Satpura, Son Valley and Krishna-Godavari basins. The species *Goubinispora triassica* sp. nov., makes its first appearance in the the topmost level of Panchet Formation, latest Early Triassic in the Damodar Basin, and is observed in Middle Triassic from Damodar Basin; so also in Late Triassic of Son Valley (Fig. 2).

To conclude, the occurrences of species *Kamthisaccites ringus* sp. nov., and *Goubinispora triassica* sp. nov., have been recorded in the Triassic succession within the time span from latest Early Triassic upto Late Triassic. The present finding has extended the vertical range of genus *Kamthisaccites* upto Late Triassic.

GONDWANALAND AND OTHER COUNTRIES

From the survey of published palynological data of the Gondwana countries, it has been found that the specimens identified as *Densipollenites*, *Accintisporites*, *Dacrycarpites*, *Crustaesporites*, *Striamonosaccites* and *Plicatipollenites* (for reference pl. see pp. 5-7) could be assigned to the genus

Goubinispora Tiwari and Rana 1980. However, the distribution of the genus *Kamthisaccites* Srivastava and Jha 1986 could not be assessed from the illustrations given in the published literature other than India.

As illustrated in Fig. 3, genus *Goubinispora* is represented by all the three species – *G. indica.*, *G. morondavensis* and *G. triassica* in other regions of the Gondwanaland through Triassic succession. Besides, its occurrence has also been noted in the Early Triassic in Middle East; and Late Triassic in China (see Vijaya & Tiwari, 1990).

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